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A

Postgraduate Educational Programme

EFOMP Workshop (EF)
ESR meets Sessions (EM)
European Excellence in Education (E³)
Honorary Lectures (HL)
Joint Sessions
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Wednesday, March 2

08:30 - 10:00 **Room A**

E³ - ECR Academies: Interactive Teaching Sessions

E³ 121

Head and neck cancer after treatment: what you need to know

A-001 08:30

A. Imaging after surgical treatment

M. Lell; *Erlangen/DE (michael.lell@uk-erlangen.de)*

Follow-up of patients with head and neck tumours after treatment is complicated by the altered anatomy after surgical resection and reconstruction as well as radiation-induced changes of both the tumour and surrounding normal tissue. Because tumours may recur deep in the neck, completely covered by a reconstruction flap, visual inspection and clinical examination will fail at an early, potentially salvageable stage, while CT and MRI are able to detect these lesions adequately. Mucosal swelling, either because of oedema or chronic inflammation after radiotherapy, needs to be differentiated from tumour recurrence or at least direct the endoscopist to the most suspicious area. It is of importance to avoid biopsy of the mucosa after radiotherapy whenever possible, because of the increased risk of delayed healing, fistula formation or chondronecrosis. Later in the follow-up, radiation-induced necrosis (particularly osteonecrosis) becomes an important differential diagnosis to tumour recurrence. The aim of this session is to get familiar with different surgical approaches and the respective changes in follow-up imaging, radiation-induced changes of tumour and surrounding normal tissue, and radiation-induced adverse effects and tumour recurrence.

Learning Objectives:

1. To become familiar with the different surgical techniques.
2. To become familiar with the imaging findings after surgery.

Author Disclosure:

M. Lell: Advisory Board; Bracco. Research/Grant Support; Bayer, Siemens. Speaker; Bayer, Guerbet, Siemens.

A-002 09:15

B. Imaging after radiotherapy/chemotherapy

G. Madani; *London/UK (gittamadani@yahoo.com)*

Post-treatment imaging assesses the response to therapy and post-therapeutic complications and is essential to the correct management of patients; some conditions require active management whilst others need supportive care. Recognition of radiation- and chemotherapy-induced changes is the cornerstone of accurate interpretation. Soft tissue changes affect the skin, subcutaneous tissues, muscles, mucosa, submucosa and the salivary glands and should be distinguished from recurrence. Neurological sequelae of radiotherapy include radiation-induced cerebral necrosis, brain stem encephalopathy, myelopathy and radiation-induced plexopathy. In patients treated for nasopharyngeal carcinoma distinguishing radiation-induced cerebral necrosis from recurrence can present a diagnostic challenge. Radionecrosis may also be observed in the bones and cartilages (skull base, temporal bone, mandible, maxilla, hyoid bone, larynx and cervical spine). Mandibular osteoradionecrosis is the most common (although its incidence is reducing with greater use of intensity-modulated radiotherapy) and may require further surgery. Accelerated arteriopathy is a well-recognised complication of radiotherapy. Chemo-radiotherapy changes may lead to a dysfunctional larynx and imaging can provide clues to laryngeal dysfunction. Radiation-induced neoplasms are late sequelae, with a latency of many years. In the lungs, radiation and chemotherapy-induced changes should be distinguished from infection, aspiration and metastases.

Learning Objectives:

1. To become familiar with common findings after medically treated head and neck tumours.
2. To become familiar with changes after radiotherapy for head and neck tumours.

08:30 - 10:00 **Room B**

GI Tract

RC 101

Assessing inflammation and fibrosis in Crohn's disease

A-003 08:30

Chairman's introduction

A. Laghi; *Latina/IT (andrea.laghi@uniroma1.it)*

Diagnostic imaging plays a major role in the decision-making process of patients affected by Crohn's disease (CD), both at the time of diagnosis and throughout the course of the disease. One of the most relevant clinical problems in current management of patients affected by CD is represented by the assessment of inflammation and fibrosis. The two entities should not be considered separately, since they coexist in most of the patients. A correct quantification of the prevalent entity is extremely important, since the patient should be referred for medical therapy if inflammation predominates, whereas either endoscopic dilatation of the stricture or surgery becomes necessary if fibrosis is prevalent. Cross-sectional imaging (CSI) modalities, including ultrasound (US), multidetector CT (MDCT) and MR imaging (MRI), can provide useful information, particularly for inflammation, less for fibrosis. Contrast-enhanced US (CEUS) has been shown to correlate with disease activity and severity, in comparison with endoscopic score of severity. Data about CEUS and fibrosis are controversial, although a quantitative data analysis seems the most valuable approach. Very promising results have been recently obtained with US elastography. Current data with MDCT highly correlate with disease activity and severity, but not with fibrosis. Dual-energy analysis might improve MDCT performances. MRI correlates not only with inflammation, but also with fibrosis, particularly if multiparametric analysis is performed. This analysis includes the evaluation of pattern of enhancement, late enhancement and the analysis of T2 signal. In the next future, other MR techniques are under evaluation, like T1 mapping and magnetisation transfer contrast.

Session Objective:

1. To briefly present how inflammation and fibrosis in Crohn's disease impact in patient management and list the available tools for a differential diagnosis.

Author Disclosure:

A. Laghi: Speaker; Bracco, Takeda, Alfa Wassermann, Guerbet.

A-004 08:35

A. Is sonography (CEUS and elastography) the right tool?

E. Quaia; *Trieste/IT (quaia@units.it)*

Crohn's disease (CD) is a chronic transmural inflammatory disease of the gastrointestinal tract which can be assessed by ultrasound. Unenhanced ultrasound may evaluate the localisation and the length of the affected intestinal segments and may detect transmural complications, including fistulas, abscesses and phlegmons, but it is less accurate to assess CD activity. Contrast-enhanced ultrasound of the bowel is performed by wide-band transducers including the microbubble resonance frequency. Contrast-enhanced ultrasound has become an important imaging modality in patients with CD for the grading of disease activity, the differentiation between small bowel stricture due to inflammation or mural fibrosis, and for the assessment of the response to specific pharmacologic therapy. New dedicated software packages allow the accurate quantification of the enhancement within the small bowel wall after microbubble contrast agent injection to obtain different kinetic parameters—percentage of the maximal enhancement, the time-to-the peak enhancement, and the area under the time-intensity curve - which are very useful to differentiate the inflammatory oedema from fibrosis and to differentiate responders from non-responders to the specific therapy among patients with CD. The main advantage of contrast-enhanced ultrasound in the real-time assessment of the perfusion of the bowel wall but the scan is necessarily limited to one single loop each time. US elastography can be considered an additional tool to complete the US assessment of the bowel wall in patients with Crohn's disease. US elastography allows to assess the rigidity of the bowel wall to distinguish acutely inflamed from fibrotic intestine in patients with Crohn's disease.

Learning Objectives:

1. To learn about CEUS technique, including imaging acquisition and data post-processing.
2. To become familiar with US elastography, particularly with those techniques useful in the assessment of the small bowel.
3. To understand potential advantages and possible limitations of CEUS and elastography in the assessment of inflammation and fibrosis in Crohn's disease.

A-005 08:58

B. Is there space for MDCT (spectral imaging, iodine map)?

J. Podgorska; *Warsaw/PL (jpodgo@gmail.com)*

Many aspects of managing patients suffering from Crohn's disease (CD) remain unclear. It is still unknown which factors trigger disease chronicity, and which promote the development of intestinal fibrosis. On the other hand, anti-inflammatory treatment such as steroids, immunosuppressants, and anti-TNF-alpha have serious side effects; moreover, the decision for surgical treatment is also difficult. Because of many factors that influence the disease management there is a strong need for a reliable tool of inflammatory activity and fibrosis assessment. Frequently, apart from MR enterography (MRE), CT enterography (CTE) is being used to detect and monitor intestinal inflammation. Bowel wall and mesenteric changes such as mural thickening and hyperenhancement, increased attenuation of perienteric fat, and mesenteric hyperaemia have been reported to indicate CD activity. Recently introduced dual-energy CT modality allows creating monochromatic spectral images at energy levels ranging from 40 to 140 keV and water- and iodine-based material decomposition with quantitative analysis. This method has already been applied in abdominal imaging, e.g. urinary stones, renal cell carcinoma and hepatocellular carcinoma. There are also preliminary reports about implementation of spectral imaging in CTE technique for an objective assessment of Crohn's disease activity and coexistent fibrosis. The aim of this lecture is to give an overview of the CTE bowel inflammatory changes, and the possible advantages of spectral imaging for assessing activity and fibrosis in CD.

Learning Objectives:

1. To understand basic principles of spectral imaging, including data post-processing.
2. To appreciate the strengths and limitations of spectral imaging in the abdomen.
3. To learn about advantages and possible limitations of spectral imaging in the assessment of inflammation and fibrosis in Crohn's disease.

A-006 09:21

C. Will MRI (DWI and perfusion) solve the problem?

S.A. Taylor; *London/UK (csytaylor@yahoo.co.uk)*

Crohn's disease (CD) is a relapsing and remitting inflammatory condition of the GI tract. Clinical management essentially resolves around use of immunosuppressive medication and surgery. Crucial to clinical decision making is assessment of the underlying inflammatory activity, those with active inflammatory disease tend to undergo immunosuppressive therapy whereas those with fibrosis may benefit from surgical resection. In reality, however, inflammation and fibrosis tend to coexist. Both DWI and perfusion are abnormal in CD. However, the relationship between both DWI and contrast enhancement and the histopathological phenotype is complex. Whist data suggest active Crohn's disease tends to result in restricted DWI, the balance between increased inflammatory infiltrate and tissue oedema influences ADC values and recent data using surgical resection specimens suggest fibrosis also leads to restricted diffusion. Similarly, whilst perfusion tends to increase in active CD, tissue angiogenesis which increases in chronic disease also affects contrast uptake. Enhancement patterns may help radiologist grade activity. For example, a layered enhancement pattern is reported in active disease, but again overlap with fibrosis is seen. Recent data suggest delayed contrast-enhanced sequences at around 7 minutes can help quantify fibrosis. This presentation will describe clinical protocols used to acquire DWI and perfusion imaging in CD and present the data as to their utility in clinical practice.

Learning Objectives:

1. To understand basic principles of DWI applied to Crohn's disease.
2. To learn about MR-perfusion protocols and data analysis.
3. To learn about advantages and possible limitations of MRI in the assessment of inflammation and fibrosis in Crohn's disease.

Author Disclosure:

S.A. Taylor: Investigator; Robarts plc.

09:44

Panel discussion: How do I approach a case in my routine clinical practice?

08:30 - 10:00 **Room O**

New Horizons Session

NH 1

New frontiers in imaging of vascular wall and plaque

A-007 08:30

Chairman's introduction: How to use the tools?

C. Loewe; *Vienna/AT (christian.loewe@meduniwien.ac.at)*

The aim of this New Horizon Session is to provide an in-depth view into the most recent advances in atherosclerosis imaging. To become able to answer the difficult question on "how to use the tools", knowledge about the different modalities and techniques, their potential and limitations is required. The chairman's introduction will focus exactly on this important question by introducing the demands in vessel wall and plaque imaging and by underlining the need of comprehensive assessment on atherosclerosis. The following lectures will introduce four different technical approaches to plaque and vessel wall imaging. These four techniques include molecular imaging for MR, nuclear and hybrid imaging, elastography and CT. Four well-known speakers will share their outstanding knowledge in each out of these four techniques. The potential and challenges of the different methods in atherosclerosis imaging will be underlined. However, despite these advances in diagnostic possibilities the recently developed knowledge about relationship between plaque composition, vessel wall inflammation and clinical events is not yet incorporated into currently used treatment recommendations. Since decades, the clinical decision making in vascular medicine focused mainly on the mechanistic approach to treat stenoses if they account for more than 70% of luminal narrowing (the "plumbers principle") and the advances in imaging are not taken into account by the actual guidelines. The final panel discussion will discuss the current situation under the title "where do we stand". The current and possible future predictive role of imaging in the evolution of atherosclerosis should be defined.

Session Objectives:

1. To learn about the demands in vessel wall and plaque imaging.
2. To understand the importance of non-invasive imaging for risk assessment.
3. To appreciate the necessity of comprehensive assessment in atherosclerosis.

Author Disclosure:

C. Loewe: Speaker; Speaker Honorarium from: Siemens, Bracco, Guerbet, GE Healthcare, Medtronic.

A-008 08:35

Molecular imaging for MR

M.R. Makowski; *Berlin/DE (marcus.makowski@charite.de)*

Atherosclerosis and its consequences remain the main cause of mortality in industrialised and developing nations. Clinical risk-scoring systems currently do not allow a reliable identification of individuals at high risk for cardiovascular events or with silent subclinical disease. Novel imaging techniques to identify asymptomatic individuals at high risk for future cardiovascular events are, therefore, urgently needed.

Learning Objectives:

1. To understand the potential of MRI for clinical risk assessment in atherosclerosis.
2. To learn about new specific contrast agents for plaque load quantification and plaque remodelling visualisation.
3. To appreciate the value of MRI for predicting future atherosclerotic events.

Author Disclosure:

M.R. Makowski: Research/Grant Support; DFG.

A-009 08:53

New insights using nuclear and hybrid imaging

J. Knuuti; *Turku/FI (juhani.knuuti@utu.fi)*

In the imaging of vulnerable plaque, non-invasive techniques such as multislice CT provide accurate localisation of plaques and also characterise morphological criteria associated with a high risk of atherosclerotic plaque rupture. In contrast, PET uses radiolabelled molecules designed to specifically target individual biological activities in atherosclerotic plaques. Hybrid imaging combines different modalities to obtain complementary anatomical and functional information in a single imaging study. Morphological imaging with CT and MR has benefited from the improvement of spatial and temporal resolution. PET/CT, SPECT/CT and more recently PET/MRI systems have become commercially available and increasingly used also in cardiac imaging for both small animals for research purposes and humans for clinical research

and routine. Number of PET tracers for plaque imaging has been developed. Currently the most commonly used tracer is glucose analogue FDG that has been used as a surrogate for plaque inflammation in number of studies. The reproducibility has been also found to be good but limited information about coronary imaging is available. FDG is specific for glucose uptake but unspecific for inflammation. Sodium fluoride (F-18) has been also used to detect the microcalcifications associated with the vulnerable plaques and also promising results in coronary plaque imaging have been published. Recently, nearly 20 different specific traces have been tested in animal models but few of these have been used in studies in humans. The most promising tracers for future testing in humans are fluorocholine, folate ligands and leucocyte adhesion tracers.

Learning Objectives:
1. To understand the potential of hybrid techniques for assessing vulnerable plaque and atherosclerosis activity.
2. To learn about new tracers for plaque imaging.
3. To appreciate the importance of functional imaging in atherosclerosis.

Author Disclosure:
J. Knuuti: Consultant; Lantheus inc. Grant Recipient; CardiRad oy. Speaker; GE Healthcare.

A-010 09:11

Ultrasound elastography: how useful can it be?

N. Liasis; *Athens/GR (nikos.liasis@euromedic.gr)*

Atherosclerosis is a systemic vascular disease that can remain asymptomatic but is associated with serious complications that include stroke, myocardial infarction and sudden death. Although ECST and NASCET trials have shown carotid endarterectomy to be beneficial for symptomatic patients with severe stenosis (> 70%), the benefits of carotid endarterectomy for patients with moderate stenosis (50-69%) and for asymptomatic patients continues to be debated. There is a need for revision of management strategies and for identifying high-risk patients that would be more likely to benefit from carotid endarterectomy. Several ultrasound features that have been proposed to predict stroke in patients with asymptomatic carotid stenosis and thus contribute to risk stratification have been confirmed in prospective studies but there is not a single feature that could identify all the potentially unstable and high-risk plaques as several mechanisms can result in embolisation. Elastography techniques can be used to calculate the level of tissue deformation after the application of pressure or using shear wave velocity to calculate true elastic modulus. They have been researched in the liver, breast, prostate and thyroid but their use in carotid plaques is novel. Application of elastography for imaging carotid plaques is challenging as the plaque is subject to continuous arterial pulsatile and the size and morphology of the plaque varies significantly between the subjects. Use of elastography for plaque vulnerability assessment yields promising results which are paving the road toward the non-invasive and efficient detection of high-risk plaque which can alter management strategies.

Learning Objectives:
1. To become familiar with the technical principles of ultrasound elastography in vessel wall imaging.
2. To learn about the potential of elastography in the identification of the vulnerable plaque.
3. To understand the role of ultrasound elastography in atherosclerosis and risk assessment.

A-011 09:29

New options with CT

A. Persson; *Linköping/SE (anders.persson@cmiv.liu.se)*

The submillimeter spatial resolution and excellent image quality of modern computed tomography (CT) scanners allow atherosclerotic lesions to be detected, characterised, and quantified. To some degree, plaques can be classified based on their typical visual appearance. Based on the relative amount of calcified and non-calcified components, plaques are usually classified into 1 of 3 categories: non-calcified plaque, calcified plaque, or partially calcified plaque (sometimes referred to as "mixed plaque"). Identifying vulnerable plaque with single-energy CT angiography (CTA) is limited by the overlap between attenuation of necrotic core and fibrous plaque. Using x-rays with differing energies (dual-energy CT) alters attenuation values of these components, depending on their material composition. Dual-energy CT (DECT) has the potential to increase the resolution of necrotic core and fibrous plaque compared to single-energy coronary CTA. Although this suggests that DECT may identify vulnerable atherosclerotic plaques with more precision than single energy, its clinical usefulness has not yet been proven. Constant improvements in CT technology such as multi-energy CT (MECT) with recently developed energy-sensitive photon-counting detectors that can sample the material-specific attenuation curves at multiple energy levels have the potential to concurrently identify multiple materials with increased accuracy and maybe predict future coronary events.

Learning Objectives:
1. To become familiar with the technical possibilities of modern CT in plaque analysis.
2. To learn about the value of multi-energy imaging for functional imaging in atherosclerosis.
3. To appreciate the usefulness of CT based scores for assessment of atherosclerotic plaque burden.

09:47
Panel discussion: Predictive role of imaging in the evolution of atherosclerosis: where do we stand?

08:30 - 10:00 **Room N**

Computer Applications

RC 105

Daily use of mobile devices in radiology

A-012 08:30

Chairman's introduction

O. Ratib; *Geneva/CH*

Mobile devices such as tablets and high-resolution smartphones are becoming widely available providing convenient mobile solutions for physicians and healthcare providers to access imaging data. This is particularly attractive in medicine where "nomad" physicians need to be able to access relevant patient data and images anywhere-anytime in their daily practice where they are rarely at a single location. While they may not always be adequate for routine diagnostic tasks they provide a convenient mobile solution for on-call and remote consultations. There are different types of software architecture that can be implemented for such tasks. Two major different design are: (1) online web-based applications where the device serves as a "thin-client" to display images rendered and manipulated on a remote computer and (2) local applications that reside on the mobile device and can run independently after images have been downloaded on the device. The first solution requires the user to be constantly connected to the network, while the second solution can continue to function after disconnecting from the network. Most vendors are starting to provide web access to their imaging solutions that can be accessed from mobile devices. Web access can, however, be slow and dependent on reliable access to wireless network.

Session Objectives:
1. To give an overview of tools available on mobile devices for education and exam reporting.
2. To underline the impact of mobile devices in routine clinical activity.
3. To learn about the legislative backbone and potential drawbacks of mobile technology.

A-013 08:35

A. What did mobile devices change in radiology education?

E. Kotter; *Freiburg/DE (elmar.kotter@uniklinik-freiburg.de)*

Mobile devices and fast networks are ubiquitous today. E-learning has been used in radiology for more than 30 years. The lecture will give an introduction to and an overview of e-learning systems for radiology with emphasis on e-learning on mobile devices. Advantages and limitations of mobile e-learning will be discussed. An outlook to future development of e-learning will be given.

Learning Objectives:
1. To give an overview of tools available for e-learning.
2. To explore the potential impact of e-learning in the daily radiological practice.
3. To explore future developments and limits of e-learning.

Author Disclosure:
E. Kotter: Consultant; Thieme Verlag - eRef (RadBase).

A-014 08:58

B. Is it appropriate to read a study on a smartphone or a tablet?

E. Neri; *Pisa/IT (emanuele.neri@med.unipi.it)*

"no abstract submitted"

Learning Objectives:
1. To give an overview of available DICOM viewers and software for reporting imaging studies.
2. To discuss technical requirements of mobile devices for use in imaging interpretation.
3. To provide insight on future developments of imaging viewing technology.

A-015 09:21

C. Security and ethical issues of mobile device technology

E.R. Ranschaert; *'s-Hertogenbosch/NL (ranschaert@telenet.be)*

With mobile device medical specialists are able to quickly exchange patient information and medical images through well-known social media such as WhatsApp. One of the principal reasons for transmitting medical information and pictures with smartphones is to ask colleagues on distance for advice regarding a diagnosis or treatment, sometimes even in an acute situation. The digital transmission of patient information through social media has several implications from an ethical and security-related point of view. Four critical questions need to be answered: is this a problem? Is this secure? Are there any regulations or guidelines? Is there something better than WhatsApp or Instagram? In this refresher course these issues will be discussed in more detail.

Learning Objectives:

1. To provide an overview of technical solutions for patients' image and data mobility.
2. To provide a risk assessment analysis (data loss, privacy, etc). of mobile technology.
3. To give an overview of European legislation in relation to patient image and data mobility.

09:44

Panel discussion: Will mobile technology overcome stationary technology in radiology?

08:30 - 10:00 **Room L8**

EuroSafe Imaging Session

EuroSafe 1

Low-dose research in medical radiation protection

Moderator:
L. Rainford; Dublin/IE

A-016 08:30

Developing a strategic research agenda for medical radiation protection: a chance for advancing research in radiology

W. Stiller; *Heidelberg/DE (wolfram.stiller@med.uni-heidelberg.de)*

Over the past decade, the European Commission's funding scheme for radiation protection research has changed from the identification of research topics and their selection by the Commission, to the funding of large-scale projects organising own calls for scientific projects based on research topics of particular interest and importance identified in strategic research agendas (SRAs). Therefore, and to jointly improve medical care by sustainable research efforts, the medical associations involved in the application of ionising radiation in medicine (EANM, EFOMP, EFRS, ESR, ESTRO) have developed and endorsed a common medical SRA. Its development has been of special importance, since medical applications are among the most important contributors to exposure of the European population to ionising radiation. Five main research areas, each with a number of specific research topics of particular importance for establishing optimal radiation protection in the field of medical applications, have been identified: 1. Measurement and quantification in the field of medical applications of ionising radiation. 2. Normal tissue reactions, radiation-induced morbidity and long-term health problems. 3. Optimisation of radiation exposure and harmonisation of practices. 4. Justification of the use of ionising radiation in medical practice. 5. Infrastructure for quality assurance. For medical radiation protection research in these areas to be effective, it is equally critical that research results are directly translatable and transferred into everyday clinical practice, and that scientific education and training in the field of radiation protection for medical applications of ionising radiations is brought forward along with a harmonisation of practices throughout Europe.

Learning Objectives:

1. To raise awareness of the multi-disciplinary effort to define a common strategic research agenda (SRA) for medical radiation protection.
2. To learn about the research topics identified in view of low-dose imaging.
3. To understand the SRA's potential for furthering and improving low-dose imaging research and its translation to clinical routine application.

A-017 08:53

Do iodinated contrast media enhance DNA damage after exposure to ionising radiation?

G. Frija; *Paris/FR (guy.frija@egp.aphp.fr)*

Some recent publications raise the possibility that radiation exposure from CT can cause more DNA damage when iodinated contrast agents are used than in CT without contrast agents.The mechanism seems to be related to the interaction between x-rays and the high Z of iodine which induces a photoelectric effect with a consequent damage on the neighbouring cells. The magnitude of these findings and their clinical signification remains unclear, especially with short-term repeated examinations. We will review the most relevant studies to clarify the mechanisms, the eventual role of the chemical structure of the contrast agent, the biological pathways which could be involved and the potential clinical signification. The area of some potential remaining research to be developed will be finally outlined.

Learning Objectives:

1. To raise awareness of the interrelation of ionising radiation-induced DNA damage and iodinated contrast media usage.
2. To understand the underlying mechanisms of radiation-induced DNA damage in the presence of iodinated contrast agents.
3. To outline the clinical implications in view of contrast-enhanced imaging employing iodinated contrast agents.

A-018 09:16

Dose reduction in modern digital plain-radiography on the basis of indication-specific, standardised quality criteria

D. Spira; *Heidelberg/DE (daniel.spira@med.uni-heidelberg.de)*

The reference values of the German Federal Office for Radiation (BfS) for plain radiography examinations are organ specific and not adapted to indications. However, in contrast to other indications such as suspected bone tumours or trauma, where the highest contrast is mandatory, radiation exposure can be reduced in specific indications. Plain radiography of the total spine in patients with scoliosis can be performed with a dose reduction of 50%, still enabling the assessment of Cobb angle, rotation, lateral alignment and perpendicular measurement. Full-leg plain radiography in patients with knee malalignment permits evaluation of mechanical axis, leg length and epiphyseal plates even after a dose reduction of 33%. Pelvic x-ray examinations in patients with total hip arthroplasty or femoral osteosynthesis can still be used to evaluate bone-implant interface, implant-implant discrimination, implant-surface character and periarticular heterotopic ossification after a dose reduction of 42%. And the same parameters are readily assessable on digital radiographs of the knee joint after total-knee arthroplasty with 37% reduced image receiver dose.

Learning Objectives:

1. To learn about the definition of indication-specific objective quality-control criteria for radiation dose reduction in digital radiography.
2. To understand that objective quality-control criteria enable indication-specific radiation dose reduction of 40-50% without loss of relevant diagnostic information.
3. To raise awareness of the dose reduction potential in digital plain-radiography of the entire spine, of the full leg in knee malalignment, of the pelvis after total hip arthroplasty or osteosynthesis, and of the knee following total knee arthroplasty.

A-019 09:38

Paediatric imaging: are risks of ionising radiation exposure established?

H. Ducou le Pointe; *Paris/FR (hubert.ducou-le-pointe@trs.ap-hop-paris.fr)*

The risks of ionising radiation exposure are considered superior in children compared to adults for mainly two reasons: first, tissues with high mitoses rates are more vulnerable to radiation and second, with a longer life expectancy, children are more subjected to long-term radiation adverse effects than adults. Research is currently undertaken on the individual responses to radiation. Deterministic injuries as a result of high-dose exposure during interventional radiology procedures are described. Such effects do not occur in diagnostic radiology procedures. Stochastic effects related to relatively high doses are well established, but the stochastic effects of low-doses (up to 100 mSv) and linear-no-threshold models are still subjects of debate. Large-scale epidemiological studies of children exposed to CT scans have provided direct risk estimates (Pearce 2012, Mathews 2013, and Huang 2014). A major drawback of these studies is that the clinical indications for the CT scan were not identified whereas recent studies (Journy 2014, Krille 2015) have demonstrated the potential impact of predisposing factors for cancer in estimating related cancer risks from CT scans. In addition, according to a French national survey, CT scans represent only 2.1% of all ionising radiological procedures in children, the vast majority being represented by conventional radiography. Thus, 70% of the effective dose is delivered to the paediatric population by conventional radiological procedures. Finally, rigorous

justification of radiological procedures and optimised protocols adapted to patient size and weight is mandatory to reduce the delivered dose.
Learning Objectives:
1. To learn about the risks associated with the exposure to ionising radiation in paediatric imaging.
2. To become familiar with current research methods and underlying theories for defining the risks in paediatric patient populations.
3. To outline the clinical implications in view of paediatric imaging.
Author Disclosure:
H. Ducou le Pointe: Other; Member of EDF scientific committee.

08:30 - 10:00 **Room E1**

Musculoskeletal

RC 110
The elbow: a comprehensive approach

A-020 08:30
Chairman's introduction
A. Alcalá-Galiano; *Madrid/ES (aalcalagaliano@gmail.com)*

The elbow is a complex hinge joint commonly injured in trauma and subject to chronic overuse syndromes in both athletic and non-athletic individuals. Understanding of the anatomy, systematic image evaluation as well as structured reporting are crucial for accurate diagnosis and to assist in surgical decision making. Recognised pitfalls and normal variants should not be confounded with pathology. Chronic overuse injuries or instability may have subtle imaging manifestations and some injuries may clinically emulate or exacerbate other entities; therefore, imaging prior to intervention is essential. Relevant parameters of tendon injury for treatment planning and the imaging appearance of the different instability patterns of the elbow joint due to lesion of the valgus/varus stabilizers need to be identified. Ulnar neuropathy at the elbow is the most common and best recognised, but there are other nerve entrapment syndromes that should not be missed. The choice of imaging modality for soft-tissue derangement at the elbow includes MR and US, whereas CT is usually reserved for osteoarticular evaluation. US allows dynamic evaluation and may demonstrate findings which would otherwise be missed at static examinations. This session will provide a profound review of the imaging appearance of tendon anatomy and pathology, ligament injury and instability and nerve entrapment syndromes at the elbow with different imaging modalities. Interventional techniques for treating elbow tendon disease will also be discussed.
Session Objectives:
1. To understand that assessing this joint requires specific technical focus of technique, imaging protocol, choice of coils and sequences and modalities.
2. To learn about the pivotal role of the radiologist in evaluating elbow imaging in order to provide essential information for the arthroscopist.

A-021 08:35
A. The tendons: anatomy, pathology and intervention
P. Peetrons; *Brussels/BE*

The anatomy of the extensor and flexor tendons in the elbow is simple. It is not the case with the biceps tendon and more information will be given about the division between the distal tendons including the lacertus fibrosus covering the flexor muscles and joining their aponeurosis. The distal tendons, formed by 2 different tendons (one for the short head, one for the long head) will be analysed in detail, including the different ultrasonic approaches to see them correctly. Pathology of the common extensor and flexor tendons is tendinopathy. The term "tendonitis" is not appropriate. The lesions are degenerative, including clefts, fissures and hypervascularisation. No inflammation is seen within the tendon. In both MR and US, there is hypertrophy of the tendons, hypersignal (in MR), hypoechogenicity (in US), clefts and many vessels in power Doppler or microangiographic Doppler. Pathology of the biceps tendon (s) includes tendinopathy at the level of the insertion on the radial tuberosity, (partial) rupture of one tendon, full thickness rupture with or without involvement of the lacertus fibrosus. Biceps distal tendon has no synovial sheath but is surrounded by the radiobicipital bursa. Treatment of the common flexor and extensor tendons changed a lot these last years. Intratendinous platelet-rich plasma injections as well as needle "fenestration" of the tendon, using ultrasonic guidance give very good results. In our practice, ultrasonic-guided injections of 1 ml of PRP inside the tendon, lead to 82% of improvements or disappearance of the tendons within 6 months.
Learning Objectives:
1. To become familiar with the normal imaging anatomy and pathological appearances of the elbow tendons.
2. To learn about interventional radiological techniques for treating elbow tendon disease.

A-022 08:58
B. Ligament injury and instability: what to look for and what to say
M.C. De Jonge; *Amsterdam/NL (MdJonge@zuwehofpoort.nl)*

The elbow joint is an intrinsic very unstable joint. It derives its stability from the capsula, joint crossing muscles, tendons and ligaments. Ligament injuries are not frequent although it depends upon the patient population. In sports people, e.g. throwing sports like baseball, it is quite common. The most common stabilizing ligaments are on the ulnar and radial side. On the ulnar side the ulnar collateral ligament (UCL) is the most important one often injured in situations where acute (severe) valgus stress is applied to the elbow. The most common chronic instability due to a ligament injury of the elbow, however, is the posterolateral instability. The most important structure on the radial side involved in this type of instability is the lateral ulnar collateral ligament (LUCL). At the same time, this is also one of the most challenging ligaments to visualise for the radiologist. After a brief introduction of the anatomy, the mechanisms of injury to the medial and lateral ligaments will be discussed. Optimisation of the imaging protocol will be reviewed with the respective values of ultrasound and MRI.
Learning Objectives:
1. To become familiar with patterns of abnormality seen in elbow instability.
2. To learn about the imaging findings of elbow instability.

A-023 09:21
C. Nerve entrapment at the elbow
L.M. Sconfienza; *San Donato Milanese/IT (io@lucasconfienza.it)*

The most common condition around the elbow is the cubital tunnel syndrome. It is a compression neuropathy that can occur either at the condylar groove or at the edge of the arcuate ligament. Causes of compression include direct extrinsic compression on the condylar groove, bone abnormalities, and soft tissue lesions. Clinical findings include elbow pain and sensory symptoms in the innervated area. Diagnosis is mainly based on electrophysiological studies but US may demonstrate the presence of nerve thinning/thickening and associated abnormalities. Ulnar nerve instability at the cubital tunnel is also common but is asymptomatic in up to 47% of patients. When symptoms are present, US may demonstrate nerve thickening with hypervascularisation. The median nerve is infrequently impinged around the elbow. Anterior interosseous neuropathy occurs where nerve branches off the median nerve, in proximity to the pronator teres and the tendinous bridge connecting the heads of the flexor digitorum superficialis. When this syndrome is clinically suspected, US evaluation is usually inconclusive. However, abnormal reflectivity of innervated muscles can be seen. The median nerve may also be impinged as passing the pronator teres muscle. Posterior interosseous neuropathy is an uncommon condition of impingement at three different locations around the elbow, but more typically near or behind the supinator muscle at the proximal third of the forearm, where the nerve enters a strong fibrous arcade (i.e., arcade of Frohse). Clinical presentation is typical and US is able to identify the thickened nerve impinging in the arcade of Frohse.
Learning Objectives:
1. To understand the radiological anatomy of the peripheral nerves at the elbow.
2. To learn about the imaging findings of nerve entrapments at the elbow.

09:44
Panel discussion: US, CT, conventional MR, high field MR: what to choose when?

08:30 - 10:00 **Room F2**

Breast

RC 102
Breast ultrasound 2016

Moderator:
A. Athanasiou; Athens/FR

A-024 08:30
A. Evidence for screening in dense breasts
V. Girardi; *Brescia/IT (giravero@yahoo.it)*

The goal of screening is to reduce the advanced breast cancer rate by finding as many invasive tumours in their preclinical, detectable phase as early as possible. The normal parenchymal patterns of the breast vary from woman to woman. Dense breast tissue may make very difficult to detect pathologic lesions while they are still small - the effect on mammographic sensitivity that drops to 30-50% in dense breasts - and can explain many of the delayed diagnoses and the occurrence of most of the interval cancers. The additional cancer yield of ultrasound as added to negative mammography is about 1.8-4.1 per 1000 women. This means that ultrasound increases the cancer detection rate in range by 15-37%. The majority of additional cancers found is smaller than 1 cm and are invasive (90% of cases) that we presume would benefit for survival patients. The questions not completely answered are false-positive findings; no evidence reduce mortality. Ultrasound significantly increases rates of false positive findings (7% increase in recall rates for incidence screens compared to mammography alone; 3% increase in short-interval follow-up; 5% increase in women biopsied). A significant reduction in the number of unnecessary biopsies is an important prerequisite for widespread implementation of screening ultrasound as an adjunct to mammography. The management of the more frequent benign breast disorders in screening ultrasound should be different from traditional setting. A learning curve exists in interpreting ultrasound results and to achieve optimal results high level of expertise in ultrasound is required.
Learning Objectives:
1. To understand how breast density negatively impacts on sensitivity of screening mammography.
2. To know the results of additional screening methods in women with dense breasts.
3. To be aware of cost considerations for additional screening methods.

A-025 09:00
B. Elastosonography: true advances or false hope?
C.S. Balleyguier; *Villejuif/FR (Corinne.BALLEYGUIER@gustaveroussy.fr)*

Ultrasonography (US) B-mode is an established and challenging imaging tool in the diagnosis of breast tissue abnormalities. US provides a high degree of sensitivity in differentiating malignancies, nevertheless, false-positive results represent a drawback for US. Elastography imaging has been shown to improve specificity of the US evaluation of breast masses, in evaluating tissue stiffness. Most common elasticity imaging techniques are represented by free-hand elastography, which requires manual compression on a lesion with the ultrasound probe. This technique is easily feasible with a learning curve, but remains dependent of the operator. Shear-wave elasticity imaging is a new technology which provides qualitative and quantitative analysis on a lesion, less dependent on the operator. Performances of shear-wave elasticity may improve breast lesion characterisation and help to better categorise undetermined lesions such as BI-RADS 4a and 3 nodules. Elasticity imaging characteristics has been added in the new version of BI-RADS ultrasound lexicon. Anyway, some false positives encountered in benign fibrous lesions, and false negatives occurring in smooth lesions such as mucinous carcinoma, cystic carcinoma or inflammatory lesions must be known. Elasticity imaging is not mandatory but may be used as an additional tool to help characterisation. Anyway, in case of doubt, B-mode imaging features still should be considered with priority against elasticity results. Elasticity imaging principles with an overview of the different elasticity modes which may be used will be presented during this session.
Learning Objectives:
1. To understand physical principles of elastosonography.
2. To become familiar with the technique of shear-wave elastosonography of the breast.
3. To appreciate reproducibility and clinical value of elastosonography in clinical practice.
Author Disclosure:
C.S. Balleyguier: Speaker; Siemens, Samsung.

A-026 09:30
C. Nodal staging of breast cancer: still needed?
F. Kilburn-Toppin; *Cambridge/UK (fleur.kilburn-toppin@addenbrookes.nhs.uk)*

Evaluation of regional lymph node status is important for staging, treatment planning and prognosis in breast cancer patients. Pre-operative axillary ultrasound and ultrasound-guided biopsy are routinely used to detect nodal metastases, allowing patients to proceed directly to axillary lymph node dissection thereby avoiding sentinel lymph node biopsy. However, following recent clinical trials and with improvement in systemic and radiation therapies, the role of staging sonography has been questioned. In this lecture, the current role of axillary staging will be reviewed, the impact of nodal status on treatment planning discussed, and the future for nodal staging in the advent of evolving surgical management of the axilla and a trend towards less aggressive surgery will be considered.
Learning Objectives:
1. To know the current debate on sentinel node biopsy and axillary lymph node dissection.
2. To appreciate the clinical role of staging of the axilla using ultrasound with selective ultrasound-guided needle biopsy.
3. To understand the need for discriminating between minimal versus advanced nodal metastatic involvement.

08:30 - 10:00 **Room D1**

Chest

RC 104
Pneumonia

A-027 08:30
Chairman's introduction
I.E. Tyurin; *Moscow/RU (igortyurin@gmail.com)*

Pneumonia is a major health care and economic problem because of high morbidity and mortality rate, and due to direct and indirect costs of its management. The most common cause is community-acquired pneumonia, caused by common bacteria like S. Pneumonia as well as different viral agents. Tuberculosis is one of the most important respiratory infections in developing countries and in immune-compromised patients with AIDS everywhere. Tuberculosis pneumonia can easily mimic bacterial CAP and other pulmonary infections. Viral and mycotic infections represent a common course of febrile neutropenia in immune-compromised patients under aggressive therapy. In most of all these patients, a diagnosis is made on the basis of a combination of clinical, radiographic, and laboratory findings. High-resolution CT is usually performed in patients with nonspecific clinical and radiologic findings and in patients with progression of disease despite therapy. A large number of acute and chronic infectious and noninfectious diseases may also result in parenchymal lung disease in both immune-competent and immune-compromised patients. Thin section CT is also performed in patients with noninfectious causes of acute parenchymal lung disease such as organising pneumonia, acute interstitial pneumonia, hypersensitivity pneumonitis, acute eosinophilic pneumonia, and pulmonary hemorrhage. These diseases often have clinical and functional features similar to one another but obviously requiring different treatment. Therefore, the differential diagnosis of these entities is important in daily clinical practice.
Session Objectives:
1. To review the role of imaging in infectious lung diseases.
2. To become confident in recognising typical patterns.

A-028 08:35
A. Community-acquired pneumonia
I. Hartmann; *Rotterdam/NL*

Community-acquired pneumonia (CAP) refers to pneumonia acquired outside of hospitals or extended-care facilities and is one of the most common infectious diseases. CAP is an important cause of morbidity and mortality worldwide. According to the IDSA/ATS/AAFP guidelines, a chest radiograph is required for the routine evaluation of patients with suspected CAP to exclude conditions that mimic CAP (e.g., acute bronchitis) and to confirm the presence of an infiltrate compatible with the presentation of CAP. Although chest radiography findings usually do not allow identifying the causative organism, they may be helpful in narrowing down the differential diagnosis, prognosis, and detection or the detection of associated conditions. Serial chest radiography can be performed to observe the progression of CAP. CT scanning is increasingly used in clinical practice. Performing CT should be considered if any of the abnormalities at presentation or at follow-up are not consistent with the diagnosis of pneumonia, if concomitant disease is suspected such as an underlying bronchogenic carcinoma, for the confirmation

of pleural effusion, and for the detection of pulmonary complications. The aim of the presentation is to provide an overview of the imaging findings of the most common etiologic organisms in patients with CAP. In addition, imaging findings that may help in the differentiation between pneumonia and other common non-infectious causes of abnormal chest radiographs in patients with suspected CAP will be discussed.

Learning Objectives:

1. To review the role of imaging examinations in the management of community-acquired pneumonia.
2. To learn about signs which suggest specific pathogens and help to discriminate from noninfectious diseases.

A-029 08:58

B. Tuberculosis

E. Castañer; *Sabadell/ES (ecastaner@tauli.cat)*

Pulmonary tuberculosis (TB) remains a common worldwide infection that produces high mortality and morbidity, especially in developing countries. In 2013, an estimated 9.0 million (360000 of whom were HIV positive) people developed TB and 1.5 million died from the disease. Chest radiographs play a major role in the screening, diagnosis, and response to treatment of patients with TB. However, the radiographs may be normal or show only mild or nonspecific findings in patients with active disease. We will review the chest radiograph findings of TB, which vary widely in function of several host factors, age, prior exposure to TB, and underlying immune status. CT is useful in detecting TB incidentally, in resolving cases with inconclusive findings on chest radiographs, and in assessing disease activity. Cavities, centrilobular nodules and tree-in-bud appearance are the most common CT findings of active pulmonary tuberculosis. We will discuss the classic, and some not-so-classic, signs that should suggest the diagnosis of TB.

Learning Objectives:

1. To review typical and atypical tuberculosis manifestations on imaging.
2. To differentiate between acute and chronic tuberculosis infection.

A-030 09:21

C. Fungal pneumonia in immunocompromised hosts

J. Mayer; *Heidelberg/DE (johanna.mayer@med.uni-heidelberg.de)*

Opportunistic infections including invasive fungal infections (IFI) are the leading cause of morbidity and mortality in severely immunocompromised patients despite of successful prophylaxis and empirical therapy. The incidence of invasive fungal infections ranges from 10 to 30% in patients with acute myeloid leukaemia (AML), high-risk acute lymphoblastic leukaemia (ALL), recurrent leukaemia and allogeneic hematopoietic stem cell transplantation (HSCT). Incidence rates in patients with lymphoma, solid tumours treated with high-dose chemotherapy followed by autologous HSCT are below 5%. Depending on the type of immune deficiency and the immune status there are different infecting agents (e.g. S. aureus, P. aeruginosa, aspergillosis, candidiasis, mucormycosis, pneumococci, CMV, and pneumocystosis) that lead to pneumonia in adult immunocompromised patients. The diagnosis is based on clinical, radiological and microbiological findings, leading to possible, probable and proven IFI. Dense, well-circumscribed lesion (s) with or without halo sign, the air-crescent sign or cavity are radiological signs and a part of the clinical criteria of probable invasive fungal disease. Knowledge of the type of immunosuppression in combination with the CT patterns enable to identify IFI early, leading to initiation of appropriate treatment and improved outcome.

Learning Objectives:

1. To review the various expression of fungal lung infection depending on the type of immune depression.
2. To become familiar with CT signs suggesting angio invasive fungal infection.

09:44

Panel discussion: What is the role of radiologists in the diagnosis and management of lung infections?

08:30 - 10:00 **Room D2**

Physics in Radiology

RC 113

Single-dual-multi-energy CT

A-031 08:30

Chairman's introduction

J. Damilakis; *Iraklion/GR (damilaki@med.uoc.gr)*

Dual-energy CT acquisition is possible using either single-source CT or dual-source CT. In single-source CT units, a generator switches x-ray tube potential from 80 kVp to 140 kVp corresponding to photon energies from about 40 keV to 140 keV. For each exposure, the exposure time is only 0.5 msec, allowing simultaneous acquisition of low-kVp and high-kVp images. Dual-source CT scanners are composed of 2 tubes and 2 detector arrays. The 2 tubes are positioned at 90 degrees from each other. For dual-energy CT the potential applied across the 2 tubes is 80 kVp to 140 kVp. The tube load (mAs) is adjusted accordingly to 50 mAs for the high-kVp tube and 200 mAs for the low-kVp tube. Other approaches have been introduced through energy-sensitive detectors and photon counting detectors. All CT examinations should be optimised to achieve diagnostic image quality with the lowest radiation dose possible. Dose optimisation of dual-energy examinations is an area of great interest for both medical physicists and radiologists. The replacement of pre-contrast imaging by virtual non-contrast-enhanced imaging provides a great opportunity of radiation dose reduction. Moreover, several techniques and tools have been developed for CT dose optimisation and these methods are also applicable for dual-energy CT studies. For example, application of new iterative reconstruction algorithms, use of automatic exposure control and other dose saving tools may help to reduce patient doses considerably.

Session Objectives:

1. To learn about the basics of dual energy CT (DECT).
2. To understand today's photon counting detector technology.
3. To learn how DECT is applied in clinical practice.

A-032 08:35

A. Basics of diagnostic dual energy CT

T. Klinder; *Hamburg/DE (tobias.klinder@philips.com)*

Although the first applications of dual-energy CT (DECT) were already introduced in the 1980s, they were not adopted in clinical practice. However, with advancements in the CT systems, DECT experienced its comeback and is now clinically emerging. In this course, we will explain the technological basics of diagnostic DECT and show its clinical potential. First, the general idea of CT acquisition is reviewed to acknowledge the spectral information that DECT provides. The fundamental underlying physics of DECT is explained. In particular, it is derived how spectral acquisition allows to parameterise the energy-dependent attenuation coefficient inaccessible to single-energy CT. As a consequence, while single-energy CT provides images that consist of water-normalised effective x-ray attenuation coefficients given in Hounsfield units (HU), DECT aims to provide parameters such as concentrations, densities or atomic numbers.The different techniques for acquisition of DECT, such as dual source, kVP switching, and dual layer, will be compared, presenting advantages and disadvantages of the various concepts. Dual-energy data can be post-processed and presented in various ways (e.g. monochromatic images, iodine maps or virtual non-contrast images). The individual possibilities are thereby described on the basis of the introduced physical principles. Finally, an overview of main clinical applications of DECT is given including the detailed review of different clinical example cases. Where appropriate, a comparison to single-energy CT is given to fully appreciate the additional value of DECT.

Learning Objectives:

1. To learn about the underlying physics and today's technology.
2. To see potential advantages compared to single energy CT.
3. To appreciate the rationale behind clinical applications.

Author Disclosure:

T. Klinder: Employee; Philips Research.

A-033 08:58

B. Photon counting detector technology for diagnostic CT

M. Danielsson; *Stockholm/SE (md@mi.physics.kth.se)*

Recent developments and principles of photon counting detectors for spectral x-ray imaging will be explained. Typical technical implementations are described and fundamental differences to energy integrating systems are pointed out. In particular, the issues of high-rate handling and the effect of detector cross talk on energy resolution and dose efficiency will be discussed.

Another objective is to outline clinical applications based on energy weighting and material decomposition methods.
Learning Objectives:
1. To learn about the underlying physics and technological solutions.
2. To understand the potential advantages compared to dual energy CT.
3. To appreciate how mature today's photon counting technology is.
Author Disclosure:
M. Danielsson: Board Member; Biovica International AB. CEO; Prismatic Sensors AB. Founder; Prismatic Sensors AB. Owner; Innovicum AB. Shareholder; Prismatic Sensors AB.

A-034 09:21

C. Do we really need multi-energy CT?
S.T. Schindera; *Basle/CH (sschindera@aol.com)*

During the last few years, dual-energy CT has gained increasing attention in clinical routine due to improved diagnostic performance from the quantitative analysis of different tissue composition. Various clinical indications for a dual-energy CT scan will be reviewed with a focus on the added value. Potential future opportunities of dual-energy CT, which still are viewed as research tools, will also be discussed.
Learning Objectives:
1. To learn about medical applications and potential benefits.
2. To see which single energy applications should be replaced by dual energy applications, and why.
3. To find out what additional multi-energy CT applications would be nice to have.
Author Disclosure:
S.T. Schindera: Advisory Board; Bayer Healthcare. Research/Grant Support; Siemens, Bayer Healthcare, ulrich medical. Speaker; Siemens, Bayer Healthacre.

09:44
Panel discussion: How many energies do we need in CT?

08:30 - 10:00 **Room K**

Genitourinary

RC 107

Pitfalls in gynaecologic oncologic imaging: how to avoid them and minimise risks

A-035 08:30

Chairman's introduction
E. Sala; *New York, NY/US (salae@mskcc.org)*

There are several pitfalls that should be recognised when imaging the female pelvis. Appearances of uterus and ovaries are dependent on the phase of menstrual cycle/use of exogenous hormone therapy. Normal post-surgical and post-radiation appearances of the pelvis can sometimes mimic tumour recurrence. It is important to become familiar with these appearances to avoid potential pitfalls. Choice of correct imaging plane is crucial for accurate evaluation of depth of myometrial invasion in endometrial cancer and parametrial invasion in patients with cervical cancer. Both dynamic contrast-enhanced MRI and diffusion-weighted MRI improve the accuracy of MRI in evaluation of gynaecologic malignancies. However, certain pitfalls related to each technique should be recognised to avoid misinterpretation. It is crucial to be familiar with the anatomy of the uterovesical (UV) ligament as it is often the site of pelvic lymphoma (such as bladder or cervix lymphoma). However, some benign conditions such as endometriosis can involve the UV fold and invade both bladder and uterine wall. Certain MRI features can be helpful in making the correct diagnosis.
Session Objectives:
1. To provide an overview of pitfalls and errors in interpretation of gynaecologic cancers.
2. To become familiar with strategies for avoiding pitfalls.

A-036 08:35

A. Mistakes in assessment of cervical cancer
K. Downey; *London/UK (katherine.downey@rmh.nhs.uk)*

MR imaging has become standard in the pre-treatment assessment of disease extent in cervical cancer as an adjunct to the internationally recognised clinically based (FIGO) staging. Using imaging to accurately identify and delineate tumour extent ensures optimum treatment planning. Imaging is also crucial in assessing treatment response and in post-treatment surveillance although there is no current consensus regarding the timing of routine follow-up. Choosing the most favourable available modality or MRI sequence as well as accurately interpreting the acquired images in the pre- and post-treatment cervix is not always straightforward. The aim of this refresher course presentation is to highlight the imaging features of some of the common mimics of cervical cancer which can hinder accurate identification of disease and to become familiar with some imaging pitfalls and potential radiological mistakes in pre-treatment disease staging and the assessment of treatment response.
Learning Objectives:
1. To become familiar with pitfalls in staging of cervical cancer and in monitoring treatment response.
2. To learn how to differentiate mimics of cervical cancer.
3. To understand the central role of MRI in treatment planning.

A-037 08:58

B. Mistakes in assessment of endometrial cancer
T.M. Cunha, M. Horta; *Lisbon/PT (tmargarida@gmail.com)*

Endometrial carcinoma represents 4.8% of all cancers in women worldwide with approximately 75% of cancers diagnosed at an early stage. Although magnetic resonance imaging is not considered in the International Federation of Obstetrics (FIGO) 2009 staging classification, it plays an important role in the diagnosis and pre-operative staging of endometrial carcinoma; thus being a crucial tool for defining the surgical and therapeutic approach of these tumours. To help prevent diagnostic errors and to guide appropriate therapeutic management, radiologists should be aware of common magnetic resonance imaging mistakes in assessment of endometrial carcinoma. Pitfalls that may mask or simulate endometrial carcinoma include: a cervical adenocarcinoma misinterpreted as an endometrial adenocarcinoma; benign endometrial pathology misinterpreted as malignant pathology; specific tumoural locations and uncommon cancer-enhancing patterns. Several common mistakes in staging endometrial carcinoma will also be outlined. Knowledge of the existence of these diagnostic pitfalls should help prevent misinterpretation of a pelvic magnetic resonance for assessment of endometrial carcinoma.
Learning Objectives:
1. To become familiar with pitfalls in local tumour spread in endometrial cancer.
2. To learn how to differentiate benign and malignant mimics.
3. To appreciate the complementary value of functional MRI techniques.
4. To understand the potential clinical impact of these mistakes in treatment planning.

A-038 09:21

C. Mistakes in assessment of ovarian masses
I. Thomassin-Naggara; *Paris/FR (isabelle.thomassin@tnn.aphp.fr)*

Pelvic MR imaging allows to avoid most of the mistakes in the assessment of ovarian masses made using transvaginal ultrasonography or CT scan. However, even using pelvic MR imaging, there are some pathologies that may mimic primitive ovarian cancer including pelvic inflammatory disease, uterine myoma, digestive tumour, or ovarian metastasis. Preoperative diagnosis of these pathologies is crucial because therapeutic strategy is completely different and the absence of diagnosis may impact on the prognosis. Thus, this lecture will present three clinical situations where the radiologist needs to accurately analyse MR images to not misdiagnose as ovarian cancer a wide variety of pelvic pathologies.
Learning Objectives:
1. To become familiar with benign masses mimicking ovarian cancer.
2. To demonstrate benign and malignant diseases mimicking peritoneal carcinomatosis.
3. To learn about imaging strategies for avoiding these pitfalls.
Author Disclosure:
I. Thomassin-Naggara: Speaker; General Electric. Other; Travel Congress - General Electric.

09:44
Panel discussion: How can we improve interdisciplinary communication and avoid misunderstanding in our reports?

08:30 - 10:00 **Room G**

Neuro

RC 111

Toxic brain disorders

Moderator:
P. Due-Tønnessen; Oslo/NO

A-039 08:30

A. Alcohol-related changes in the brain
M. Knauth; *Göttingen/DE*

Alcoholism is a major problem (not only, but also) in the western industrial societies, including Europe, of course. Therefore, every radiologist has to be familiar with the MRI detectable changes that can occur in the brain in acute, chronic or acute on chronic alcohol intoxication. This does not only include alterations of the brain structure that are directly caused by ethanol, but also those that are more correctly attributable to the circumstances of chronic alcohol addiction, i.e. malnutrition. Also, the lecture will deal with the reversibility potential of some of these brain changes when alcohol abstinence can finally be achieved. The main focus will be the ethanol-induced brain changes, but we will glance at "neighbouring" alcohols as well.
Learning Objectives:
1. To document how imaging can help with diagnosing acute alcohol poisoning and chronic alcoholic encephalopathy.
2. To discuss Wernicke encephalopathy.
3. To present the imaging findings in methanol and ethylene glycol poisoning.

A-040 09:00

B. Recreational drugs and occupational hazards
L. Reneman; *Amsterdam/NL (l.reneman@amc.uva.nl)*

Recreational drugs are drugs (legal, controlled, or illegal) with the primary intention to alter the state of consciousness to create positive emotions and feelings. There is a strong association in the literature with amphetamine-like substances, of which MDMA is unquestionably the most popular and extensively studied. However, despite their popularity few detailed assessments of risks in humans exist. This may be due to the fact that previously, potential neurotoxic changes in the living human brain have only been identified using indirect methods. However, in vivo neuroimaging tools, such as positron emission tomography (PET), single photon emission computed tomography (SPECT), and several magnetic resonance (MR) imaging applications show great promise in directly identifying potential neurotoxic consequences of recreational drugs in the living human brain. Similarly, neuroimaging techniques have also greatly advanced our knowledge on occupationally used toxic substances, such as organophosphates (widely used as solvents, plasticizers, and EP additives). Several studies now have shown that some recreational drugs and occupationally used substances can induce neuronal injury. If true, the health implications may be considerable, in which they could be responsible for early or late neuropsychiatric morbidity.
Learning Objectives:
1. To present an overview of recreational drugs and how they influence the brain.
2. To illustrate the effect of drugs on imaging studies (amphetamines, ecstasy, cocaine, heroine, methadone, …).
3. To understand how occupationally used toxic substances can influence the brain (including toluene, cyanide, organophosphates, lead and mercury poisoning, …).

A-041 09:30

C. Treatment-induced effects on the brain parenchyma
J. Alvarez-Linera; *Madrid/ES (jalinera@ruberinternacional.es)*

Treatment-induced CNS toxicity remains a major cause of morbidity in oncologic patients and can produce a broad spectrum of neuroradiological findings that pose a diagnostic challenge. Secondary lesions to treatment can be focal or diffuse and occur both in early and late stages. In terms of focal lesions, both in early stage (pseudoprogression), and late (radionecrosis), the main objective of neuroimaging is to rule out tumour recurrence or progression. MRI is the main diagnostic tool and diffusion, perfusion and spectroscopy techniques play an important role in the differential diagnosis. Diffuse lesions predominantly affect the white matter and can manifest itself as leukoencephalopathy or vasculopathy. Severe neurotoxicity after chemotherapy is more frequent in combination with radiotherapy. The most striking toxic effect is disseminated necrotising leukoencephalopathy, which has been reported after treatment with high-dose methotrexate and whole brain irradiation. Reversible posterior leukoencephalopathy syndrome (PRES) is associated with an increasing number of drugs and MRI findings are characterised by symmetric hyperintense T2 signal involving bilateral occipital and parietal lobes in a predominant subcortical distribution. Knowledge of the different neuroradiologic patterns related to neurotoxicity is fundamental both to minimise neurological damage and to optimise oncologic treatment.
Learning Objectives:
1. To show the imaging findings after radiation therapy in the acute, early and late delayed stages.
2. To present an overview of long-term sequelae after radiation therapy.
3. To discuss treatment induced leukoencephalopathy after chemotherapy (especially metothrexate).

08:30 - 10:00 **Room M 1**

Molecular Imaging

RC 106

Molecular imaging: what can we quantify?

Moderator:
T.H. Helbich; Vienna/AT

A-042 08:30

A. Advanced MRI techniques
C.A. Cuénod; *Paris/FR (ca@cuenod.net)*

Even if "size quantification" has been used since the beginning of radiology, the advent of MRI has triggered a new trend in quantification. The versatility of MRI allows assess to a large array of physical, biophysical, chemical and functional parameters, including T1 and T2 relaxation rates, temperature, elasticity, magnetisation transfer, biochemical compounds (via MR spectroscopy) to mention a few … and of course diffusion, perfusion and capillary permeability. All these parameters can be roughly estimated visually - there properties are in this case used only to create contrast in the images- they can be normalised as compared to other tissues, or they can be quantify in an absolute way. Quantification is a difficult process, but gives access to objective and statistical studies, which are required to enhance our medical and scientific knowledge, and therefore improve our ability to diagnose and treat diseases. The process of quantification implies a deep understanding of the measured parameters and the measuring tools. It has to be standardise and the measure units have to be precisely defined and agreed on. Through two examples of microcirculation analysis using Dynamic Contrast Enhanced MRI (DCE-MRI) and diffusion using IVIM concept, we will illustrate and discuss the goals, issues and limitations of absolute quantification using MRI. The presentation will demonstrate that currently, even if monocentric studies (or multicenter studies using the exact same acquisition AND analysis protocol) can be reliably analysed, they can usually not be compared to results obtained by other groups using slightly different protocols.
Learning Objectives:
1. To learn about functional MRI (fMRI, DCE-MRI), diffusion tensor imaging (DTI) and diffusion-weighted imaging (DWI).
2. To understand the application of these techniques in the study of the healthy and diseased.
3. To learn about quantification using MR.
Author Disclosure:
C.A. Cuénod: Research/Grant Support; Intrasens.

A-043 09:00

B. Advanced PET imaging techniques
T. Beyer; *Vienna/AT (thomas.beyer@meduniwien.ac.at)*

PET is a non-invasive imaging technique that provides reproducible and fully quantitative information on preselected metabolic/signaling pathways. PET is highly sensitive, thus, requiring only small amounts of biomarkers to be used for visualisation and quantification purposes. By comparison to high-resolution anatomical images PET images appear blurred, which is attributed to the positron range effects and the limited detector size of the PET ring systems. Today, clinical PET imaging systems are offered almost exclusively in combination with CT and MR systems. Advantages of these imaging combinations are manifold and include, mainly for PET/CT, a marked reduction in total acquisition time, and improved spatio-temporal alignment of the complementary image information. Advancing PET-imaging technology into combined PET-based imaging technology included methodological input and technical innovation. In this presentation, we will highlight the most important advances of PET instrumentation that help increase volume sensitivity, improve spatial resolution and overall image quality. PET imaging in the context of combined PET/MRI was made possible only through the introduction of completely revised PET detectors that can operate in high-strength magnetic fields. Overall, increased volume sensitivity helps reduce the amount of radiotracer injected into patients or shorten the emission scan time, in combination with increased signal-to-noise in the emission images (thanks to

the use of time-of-flight, a concept different from TOF-MR) it helps increase sensitivity and reader accuracy of PET images. Lastly, advances in image reconstruction have brought the level of PET, and the appearance of the PET images, closer to the common understanding of radiologically useful images.
Learning Objectives:
1. To understand the fundamentals of PET physics relevant to MR/PET imaging.
2. To appreciate the advantages of MR/PET and its complementary role in diagnostic oncology.
3. To learn about the benefits and challenges of quantification in PET.
Author Disclosure:
T. Beyer: Research/Grant Support; Siemens Healthcare, PET/MR. Speaker; Siemens, Philips.

A-044 09:30

C. Clinical applications of quantitative hybrid imaging in oncology
L. Umutlu; *Essen/DE (Lale.Umutlu@uk-essen.de)*

With the successful introduction of simultaneous PET/MRI into clinical imaging, it has demonstrated its strength as a highly valuable imaging tool for oncologic imaging. While the PET component enables the assessment of tumour metabolism, the integrated 3 Tesla MR scanner interchanges the CT component for anatomical correlation, enabling high-resolution MR imaging. Most studies have reported the comparable diagnostic potential of PET/MRI to PET/CT for whole body staging, yet also its diagnostic superiority in soft tissue-depending application fields such as prostate or cervical cancer. The first aim of this trial is to give a review on the broad application fields and current study results of PET/MRI in the field of oncology. Apart from its very successful implementation in numerous oncological applications, the value of absolute quantification of PET/MRI-derived standardised uptake values remains to be a scrutinised issue due to the modified attenuation correction technique. The second aim will be to give an insight into established and new techniques of attenuation correction as well as to discuss the true value of absolute quantification of hybrid imaging techniques.
Learning Objectives:
1. To become familiar with the role of hybrid imaging in clinical oncology.
2. To learn about quantification in oncology: its benefits and limitations.
3. To understand hybrid imaging applications in relationship to disease presentations.
Author Disclosure:
L. Umutlu: Consultant; Bayer Healthcare. Research/Grant Support; Siemens Healthcare.

08:30 - 10:00 **Room M 3**

Interventional Radiology

RC 109
Image fusion for image-guided interventions

A-045 08:30

Chairman's introduction
A. Adam; *London/UK (andy.adam@kcl.ac.uk)*

Imaging-guided interventions are making an increasing contribution to the treatment of patients with many vascular and non-vascular conditions. Minimally invasive techniques enable effective treatment that is followed by rapid recovery. The effectiveness of such methods of treatment is enhanced by image fusion techniques, which are used to increase the accuracy of placement of instruments, or to identify active disease that would be more difficult to target with a single imaging modality. This session will explore current methods of image fusion and their current applications in image-guided therapy.
Session Objectives:
1. To provide an overview of 3D navigation systems.
2. To learn about stereotaxis with manual and automatic aiming devices.
3. To learn about cone beam CT and ultrasound guidance with image fusion.

A-046 08:35

A. Cone-beam CT in vascular and non-vascular interventional procedures
T.F. Jakobs; *Munich/DE (tobias.jakobs@barmherzige-muenchen.de)*

Clinical experience has demonstrated cone-beam CT to be a useful adjunct to DSA in hepatic vascular interventions. One advantage of using cone-beam CT with conventional DSA is that cone-beam CT gives users the information they need to create an anatomic survey for treatment planning that delineates a patient's vascular anatomy and accounts for vascular structures, the associated parenchyma, and the target lesion This ability enables more selective catheterisations to be performed, which may improve the safety and efficacy of interventions by depositing therapeutic agents more selectively; that is, the amount of therapeutic agent delivered to the target area is increased and the amount of non-tumour-bearing liver exposed to the agent decreased. In addition, an anatomic survey also allows for the confident identification of non-target extrahepatic arteries and variant anatomic structures supplying the GI tract during hepatic arterial treatment. Cone-beam CT may depict vessels not identified at DSA or, more likely, help clarify extrahepatic or variant anatomic vascular structures that are indeterminate at DSA evaluation. In addition cone-beam CT can also allow the operator to determine, whether the entire target lesion is included within the treatment area. If only a portion of the lesion is supplied, that portion of the tumour can be estimated and the agent can be proportioned accordingly. Because cone-beam CT provides soft tissue information, the operator can still selectively treat lesions that are difficult to visualise at DSA and would potentially not have been feasible to treat with DSA alone.
Learning Objectives:
1. To learn how to use cone-beam CT in guiding interventional procedures.
2. To learn when to use this technique in oncologic biopsies and ablations.
3. To learn how to use this technique in improving efficacy and safety of intra-arterial procedures.
Author Disclosure:
T.F. Jakobs: Advisory Board; Surefire, Siemens, BTG, Cook. Speaker; Siemens, BTG, Surefire.

A-047 08:58

B. US image fusion
G.H. Mostbeck; *Vienna/AT (gerhard.mostbeck@wienkav.at)*

US image fusion may be defined as overlaying US images with CT, MRT or PET-CT imaging data. Basically, this can be performed either static (3D US volume vs CT/MRT/PET-CT) or real time, which enhances the technique to perform US-fusion-guided interventional procedures. Today, software for real-time US image fusion with CT/MRT/PET-CT data is available in various high-end US machines from different vendors. Basically, spatial co-registration is needed to make sure that US volume data and CT/MRT/PET-CT data represent the same volume. This is obtained by defining standard registration points, either by external fiducials placed on the patient or by defining specific anatomic structures in the specific patient. All US image fusion systems available work based on an electromagnetic tracking system, where sensors and transmitters on the US scan head inform the system about the orientation and position of the current imaging plane. However, different patient position, different respiratory cycles and/or involuntary patient movements may cause misalignment. Clinical applications in radiology are seen in imaging and especially in interventions in the breast, liver, prostate, kidney and MSK system. To date, there are only small case series and no larger studies available. General issues are guiding biopsy and/or tumour ablation in special situations, where US alone might not be sufficient to show the target or when US-fusion-guided interventions are more cost-effective, easier to perform, faster and without radiation for patients and staff as interventions performed on CT or MRT.
Learning Objectives:
1. To learn about the technologies used to fuse CT/US and MR/US images.
2. To understand how to use them in clinical practice.
3. To understand the indications for these technologies in difficult cases.

A-048 09:21

C. How can we improve targeting in image-guided interventions: stereotaxis, robotics and advanced techniques
L.A. Solbiati; *Rozzano/IT (luigi.solbiati@hunimed.eu)*

Precise placement of needle biopsies and ablation devices is of crucial importance to achieve clinical success and decrease complication rates in both diagnostic and therapeutic image-guided interventions. Navigation and guidance devices (electromagnetic and optical tracking, laser guidance, cone-beam CT fusion, etc …) are nowadays extensively used to increase operator spatial awareness and hand-eye coordination. Real-time fusion of ultrasound with any static, single or even multiple, imaging modality allows to precisely and rapidly target lesions otherwise reachable only through more invasive approaches. When challenging complex or multi-angle needle trajectories have to be planned (performed) to reach targets in difficult anatomic locations and/or adjacent to anatomic structures at risk, automatically moving robotic guide arms are particularly useful to reduce procedure times and increase precision of targeting. When multiple devices have to be inserted and simultaneously activated into a single large target or many small lesions (i.e. for the ablation of a single large and/or irregularly shaped metastasis requiring multiple overlapping ablation volumes or of multiple small metastases), the use of stereotactic navigation systems is mandatory. Modern frameless stereotactic targeting devices have recently joined (and, for some applications, overcome) traditional arc centered stereotactic frames. Arm-based targeting devices have

the broadest dynamic range and functionality and aiming facilities improve trajectory alignment, allowing targeting errors not exceeding 3-5 mm, according to the most recent literature.
Learning Objectives:
1. To become familiar with principles of stereotaxis and robotics for guiding interventions.
2. To learn about new and advanced techniques in image-guided therapies.
3. To understand when and how to use these techniques in oncologic and non-oncologic interventions.

09:44
Panel discussion: Practical and economic issues in using high-end guidance for interventional radiology

08:30 - 10:00 **Room M 4**

Emergency Radiology

RC 117

Abdominal trauma: does it bleed, will it start bleeding or is something else leaking?

Moderator:
S. Wirth; Munich/DE

A-049 08:30

A. Liver and spleen
M. Scaglione; *Castel Volturno/IT*

Over the past 20 years, the management of blunt liver and splenic trauma has evolved from a primary operative approach to a non-operative one, for both low- and high-grade injuries, on the basis of haemodynamic stability and accurate diagnosis provided by CT. Contrast-enhanced CT enables accurate grading of hepatic and splenic injuries and provides crucial information regarding the presence of parenchymal and, particularly, of vascular injuries. Actually, identification and characterisation of injuries provided by CT angiographic sequences are essential for selecting patients towards non-operative management, angiographic intervention or emergency surgery. In this lecture, the importance of up-to-date CT scanners and dual-phase CT protocol for identification and characterisation of hepatic and splenic injuries will be discussed. Finally, the role of emergency radiologist in the trauma team will be emphasized.
Learning Objectives:
1. To become familiar with traumatic injuries of the liver and spleen that can result in hemodynamic instability and other clinical complications.
2. To learn how to optimise scanning protocols to diagnose these injuries.
3. To understand the impact of these imaging findings on further management of patients and report accordingly.

A-050 09:00

B. Pancreas, bowel and mesentery
M.A. Patak; *Zurich/CH (Michael.Patak@hirslanden.ch)*

Imaging in abdominal trauma is crucial to get a fast overview of the situation and to plan treatment according to the different injuries. Injuries of the pancreas, the bowel and the mesenteries are rather rare conditions and happen mostly to severely injured patients. It is important to actively rule out any possible injury to one of these organs. The presentation will show the typical aspects of traumatic injuries to pancreas, bowel and mesenteries. CT is the most often performed modality in acute trauma and will be discussed extensively. Treatment consequences according to imaging will be discussed.
Learning Objectives:
1. To become familiar with traumatic injuries of the pancreas, bowel and mesentery that can result in hemodynamic instability and other clinical complications.
2. To learn how to optimise scanning protocols to diagnose these injuries.
3. To understand the impact of these imaging findings on further management of patients and report accordingly.

A-051 09:30

C. Urogenital tract
R.H. Oyen; *Leuven/BE (Raymond.Oyen@uzleuven.be)*

Blunt and penetrating abdominal trauma requires dedicated imaging exploration to assess the location and extent of the lesions and to tailor appropriate therapeutic strategies. Surgery-related morbidity after abdominal, urological and gynaecological interventions seems to be low, yet is significant when reported using a standardised methodology. Fortunately, the majority of complications are low grade. Acute complications include haemorrhage, leakage (biliary tract, pancreas, GI tract, urinary tract) and collections. With haemorrhagic complications optimised imaging technique is essential to recognise active bleeding and to evaluate whether dedicated interventional procedures are indicated to avoid invasive surgical interventions. When urinary leakage is suspected, delayed imaging in the excretory phase is essential to clearly demonstrate the site of the leakage. Percutaneous procedures may be indicated, including nephrostomy, and antegrade or retrograde ureteral stenting. Similarly, for detection of leakages of the GI tract appropriate opacification of the involved segments is essential to achieve a diagnosis. When collections are expected, imaging studies are crucial to define the content and to discuss further therapeutic management. In selected cases, imaging-guided percutaneous treatment can be performed in the same setting. For the evaluation of surgical complications, it is essential to understand the surgical technique performed (organ sparing surgery, urinary derivations, bowel derivations, etc).
Learning Objectives:
1. To become familiar with traumatic injuries of the urogenital tract that can result in hemodynamic instability and other clinical complications.
2. To learn how to optimise scanning protocols to diagnose these injuries.
3. To understand the impact of these imaging findings on further management of patients and report accordingly.

08:30 - 10:00 **Room M 5**

E³ - ECR Master Classes (Cardiac)

E³ 126

Cardiac CT and new interventions

A-052 08:30

Chairman's introduction
A. Jankauskas; *Kaunas/LT (jankauskas.antanas@gmail.com)*

Technological advances of cardiovascular interventional equipment led to rapid growth of minimally invasive procedures. Increasing variability of devices, refinement of current ones improved possibilities of access, decreased complication rate, in some procedures provided the option of correction. The consequence is increasing appliance, expanding indications of minimally invasive procedures. Most cardiac interventions need a careful planning of procedure, including evaluation of access route, knowledge about exact anatomy and sizing of relevant cardiac structures, their relationship to adjacent organs. In this case, preprocedural and postprocedural imaging plays crucial role. CT has large field of view, possibility of multiplanar, 3D and 4D reconstructions; furthermore, this imaging modality also experiences many technical improvements, including increasing acquisition time, temporal and spatial resolution, improved safety by lowering radiation dose and less contrast volume required. These properties established CT as important imaging tool for cardiac intervention planning and for postinterventional observation.
Session Objectives:
1. To appreciate the relationship between the evolution of CT technology and growing innovations in cardiovascular intervention equipment.
2. To learn about advantages and disadvantages of preinterventional and postinterventional CT compared to other imaging modalities.
3. To learn techniques for lowering radiation dose during preprocedural and postprocedural CT.
4. To become familiar with possible approaches for interventional procedure and CT, as well as criteria for successful performance.

A-053 08:40

A. CT before and after transcatheter aortic valve interventions (TAVI)
J.-N. Dacher; *Rouen/FR (Jean-Nicolas.Dacher@chu-rouen.fr)*

In recent years, transcatheter aortic valve intervention (TAVI) gained wide acceptance in patients with severe aortic stenosis contraindicated to surgical valve replacement. Pre-operatively, CT of the heart, aorta and iliac vessels is recommended. Various CT techniques can be performed depending on CT generation. Basically, ECG-gated examination of the heart and aortic root should be performed, completed by non-gated coverage of the abdominal aorta and iliofemoral vessels. Systolic reconstruction of the heart should be obtained to evaluate the aortic valve area and measure the annulus (diameters and planimetry). Diastolic reconstruction can be used for evaluating distances between annulus and coronary ostia, the sub-aortic septum, the calcification and cuspidity of the valve, the extent of the calcification (i) to the annulus (increasing the risk of per procedural rupture), (ii) to the septum (risk of conduction abnormality) and (iii) mitral valve. Vascular route should be evaluated from the access up to the aortic valve. All images should be transmitted to the cath. lab. with a structured report, including any other thoraco-abdominal abnormality/disease. Postoperatively, cardiac CT can be

used for assessing the placement of the prosthesis and detect potential complications.
Learning Objectives:
1. To learn about the technical principles, possible complications and potential limitations of MDCT acquisition in TAVI candidates.
2. To understand the anatomy of the aortic annulus and to learn about CT prosthesis sizing.
3. To understand the importance of optimal communication of CT results to the Heart Team and to learn about a structured report.
4. To learn how to anticipate the various possible complications of TAVI and to learn how to detect them by postprocedural CT.

A-054 09:00

B. CT before and after transcatheter mitral valve interventions (TMVI)
P. Blanke; *Vancouver, BC/CA (phil.blanke@googlemail.com)*

Transcatheter mitral valve implantation (TMVI/TMVR) represents a promising approach to treating mitral valve regurgitation in patients at increased risk of perioperative mortality. Similar to transcatheter aortic valve replacement (TAVR), TMVI relies on pre- and periprocedural noninvasive imaging. Although these imaging modalities, namely echocardiography, computed tomography, and fluoroscopy, are well established in TAVR, TMVI has entirely different requirements. Approaches and nomenclature need to be standardised given the multiple disciplines involved. This presentation provides an overview of anatomical principles and definitions, a methodology for anatomical quantification, and perioperative guidance.
Learning Objectives:
1. To understand the anatomy and normal appearance of the mitral apparatus on cardiac CT.
2. To learn about common mitral valve pathologies including mitral annular calcifications, myxomatous degeneration, mitral valve prolapse and mitral stenosis and their appearance on cardiac CT.
3. To learn about recent advances in TMVI and the role of preoperative cross-sectional imaging for patient and device selection.
4. To understand how CT-derived information can facilitate periprocedural guidance with echocardiography and fluoroscopy.
Author Disclosure:
P. Blanke: Consultant; Edwards Lifesiences, Neovasc, Tendyne, Circle Imaging, HeartFlow.

A-055 09:20

C. CT before and after electrophysiology interventions
R. Salgado; *Antwerp/BE (rodrigo.salgado@uza.be)*

Considerable advances have been made in the treatment of certain cardiac arrhythmias using transcatheter-based procedures, aimed directly at manipulating the triggers and substrates of these disorders. The rising success and implementation of these electrophysiology (EP) interventions have led to an increasing demand for non-invasive pre-operative imaging of the heart outside the setting of coronary arteries evaluation. As such, it is important for the radiologist to be aware of the different EP procedures, their requisites from non-invasive 3D imaging and the specific questions that need to be answered. In this lecture, we will review the underlying pathophysiology of the most common arrhythmic conditions which may require an EP intervention, assess the information needed from the radiologist, and review common and more rare complications than can be detected through imaging. Also, cardiac resynchronisation through biventricular pacing has emerged as a valid therapeutic option in patients with heart failure. Pre-procedural imaging can here help by identifying suitable coronary veins for left ventricular lead placement, and provide assistance in defining the optimal position of the pacemaker leads. The basic procedural elements of biventricular pacemaker implantation will be discussed, as well as coronary venous anatomy and its importance in guiding the placement of pacemaker leads.
Learning Objectives:
1. To learn about the evolving role of CT imaging in patients before and after an electrophysiology intervention.
2. To understand what the electrophysiologist wants to know from the CT examination, and how to adapt your scan protocol accordingly.
3. To become familiar with the commonly performed electrophysiology procedures, their pathophysiological background and the most common complications.

09:40
Discussion: How can CT best facilitate cardiac interventions?

10:30 - 12:00 **Room A**

E³ - ECR Academies: Interactive Teaching Sessions

E³ 221
Unexpected findings on brain MRI

A-056 10:30

A. Large ventricles: normal or abnormal?
S. Langner; *Greifswald/DE (soenke.langner@uni-greifswald.de)*

Knowledge of normal and abnormal appearance of the ventricular system is essential for the diagnosis of hydrocephalus. Therefore, anatomical basics of the ventricular systems and basic physiological principles of CSF production and resorption will be explained. Different forms of hydrocephalus with their differential diagnoses will be presented and their differential diagnoses to physiological changes will be discussed. Imaging protocols and strategies will be provided.
Learning Objectives:
1. To gain a basic understanding of CSF production, resorption and flow.
2. To learn how to differentiate the different forms of hydrocephalus.
3. To learn how to differentiate physiologic changes of the ventricular system from hydrocephalus.

A-057 11:15

B. Incidental lesions on a brain MRI
E.T. Tali; *Ankara/TR (turgut.tali@gmail.com)*

Incidental lesions on brain MRI can be categorised according to lesion type as congenital or acquired. Frequently, incidental findings are clinically silent and do not require any further investigation or follow-up imaging. However, some of them require further investigation for the probable future neurological deficits and even prompt treatment. Congenital lesions detected incidentally generally do not have associated clinical finding. Majority of these congenital lesions such as hamartomas, dysplasia do not require follow-up imaging. However, particularly vascular abnormalities; AVMs, cavernomas or tumour-like lesions; colloid cyst which may cause primary or secondary effects require close follow-up to prevent further neurologic deficit. Acquired incidental lesions can be categorised simply as inflammatory, infectious, degenerative, metabolic neoplastic and vascular. Clinically silent demyelinating diseases, subclinical cerebritis, especially parasitic infestations, meningeal and parenchymal lesions of sarcoidosis can be shown incidentally on brain MRI. Incidental findings of metabolic diseases help for the treatment planning and monitoring. Particularly, acquired vascular lesions detected incidentally such as aneurysm, dissection, occlusion, atherosclerosis, vasculitis require either prompt treatment or close follow-up to prevent further clinical deterioration. Incidental lesions of silent infarcts also require further investigation of carotid and vertebral arteries to prevent the further neurologic catastrophe. Advanced and follow-up imaging is required for the incidental low-grade primary neoplasm while many of the primary neoplasia such as meningiomas do not require follow-up imaging. Incidental imaging of the brain metastases may also pivot to investigate and find the primary neoplasm. Many primary neoplasms are investigated after incidental imaging of the brain metastases.
Learning Objectives:
1. To gain an in-depth understanding of the normal anatomy of the brain.
2. To learn how to identify incidental findings on a brain MRI.
3. To be able to confidently detect and describe normal imaging findings of the brain on x-ray, ultrasound, CT and MRI.
4. To learn how to handle the incidental findings.

12:30 - 13:30 **Room B**

E³ - The Beauty of Basic Knowledge: Breast Imaging

E³ 24 A

Breast ultrasound: a primer

Moderator:
J. Camps Herrero; Valencia/ES

A-058 12:30

Breast ultrasound: a primer
A. Tardivon; *Paris/FR (anne.tardivon@curie.net)*

Breast ultrasound (US) is an indispensable complementary tool to clinical examination, mammography and MRI and the first imaging technique used in young or pregnant women and for staging lymph nodes (objective 1: review of indications of breast US). Along a defined scanning protocol (objective 2: how to do), the radiologist has to understand and to know not only the current B gray-scale mode but also when and how to use the other technologies for optimising lesion detection and characterisation (objective 3: principles and results for harmonic, compound, Doppler and elastography techniques). Imaging protocol of US-detected lesions will be highlighted (objective 4: how to produce high-quality imaging reports). The last part of this lecture will develop a step-by-step protocol to optimise US detection of breast lesions seen on mammograms or at magnetic resonance imaging. This inter-imaging correlation will be illustrated through clinical cases (objective 5: how to find lesion at US and validate lesion concordance between the different imaging modalities, how to detect subtle US lesions).
Learning Objectives:
1. To review the clinical indications of breast ultrasound.
2. To understand the technical issues tied to a state-of-the-art US exam and new developments.
3. To learn how to deal with lesions detected at mammography and at MRI.

12:30 - 13:30 **Room D1**

E³ - The Beauty of Basic Knowledge: Chest Imaging

E³ 25 A

Useful signs in chest radiology

Moderator:
N. Howarth; Chêne-Bougeries/CH

A-059 12:30

A. Lung parenchyma
G.R. Ferretti; *Grenoble/FR (GFerretti@chu-grenoble.fr)*

CXR remains the keystone for the diagnosis of pulmonary diseases, as it is performed in the vast majority of patients complaining of chest symptoms, because it is largely available, simple to realise, low cost and delivers low radiation dose. However, indications of CXR for imaging the lung parenchyma are challenged by ultralow-dose HRCT. In this presentation, we will focus on useful signs to detect lung parenchymal abnormalities such as airspace opacities, air bronchogram, silhouette sign, atelectasis, interstitial pattern. Pulmonary distribution of abnormalities such as butterfly-wing distribution, anti-butterfly-wing distribution, migratory consolidations may increase the value of CXR. Difficulties in the interpretation and limitations of CXR will be discussed along with correlations with HRCT results.
Learning Objectives:
1. To review the most useful signs on the chest x-ray.
2. To learn how to interpret the chest x-ray more accurately.
3. To know the appropriate indications of the chest x-ray.

A-060 13:00

B. Mediastinum and chest wall
J. Cáceres; *Barcelona/ES (josecac@gmail.com)*

Radiological signs are patterns in radiographic images, which help in the identification and differential diagnosis of selected processes. They have two main characteristics: they should be recognisable, meaning that their appearance is characteristic enough to be identified; and they should be useful, i.e. they should narrow down the differential diagnosis. In this presentation, several signs will be discussed, starting by the extrapulmonary sign and its variant, the incomplete border sign, two basic signs to differentiate whether or not a lesion is located in the mediastinum or chest wall.

Learning Objectives:
1. To review the most useful signs on the chest x-ray.
2. To learn how to interpret the chest x-ray more accurately.
3. To know the appropriate indications of the chest x-ray.

16:00 - 17:30 **Room B**

E³ - ECR Master Classes (Abdominal Viscera)

E³ 426a

A tour around cholangiopathies

A-061 16:00

Chairman's introduction
C. Matos; *Lisbon/PT (celso.matos@fundacaochampalimaud.pt)*

Cholangiopathies represent a broad spectrum of diseases involving the bile ducts ranging from an inflammatory response to malignant transformation. Multimodality imaging techniques are required for the diagnosis and appropriate multidisciplinary management. In the presence of cholestasis, imaging is generally requested to diagnose biliary obstruction and is accurate in differentiating benign and malignant causes. In the absence of cholestasis and biliary obstruction, diagnostic imaging contribution is relatively poor particularly when the disorder affects small intrahepatic bile ducts. The diagnosis of malignancy in the setting of chronic inflammation remains a challenge for any imaging modality. This ECR master class will provide a multidisciplinary overview of the different cholangiopathies and will address main diagnostic and management challenges.
Session Objective:
1. To briefly discuss the diagnostic challenge in cholangiopathies.

A-062 16:05

A. Clinical scenarios
M. Arvanitaki; *Brussels/BE (Marianna.Arvanitaki@erasme.ulb.ac.be)*

Cholangiopathies refer to chronic diseases that involve cholangiocytes, which are the epithelial cells that line the bile ducts. These cells have an important role in the modification of bile volume and composition, are activated by interactions with endogenous and exogenous stimuli (e.g., microorganisms, drugs), and participate in liver injury and repair. Cholangiopathies account for substantial morbidity and mortality given their progressive nature, and the difficulties associated with clinical management. Furthermore, they usually result in end-stage liver disease requiring liver transplant to extend survival. However, differential diagnosis is important, because specific management exists and prognosis can be different according to the type of disease. Furthermore, differentiating benign conditions from malignancy (cholangiocarcinoma) is important but still remains a challenge. Cholangiopathies include entities such as primary biliary cholangitis (previously known as primary biliary cirrhosis), primary sclerosing cholangitis, IgG4-associated cholangitis, drug-induced cholangiopathy, secondary sclerosing cholangitis (ischemic, HIV-related, drug-induced, etc)., cystic fibrosis, ductal plate malformations and idiopathic adult ductopaenia. Initial history taking, clinical examination and laboratory findings can reveal important elements for differential diagnosis. Imaging procedures as well as tissue sampling can complete the workup. Nevertheless, this can be a difficult procedure and a multidisciplinary approach is indispensable for management.
Learning Objectives:
1. To describe common and uncommon aetiologies of cholangiopathies and their complications.
2. To list laboratory tests to orientate the diagnosis.
3. To define questions which can be asked of radiologists in order to orientate the diagnosis.

A-063 16:25

B. Which imaging modalities?
J.M. Lee; *Seoul/KR (jmsh@snu.ac.kr)*

With recent developments in imaging technology of MDCT and MR, MDCT and MRI with cholangiopancreatography (MRCP) play a major role for evaluation of cholangiopathies, as a primary diagnostic test and for determining resectability and planning of surgery. High-resolution CT with multiplanar reconstruction and minimum intensity projection, as well as 3D MRCP are widely used as minimally invasive alternatives to endoscopic retrograde cholangiopancreatography for the pre- and post-operative assessment of biliary disease. Furthermore, gadoxetic acid-enhanced MR cholangiography may facilitate the evaluation of biliary structure and excretory function, and diffusion-weighted imaging may add additional benefit to MR for detection and characterisation of malignant diseases of the bile duct. More recently, integrated positron emission tomography (PET) and MR imaging system have

combined the ability of obtaining anatomic, functional, and metabolic images, and is expected to provide better diagnostic performance in evaluating malignancy of the biliary system than PET/CT. Recent advances in those imaging techniques have led to the availability of an array of modalities that are used independently or in combination, can aid in the accurate diagnosis and evaluation of various cholangiopathies. However, despite rapid development of imaging modalities, detection, accurate staging, and optimal management of biliary malignancies continue to present a significant challenge due to small size of biliary tumours and complex anatomical relationship of the bile duct tumours with adjacent vital structures such as hepatic artery or portal vein, and still, multiple disciplinary approach is frequently used for evaluation of biliary malignancies.

Learning Objectives:
1. To describe the role of imaging modalities.
2. To define the potential role of functional and metabolic imaging modalities.
3. To appraise the cost-benefit of different imaging strategies.

Author Disclosure:
J.M. Lee: Advisory Board; Bayer Healthcare. Equipment Support Recipient; Philips Healthcare. Research/Grant Support; GE healthcare, Bayer, Starmed, RF medical, Samsung Medison. Speaker; Bayer Healthcare, Guerbet, Philips Healthcare, Siemens Healthcare.

A-064 16:45

C. Treatment: which and when

E. Jonas; *Stockholm/SE (eduard.jonas@ki.se)*

Cholangiopathies are a diverse group of disease entities having in common that the disease process starts in the cholangiocyte. The disease entities can be classified as primary, for example primary biliary cirrhosis (PBC) and primary sclerosing cholangitis (PSC) or secondary, due to the hepatic manifestations of a number of infectious, vascular and toxic conditions. In many of the conditions disease progression ends in end-stage disease, regarded as terminal liver failure or the development of malignancies on the background of the chronic cholangiopathy. Although treatment of the underlying cause in some forms of secondary cholangiopathy my have an effect on the biliary pathology, cholangiopathies in general tend to be resistant to medical therapy. Endoscopic and percutaneous intervention of biliary complications are of value in some cases. Surgical intervention may be indicated for malignant transformation, for example CCC and in some cases, polycystic liver disease. Liver transplantation is a treatment option for some cholangiopathies, for example PBC and PSC, and in selected cases for malignancies secondary to the cholangiopathy. Variable natural histories and ranges in response to therapy within the different disease entities are driving the pursuit of personalised (precision) treatment.

Learning Objectives:
1. To describe surgical and non-surgical therapeutic options.
2. To identify criteria for personalised treatment.

17:05
Multidisciplinary panel discussion

16:00 - 17:30 **Room C**

New Horizons Session

NH 4
Big data: why should radiologists care?

A-065 16:00

Chairman's introduction

M. Dewey; *Berlin/DE (marc.dewey@charite.de)*

Analysing big data from radiological examinations may allow us to better answer clinical questions for the well-being of our patients. The potential of systematically and continuously analysing big data arising from cross-sectional imaging and radiology information systems is still far from being fully exploited. But big data is not going to become the panacea for all our problems because without proper hypothesising, it lacks causality and big data only provides us with correlations in a large sea of information. This purely correlative approach cannot be a substitute for clinical reasoning and sound justifications. But combined with clinical hypotheses, big data could change the way we practice radiology in particular and medicine in general. We will thus discuss how we can use big data for the future advancement of radiology.

Session Objectives:
1. To appreciate the opportunities and challenges of big data.
2. To understand the current status of big data in radiology.
3. To learn about how big data could change radiology in the future.

A-066 16:05

Big data: big science

G. Zanetti; *Pula/IT (zag@crs4.it)*

An important characteristic of today's society is its amazing capacity of producing digital data. Up until now, the data is mainly coming from the digitalisation of human interactions (Web, Facebook, Twitter, …), in the near future the proliferation and spread of IoT (Internet of Things) devices (e.g., eHealth personal solution) will further dramatically increase the growth of the digital data production rate. Big Data is a catch-all concept that cover the whole spectrum of activities -- collection, storage, processing and analysis -- that are emerging as a response to this massive data upsurge. The idea is cross-sectorial and applies to healthcare too: there is an emerging potential to advance public health by coupling data coming from multiple sources, EHR, modalities data, personal devices… However, for various reasons, including data sensitivity and the fragmentation of regulatory frameworks, combining these disparate information sources to guide health research and decision-making in the clinic has so far lagged behind the use of big data in other sectors. In this talk we discuss what is big data in the bio medical research and healthcare domain and how it is expected to impact clinical data integration and analysis, with a particular emphasis on data rich specialties such as radiology.

Learning Objectives:
1. To understand what big data is and how it will impact clinical data integration and analysis.
2. To learn about how to best use them in biomedical research.
3. To appreciate the technological challenges.

A-067 16:25

Big data: big business

B.J. Hillman; *Charlottesville, VA/US (bjh8a@virginia.edu)*

"Big data" is shorthand for the tools, processes, and procedures that allow an organisation to create, manipulate, and manage very large data sets and storage facilities (www.zdnet). Paired with advanced analytical software, the goals of big data are to provide insights from complex, noisy, heterogeneous, longitudinal, and voluminous data and answer otherwise unanswerable questions (J. Sun and C. Reddy, IBM). With regards to medical imaging, big data is in an early stage of development. Although the potential for the development of business around aspects of big data is limitless, in many ways it is a technology looking for an application. Nonetheless, there are numerous companies looking to advantage themselves by developing products and services that they believe will establish themselves in one or more of a number of possible types of businesses: collecting and/or supplying access to data; storing and/or hosting; filtering and refining (sometimes referred to as "cleaning"); improving access to databases and networking; analysing; consulting and advising. Although most are works in progress, examples exist in the world of medical imaging for many, if not all, of these applications. This presentation will delve into the business opportunities to exploit big data for medical imaging and provide real-world examples of companies that already have invested in ongoing projects.

Learning Objectives:
1. To understand the potential of computerised approaches to analyse large volumes of data so that past experiences can advise improved care for future patients.
2. To learn about how big data analytics have the potential to transform the quality and efficiency of health care.
3. To appreciate that the business of applying big data analytics to health care is in its earliest stages and is likely to develop rapidly in the near future.

Author Disclosure:
B.J. Hillman: Advisory Board; Philips Radiology Medical Advisory Network. Author; The Sorcerer's Apprentice - How Medical Imaging is Changing Healthcare (Oxford), The Man Who Stalked Einstein (Rowman and Littlefield).

A-068 16:45

Big data: what's in it for the patient?

M.G.M. Hunink; *Rotterdam/NL (m.hunink@erasmusmc.nl)*

Big data in healthcare has the potential to revolutionise patient care. The synthesis of original data from hospital information systems, pharmacies, primary care groups, (public) health insurance, national mortality and morbidity statistics, and population studies together with data from published research has the potential of informing health care decisions in a very profound way. Such big data contains a wealth of information that can give insights relevant to individual patients, paving the way to truly personalised medicine. Limitations of the use of big data include selection bias, information bias, missing data, and ethical and privacy issues. Bias in the data may yield misleading results and can lead to unjustified conclusions. The largest danger is probably the "veil of certainty": enormous amounts of data yield very precise results, but bias in the data implies that the results may be precisely wrong. Distinguishing

between precision and validity is essential in this context. Furthermore, what is statistically significant for a patient is not necessarily clinically meaningful. Finally, collecting large amounts of data from individuals without their consent poses an ethical problem.
Learning Objectives:
1. To understand how big data can be used to improve patient care and patient outcomes.
2. To learn about big data sources that could be useful to patient management decisions.
3. To appreciate limitations of big data in patient care, including bias in the data and ethical and data privacy issues.
Author Disclosure:
M.G.M. Hunink: Advisory Board; EIBIR. Author; Textbook: Decision Making in Health and Medicine. Integrating Evidence and Values. Research/Grant Support; ZonMW and STW, Netherlands.

17:05
Panel discussion: How to make best use of big data?

16:00 - 17:30 **Room O**

Paediatric

RC 412
Chest imaging in paediatrics
Moderator:
W. Hirsch; Leipzig/DE

A-069 16:00
A. Congenital anomalies of the chest
M. Haliloglu; *Ankara/TR (mithath@hacettepe.edu.tr)*

Advances in both foetal ultrasonography (US) and magnetic resonance (MR) imaging resulted in increased recognition of congenital anomalies of the chest prenatally. Despite the role of US and/or MR imaging in the prenatal diagnosis of congenital lung malformations, chest radiography and computed tomography still have an important role for postnatal diagnosis. Congenital lung anomalies have a broad spectrum ranging from small and asymptomatic to large and symptomatic lesions. They may involve lung parenchyma, bronchi, arterial supply, and venous drainage. Currently there is no organisational structure or system of nomenclature to define all lung abnormalities. Congenital lung anomalies can be divided into three categories including isolated bronchopulmonary anomalies, combined lung and vascular abnormalities, and vascular anomalies. Congenital thoracic wall anomalies involve sternum, clavicle, rib, and scapula anomalies. Malformations of the chest wall can be a manifestation of a syndrome or skeletal dysplasia. The management of congenital lung and thoracic wall anomalies depends on the type of malformation and symptoms. Radiologists should perform individualised proper imaging techniques and should be familiar with characteristic imaging findings in paediatric patients for appropriate patient management.
Learning Objectives:
1. To discuss best imaging techniques when evaluating congenital chest anomalies.
2. To have an overview of antenatal and postnatal appearances of common congenital chest anomalies.
3. To understand the clinical significance and management of congenital lung and thoracic wall anomalies.

A-070 16:30
B. Lung infection and its complications
M.L. Lobo; *Lisbon/PT*

Lung infection is one of the most common causes of illness in children, and a leading cause of mortality in developing as well as in developed countries. Chest radiography is the imaging cornerstone in the diagnosis of pneumonia. While most previously healthy children with community-acquired pneumonia treated as an outpatient will not clearly benefit from chest radiography, imaging plays an important role in the approach of paediatric patients with more severe lung infection, atypical presentation, complicated clinical course as well as in those with recurrent infections or infection in the immunocompromised children. Radiological findings are usually nonspecific, but in the appropriate clinical setting (including patient's age, immune status, seasonal epidemiology and clinical presentation) some radiographic patterns may allow to narrow the differential diagnosis, thus helping to guide treatment. Furthermore, imaging is crucial in the assessment of complicated pneumonia and development of potential late complications. Ultrasound is an invaluable imaging modality in the evaluation of pleural effusion/empyema and peripheral lung consolidations, with chest computed tomography reserved for centrally located complicated pneumonia, bronchopleural fistula and bronchiectasis, as well as unusual infections, infection in the immunocompromised children and suspicion of underlying pulmonary or systemic conditions (e.g. foreign body, congenital malformation, immunodeficiency).
Learning Objectives:
1. To understand the justification for imaging children with lower respiratory tract infection.
2. To provide tips for accurate diagnosis and to understand differential diagnosis.
3. To become familiar with complications and potential underlying conditions.

A-071 17:00
C. Imaging interstitial lung disease in children: update 2016
M.P. García-Peña; *Barcelona/ES (plgarciapena@gmail.com)*

Paediatric interstitial lung diseases (ILDs) encompass an assorted group of disorders with widespread involvement of the pulmonary interstitium resulting in impaired gas exchange and, in some cases, high morbidity and mortality. A novel classification scheme specific for paediatric ILDs has been developed. It takes into account the stage of lung growth, aetiology, pathophysiology, genetics, and clinical phenotypes. Some of these disorders present primarily in infancy or early childhood, while others are prevalent in older children. Some of them are unique to infants and young children. Paediatric interstitial lung disease usually presents either with rapid respiratory failure in the neonatal period or with an insidious course of respiratory signs and symptoms, failure to thrive, or exercise intolerance. It may be misattributed to common disorders. Correct diagnosis of ILD is imperative due to widely differing prognoses among the disorders and the need for genetic evaluation. Infants are more likely to have developmental, growth, or genetic disorders, while older children and adolescents are more likely to have disorders related to systemic diseases, infections, or environmental exposures. For some types of paediatric ILDs, the imaging findings are highly specific, while for others the imaging findings are nonspecific and laboratory tests or lung biopsy are needed for definitive diagnosis. Imaging can be useful for suggesting or corroborating a specific diagnosis, refinishing the differential diagnosis, identifying biopsy sites, monitoring disease activity, and assessing response to therapy. Familiarity with the classification, clinical presentation, and characteristic imaging features is required for appropriate diagnosis and management of paediatric ILDs.
Learning Objectives:
1. To understand optimised protocols.
2. To learn about updated nomenclature of interstitial lung diseases in children.
3. To discuss a systematic approach for the diagnosis of common entities diffusely affecting the paediatric lung.

16:00 - 17:30 **Room N**

Head and Neck

RC 408
Head and neck imaging: don't sell your ultrasound yet!
Moderator:
D.-A. Varoquaux; Marseille/FR

A-072 16:00
A. Salivary gland imaging with ultrasound
S. Colley; *Birmingham/UK (Steve.Colley@uhb.nhs.uk)*

The major salivary glands are superficial in location, and readily amenable to direct ultrasound examination. A knowledge of the relevant anatomy of the salivary glands and surrounding structures is vital, as the extent of lesions guides surgical planning or the need for further imaging, and non-salivary masses may present as "salivary" pathology. This lecture will cover the relevant ultrasound anatomy of the major salivary glands, in order to allow a diagnostic approach to salivary gland pathology. The areas of pathology covered will include obstructive salivary gland disease, inflammatory conditions, benign and malignant salivary gland tumours, and "non-salivary" pathology mimicking salivary gland disease. Specific scenarios that require additional imaging or biopsy will be highlighted.
Learning Objectives:
1. To understand the limitations of clinical examination.
2. To learn about the diagnostic approach to salivary glands.
3. To appreciate how to differentiate salivary gland pathology.

A-073 16:30

B. Masses of the soft parts of the neck

S. Robinson; *Vienna/AT (s.robinson@dzu.at)*

Well-known advantages of ultrasound are that it is easily available and accessible, cost effective, non-invasive and does not expose the patient to radiation. The radiologist can palpate lesions and get the patient's clinical history unfiltered. Unlike for other imaging modalities, once the patient has left the department, one cannot discuss the study with other colleagues easily. Therefore, making the most of the ultrasound examination is mandatory. Not only knowledge of the patient's symptoms and the referring doctor's suspicion, but also awareness of potentially coexisting other conditions or illnesses and previous surgical interventions or relevant medications is required. Precise familiarity with head and neck anatomy and normal variants helps excluding or localising pathology. Technical considerations and common pitfalls have to be taken into account. In case of a mass, echogenicity, homogeneity, vascularisation, borders, change of size with compression, mobility with swallowing, centre of origin and relationship to adjacent structures, especially vessels and bone should be assessed. Involvement of several compartments or lymph nodes will be investigated. Potential crossing of the midline has to be excluded. If previous investigations are available, a comparison will be part of the report. Taking the referring doctor's responsibility and experience into account, further or follow-up tests will be recommended. Typical examples of ultrasound anatomy and pathology will be discussed.

Learning Objectives:

1. To become familiar with cervical ultrasound anatomy.
2. To learn about benign neck masses.

A-074 17:00

C. Lymph nodes: differential diagnosis and fine-needle aspiration

R. Maroldi; *Brescia/IT (roberto.maroldi@unibs.it)*

There are several clinical scenarios where Imaging is required to investigate the neck lymph-nodes. 1. Imaging is indicated to integrate the clinical examination in the evaluation of unknown neck masses. In this clinical setting, the first task of Imaging is to differentiate between non-nodal lesions and adenopathies. If the clinical examination cannot detect a primary neoplasm in the head and neck area, fine-needle aspiration (FNAC) is indicated. Ultrasound (US) is the technique of choice for the initial evaluation and for FNAC. 2. In case of acute/subacute neck infection with enlarged adenopathies, Imaging is required to assess nodal changes (abscess), spread outside the lymph-node capsule, potential extent into deep neck spaces, with great risk of mediastinal involvement. While US can be accurate in assessing superficial cervical node changes, CT with contrast agent is indicated to survey the deep spread of infections. 3. If a malignant neoplasm arising from the mucosa of the upper aerodigestive tract (UADT) is identified at clinical examination, Imaging techniques are required to detect nodal metastases in the ispsilateral (if the primary tumour arises far from midline) and the contralateral neck. Besides detecting the abnormal node, extra-nodal spread and key vessels invasion (carotid, jugular vein) are key information to be acquired by Imaging. US, MDCT and MR can be used: their greatest limitation is the low sensitivity for non-enlarged metastatic nodes. A different setting is the assessment of thyroid papillary carcinoma where microcalcifications inside even very small metastatic nodes can be detected by US.

Learning Objectives:

1. To get acquainted with normal and abnormal findings.
2. To understand the patterns of nodal involvement.
3. To learn about technique of fine needle aspiration.

16:00 - 17:30 **Room E1**

Musculoskeletal

RC 410

Bone trauma in the axial skeleton: patterns of injury and how I describe them

Moderator:
M.-A. Weber; Heidelberg/DE

A-075 16:00

A. Thoracic and lumbar spine

V.N. Cassar-Pullicino; *Oswestry/UK (Victor.Pullicino@rjah.nhs.uk)*

Thoracolumbar spinal injuries occur in up to 4% of blunt trauma cases with an incidence of associated neurological deficit in up to 50%. The radiologist is pivotal in the evaluation of these patients. Plain film radiology, CT and MRI all play a role in the evaluation of the injury. They are often complementary as all imaging modalities have inherent strengths and weaknesses. The aim is to expedite prompt and accurate characterisation of the injured segment with the added task of excluding concomitant non-contiguous injury in the rest of the spine. The patterns of injury differ, reflecting underlying unique differences in the anatomy and biomechanics of each region, and this also varies with age and pre-morbid states such as the fused spine. The primary objective is for the radiologist to become familiar with the types of injury to ensure accurate description based on sound image interpretation. Although many classification systems have evolved with time they are primarily descriptors and not predictors of outcome. More recent classification systems include a prognostic theme. Although they are a clinical tool aiding in therapeutic decision making, the radiologist needs to have a basic understanding of the ones that are commonly used. With this in mind, the report should present the imaging data to the clinician.

Learning Objectives:

1. To become familiar with the types of injury seen in the thoracic and lumbar spine.
2. To learn how to describe the injuries in a manner useful to the clinician.

A-076 16:30

B. Pelvis

K. Verstraete, F. Vanhoenacker, L. Jans, W. Huysse; *Ghent/BE (koenraad.verstraete@ugent.be)*

Bone injury to the pelvis may be caused by high-energy trauma, stress fractures, and avulsion fractures. Pelvic ring fractures are a common consequence of motor vehicle accidents or falls from heights. Major patterns of injury include lateral compression, anteroposterior compression, vertical shear injury, or complex injury due to a combination of these fracture forces. Anteroposterior radiographs are still included in the initial evaluation, but pelvic inlet and outlet views and lateral projection are replaced by CT, which allows multiplanar reformatted imaging for diagnosis, classification and surgical planning. CT angiography is essential to detect active bleeding from cancellous bone, injured vessels or soft tissues. The typical sites of pelvic stress fractures are the sacrum and pubic rami. Fatigue or overuse stress fractures occur in athletes due to repetitive microtrauma. Insufficiency fractures are caused by normal, physiologic stress on weakened bone, usually in elderly women with osteoporosis, corticotherapy or after pelvic irradiation. These stress fractures can be undetectable on radiography in initial stages, and have an aggressive lytic appearance in late stages when patient keeps on moving. CT demonstrates fracture lines or sclerosis, and on MR bone marrow oedema is an early sign of bone stress injury. Apophyseal avulsion fractures occur in young recreational or competitive athletes (sprinters, gymnasts, football and baseball players, etc)., usually teenagers. Radiography is the technique of first choice in acute avulsion injuries. Comparison with the contralateral side is important, and in selected cases, ultrasound, CT, MRI and bone scintigraphy may be needed.

Learning Objectives:

1. To become familiar with the types of injury seen in the pelvis.
2. To learn how to describe the injuries in a manner useful to the clinician.

A-077 17:00

C. Acetabulum

A. Kassarjian; *Majadahonda/ES*

Acetabular fractures are often seen in the setting of motor vehicle collisions and high-energy pelvic trauma. The purpose of this presentation is to 1) demonstrate the common types of acetabular fractures as seen on cross-sectional imaging such as CT scans and 2) review some common classification systems used in describing acetabular fractures.

Learning Objectives:

1. To become familiar with the types of injury seen in the acetabulum.
2. To learn how to describe the injuries in a manner useful to the clinician.

16:00 - 17:30 **Room E2**

EuroSafe Imaging Session

EuroSafe 2

EuroSafe Imaging Alliance & Campaign - what is new?

Moderator:
G. Frija; Paris/FR

A-078 16:00

An overview of the EuroSafe Imaging achievements over the past year
G. Frija; *Paris/FR (guy.frija@egp.aphp.fr)*

EuroSafe Imaging's activities in the past year were guided by the roadmap 2015-16 agreed by the Steering Committee following ECR 2015 in the framework of the Call for Action. 1) The EuroSafe Imaging website was updated to provide better information for professionals, patients and carers. 'Ask EuroSafe Imaging' allows visitors to submit questions. Working groups on CT, paediatric imaging, and interventional radiology produce monthly FAQs or Tips & Tricks in response to these enquiries. 2) A project plan was developed on dose management entitled REASSURE - Radiological European Action for a Sustainable and SecURE practice. The project's aims are to reassure patients about dose optimisation and support radiology departments in developing communication strategies. 3) Data collection on CT through the 'Is your Imaging EuroSafe?' surveys continued. To recruit dedicated institutions for data collection and other radiation protection issues, the concept of 'EuroSafe Imaging Stars' was launched. 4) The European Commission tender project on DRLs for Paediatric Patients (PiDRL) has submitted the final draft of the European guidance document. In cooperation with the European Society of Paediatric Radiology, EuroSafe Imaging has developed proposals to ensure the results of the project will have a sustainable impact beyond its official end. 5) The development of research in radiation protection started with MELODI with which the ESR has signed an MoU. We are currently submitting an EC tender on the BSS implementation, and we are preparing a submission for a EURATOM call which is described in the talk.
Learning Objectives:
1. To highlight the recent activities of EuroSafe Imaging.
2. To introduce the 2015/2016 EuroSafe Imaging roadmap.
3. To point out weaknesses and strengths of the concept.

A-079 16:10

Update on the concept of Diagnostic Reference Levels
P. Vock; *Spiegel/CH*

The historical development of DRLs, starting with the first ICRP recommendation in 1996 and ending with the new EU Basic Safety Standards in 2014, will be reviewed. The presentation will then concentrate on the advantages of DRLs as an optimising tool for specific examinations of a group of standard patients and their role in clinical audits and benchmarking. Based on directly measurable exposure, DRLs are not a substitute of organ dose, nor do they reflect the age- and gender-specific risk to an individual patient. The disadvantages of current DRLs will also be discussed, e.g. the fact that staying within the DRL does not guarantee a high level of optimisation. The role of dose management software solutions and their problems with individual effective dose will be pointed out. Future modifications of DRLs include the creation of task-specific DRLs for one clinical question and the correlated image quality needs to answer the question.
Learning Objectives:
1. To review the historical development and use of Diagnostic Reference Levels (DRLs).
2. To analyse the advantages and limitations of current DRLs.
3. To discuss modifications and future applications of DRLs.

A-080 16:20

Establishing European Diagnostic Reference Levels for paediatric imaging: an update on the EC tender project PiDRL
J. Damilakis; *Iraklion/GR (damilaki@med.uoc.gr)*

There is little information on DRLs for paediatric examinations and procedures. The main reasons for this lack of information is a) that the number of examinations carried out in children is lower compared to adults and b) data need to be categorised into age/weight/body size, etc. subgroups. There is a need to establish DRLs for radiologic examinations and procedures where DRLs are not available, consolidate available information and provide guidance on what actions are needed in using DRLs to further enhance radiation protection of children. The 'European DRLs for Paediatric Imaging' project (abbreviation: PiDRL) is an EC project aimed to a) develop a methodology for establishing and using DRLs for paediatric medical imaging and b) update and extend the European DRLs to cover as many procedures as possible. The professional organisations involved include ESR as coordinator as well as EFOMP, EFRS, and ESPR, covering the key European stakeholders and professional groups with relevance to radiation protection of paediatric patients. The PiDRL project has very recently drafted European Guidelines on how to establish and how to use paediatric DRLs. More information about this project can be found at http://www.eurosafeimaging.org/pidrl.
Learning Objectives:
1. To give an overview of the PiDRL project and its achievements.
2. To understand the methodology for establishing and using DRLs for paediatric imaging.
3. To learn about the specific requirements for paediatric DRLs (in comparison to DRLs for adults).

A-081 16:30

The European paediatric imaging project
C. Owens; *London/UK (owensc@gosh.nhs.uk)*

This presentation will outline the achievements of the Paediatric Dose reference level (PiDRL project). This was a joint initiative between the ESR and ESPR with significant input from internationally renowned physicists. Problems with data collection will be outlined and the outcome of the project will be advertised online. We believe this is a powerful document, which will assist those working closely with children to inform and advise the various companies that produce medical imaging equipment to ensure best practice in children.
Learning Objectives:
1. To discuss difficulties with data collection from diverse European radiology centres.
2. To encourage engagement using the 'Eurosafe Imaging Stars' model.
3. To analyse the impact of commercial engagement and support in dose optimisation for children.

A-082 16:40

The EuroSafe Imaging dose management project
D. Caramella; *Pisa/IT (davide.caramella@med.unipi.it)*

IT tools are now commercially available to allow a real-time analysis of dose performances in Radiology Departments. The knowledge obtainable using this new IT tools may reduce variations that are not clinically justified and trigger focused training initiatives. However, dose monitoring systems may provide incomplete and even misleading data. Therefore, appropriate actions need to be taken to increase the reliability of data provided by the software. An important output of dose monitoring is a better communication strategy with patients who can be reassured by the documented efforts made for guaranteeing dose optimisation, thus strengthening the public perception of Radiology Departments as trusted dose gatekeepers.
Learning Objectives:
1. To appreciate that IT tools may enable a systematic analysis of dosimetric behaviours in radiology.
2. To understand how dose management may help to reduce all variations that are not clinically justified and to trigger focused training activities.
3. To discuss the opportunity to shift the emphasis from risk communication to safety reassurance.
Author Disclosure:
D. Caramella: Speaker; Bayer.

A-083 16:50

AFROSAFE Imaging Alliance and Campaign
M.G. Kawooya; *Kampala/UG (kawooyagm@yahoo.co.uk)*

AFROSAFE is a radiation-safety campaign under the umbrella of the African Society of Radiology (ASR). It was launched in 2015 by the Pan African Congress of Radiology and Imaging (PACORI) which is responsible for planning and implementation of its goals and objectives. The mission is to ensure favorable benefit-risk ratio in radiology and the goal is to encourage adherence to safety standards and guidelines through promotion of strategies and actions as per the "Bonn Call for Action". Collaborations and partnership with global agencies; IAEA and WHO, the ISR, ESR, governments and other radiation safety campaigns; EuroSAFE and Image Gently have been key in establishing AFROSAFE. Relationships with patients for patients' safety initiatives have led to effective sensitisation of patients and public. AFROSAFE is now a legitimate radiation safety campaign, represented at several fora like the PACORI 2015, ASR 2015, the World Health Assembly Side-Event (WHA 68), Global Summit for Radiology Quality and Safety 2015 and the IAEA workshop in Kenya in 2015. The Uganda Chapter of AFROSAFE was launched by the Minister of Health in 2015. The International Day of Radiology 2015 featured Kenya-AFROSAFE committee radio talks and a public sensitisation walk. The AFROSAFE Implementation Tool booklet has been launched. AFROSAFE is promoting the development of DRLs and Imaging Referral guidelines. The AFROSAFE website will act as a resource for relevant

data, facilitating key networks. Creation of AFROSAFE, following the example of EuroSAFE, has in turn motivated other regions like South America to form similar campaigns.
Learning Objectives:
1. To describe the process of the establishment of AFROSAFE.
2. To list the vision, mission, objectives, strategies and actions.
3. To discuss the collaborations with EuroSafe Imaging, Image Gently & Image wisely.
4. To discuss collaboration with patients for patients' safety (PFP) initiatives in Africa.
5. To review the achievements to date; namely, promotion of DRLs in African countries and raising awareness of radiation safety among policy makers, health-workers and the public.

A-084 17:00

Image Wisely and Image Gently: an overview
D.P. Frush; *Durham, NC/US (frush943@mc.duke.edu)*

The Image Gently (IG) campaign, founded in 2007 by the SPR, AAPM, ACR, and ASRT, and Image Wisely (IW) campaign, founded in 2010 by the ACR, AAPM, ASRT and RSNA share missions of improved understanding in and performance of diagnostic imaging that uses ionising radiation in children (IG) and adults (IW). IG and IW organisations are based on visionary models of consensus leadership and resonant messages of advocacy and assurance, combined with a social marketing strategy. Accomplishments include publications, presentations, modality campaigns, website enhancements (educational material for users such as patients/care givers and healthcare professionals), and input on regulatory and guidance documents and have achieved national and growing international acclaim. These efforts are also harmonious with the majority of the EuroSafe Imaging Call for Action elements. Challenges for both organisations include limited resources especially as opportunities expand, providing balanced content in the face of often biased media perspectives, measuring success, assuring adherence to best practices, and staying current. Future collective directions and initiatives for IG and IW include campaigns with broader clinical communities (e.g. acute care providers for CT of paediatric minor closed head injury: the new Think A-Head campaign, and paediatric cardiology); increased partnerships with industry to assure appropriate design and use of imaging equipment; enriched website content and format; imaging protocol development; promotion of equipment accreditation and registry participation, and clarified roles with growing global initiatives to optimise value and use of resources.
Learning Objectives:
1. To review the history and evolution of the Image Gently and Image Wisely campaigns.
2. To consider the potential future directions and initiatives that Image Gently and Image Wisely may pursue.
3. To discuss methods to insure adherence to best practices in radiation dose monitoring and control.

17:10
Panel discussion

16:00 - 17:30 **Room F1**

Oncologic Imaging

RC 416

Evaluating lymph node involvement: an impossible task?

A-085 16:00

Chairman's introduction
D.-M. Koh; *Sutton/UK (dowmu.koh@icr.ac.uk)*

The presence of nodal disease is a major determinant of disease survival in many cancers. However, accurate nodal staging by imaging criteria remains challenging because even though malignant nodes are often enlarged compared with benign lymph nodes, there is considerable overlap. In this session, the expert panel of speakers will review the relative merits and limitations of conventional imaging for nodal assessment. The diagnostic performance of advanced imaging techniques and molecular imaging techniques for nodal staging will also be surveyed.

A-086 16:05

A. The current criteria for nodal involvement MRI/CT
W. Schima; *Vienna/AT (wolfgang.schima@khgh.at)*

A variety of malignant and benign diseases, such as metastatic cancer, lymphoma, or inflammation, may present with lymph node enlargement. Thus, lymph node characterisation is an important issue to differentiate between a benign and malignant aetiology. It is based on size (short axis diameter), number (clustering) and morphologic criteria (i.e. shape, homogeneity, and contrast enhancement). For abdominal nodes, location-specific size criteria apply (upper limit of normal: lower paraaortic 11 mm, upper paraaortic 9 mm, gastrohepatic ligament 8 mm, portocaval space 10 mm, retrocrural space 6 mm; pelvic nodes 10 mm). However, in clinical practice and according to RECIST a universal size threshold of 10 mm is applied. In chest CT, the upper limit of normal is 10 mm. Size criteria alone are unreliable: CT for lung cancer staging has a pooled sensitivity of 51% (i.e. FN diagnoses of metastatic deposits in normal-sized nodes), and specificity of 86% (i.e., FP diagnoses of enlarged reactive nodes). With MRI the same size criteria apply, but additional imaging features such as central necrosis on T2w fatsat or gadolinium-enhanced images are suggestive of metastasis (or suppurative infection). DWI is helpful in identifying in lymph nodes as they exhibit high SI with higher b values. Recent studies indicate that DWI may also aid in characterisation of normal-sized lymph nodes. Despite the use of modern MDCT and MRI techniques, lymph node characterisation remains a challenge.
Learning Objectives:
1. To understand the role of local nodal staging and its importance for management and prognosis.
2. To become familiar with the current imaging criteria for assessment of nodal metastases.
3. To understand the diagnostic performance of cross-sectional imaging.

A-087 16:28

B. Advanced MRI techniques: what do they contribute?
H.C. Thoeny; *Berne/CH (harriet.thoeny@insel.ch)*

Up-to-date lymph node staging is based on size and shape criteria only; however, micrometastases can also be present in normal-sized lymph nodes and nodes can be enlarged due to inflammatory changes. New contrast agents in MRI such as ultrasmall particles of iron oxide (USPIO) have substantially improved the diagnostic accuracy of lymph node staging compared to conventional MRI. Unfortunately, USPIO is not commercially available on the market. Diffusion-weighted MRI (DW-MRI) is a noninvasive method that provides tissue microstructural information, and several studies mainly in the pelvis have shown promising results for lymph node detection and differentiation between benign and malignant nodes. These studies reported sensitivities of 79-100% and specificities of 74-93% using the underlying apparent diffusion coefficient (ADC) value; lower ADCs were reported in malignant nodes as compared to benign ones. On the other hand, it has been shown that there is a considerable overlap between ADC values of benign and malignant nodes. A recent prospective study in 120 patients with bladder and prostate cancer and normal-sized pelvic lymph nodes on conventional cross-sectional imaging compared DW-MRI to histopathology based on extended pelvic lymph node dissection. It has been shown that the combination of DW-MRI findings and meticulous analysis of morphological findings was able to detect malignant lymph nodes even in normal-sized nodes. The combination of USPIO with DW-MRI might further facilitate and improve lymph node staging in the future, provided, that USPIOs will become available for clinical use.
Learning Objectives:
1. To understand the principle of DWI of nodes.
2. To learn about the appearances of malignant nodes on diffusion-weighted MRI.
3. To become familiar with node-specific enhanced MRI.

A-088 16:51

C. PET and other nuclear medicine techniques
T. Barwick; *London/UK (tara.barwick@imperial.nhs.uk)*

PET/CT imaging using 18-fluoro-deoxyglucose (FDG), a glucose analogue, has an established role in oncology for the staging and response assessment of a variety of tumours. For the assessment of nodal involvement visual analysis and semi-quantitative SUV analysis are utilised. However, there are no reliable absolute SUV cutoffs to differentiate between benign and malignant lymph nodes. It is very important to be familiar with the typical patterns of spread of the specific cancer being assessed as this also influences the likelihood of disease involvement. Glucose metabolism is not specific for malignancy and false positives can occur with inflammation, infection and other processes such as a sarcoid-like reaction to malignancy. Further pitfalls are that some well-differentiated malignancies have only low-level glucose metabolism and the limited spatial resolution of PET means involvement of small nodes may be missed or the level of metabolic activity may be

underestimated in small nodes. New radiotracers which target more specific pathways such as C-11/ F-18 fluorocholine which target cell membrane metabolism and Ga-68 prostate-specific membrane antigen (PMSA) which targets a cell surface protein are gaining increasing use in prostate cancer imaging and the Ga-68 Dota-peptide tracers for somatostatin receptor imaging of neuroendocrine tumours.
Learning Objectives:
1. To learn the typical appearance on nodal metastatic disease on FDG.
2. To recognise the pitfalls for interpretation.
3. To become familiar with new radiotracers, including choline PET, for the demonstration of nodal disease.

17:14
Panel discussion: Will imaging ever make diagnostic biopsy unnecessary?

16:00 - 17:30 **Room F2**

Breast

RC 402
Radio-pathological correlation: more important than you thought

A-089 16:00
Chairman's introduction
F.J. Gilbert; *Cambridge/UK (fjg28@cam.ac.uk)*

The importance of radiological pathological correlation should not be underestimated. Lesions identified on breast imaging investigations that appear malignant, suspicious or even slightly suspicious should be biopsied to ensure that cancers are not missed. It is essential to ensure that the pathological result that is obtained from the biopsy specimen corresponds to the imaging abnormality. Ideally the correlation should take place with the team who is managing the patient and include the radiologist, pathologist, surgeon and oncologist. This session will discuss the advantages and disadvantages of such an approach.

A-090 16:05
A. Pre-treatment planning
C.K. Kuhl; *Aachen/DE (ckuhl@ukaachen.de)*

Imaging for treatment planning in a patient with newly diagnosed breast cancer has several goals. First, to delineate the actual extent of the known breast cancer. This includes the size of the invasive part, but also that of possible intraductal components, to reduce or avoid re-excisions. If the primary diagnosis was that of pure DCIS, a second goal of imaging is to identify possible invasive components. This is important because usually, pure DCIS will not require sentinel lymph node sampling, whereas invasive cancer usually does. The exception to this rule is very large DCIS - which implies that knowledge of the size extent of a DCIS is also important for this purpose. The third task is to search for additional manifestations of the breast cancer in the same or the opposite breast, where detection of contralateral breast cancer is more important than finding additional ipsilateral disease. This is because the ipsilateral breast will usually undergo radiation anyway, which, together with systemic treatment, will usually be able to sufficiently control such additional foci. Note that, for the same reason, detection of additional multicentric cancer foci is not a contraindication for breast conservation. Last, it is exceedingly important to ensure that the image information is translated into the OR - by lesion localisation or, even better, by bracketing of lesion extent. Such procedures must be done under US, mammo, or MR guidance, depending on which method is best able to display the finding.
Learning Objectives:
1. To know the role of the imaging methods for preoperative staging.
2. To understand the need for imaging-guided needle sampling and localisation for a tailored surgery.
3. To appreciate the need for changing surgical guidelines for treating breast cancer.

A-091 16:28
B. Intra-operative specimen evaluation
J. Camps Herrero; *Valencia/ES (juliacamps@gmail.com)*

After a thorough integrated radiological diagnosis in breast cancer staging, the following phase is as important as the rest to achieve a thorough and exact map of the cancer's extent and minimise the risk of positive margins. Preoperative planning together with the surgeon is essential, especially in those instances which are complex and have higher possibilities of yielding positive margins if the surgical decision is to preserve the breast: extensive DCIS, extensive multifocal disease, cancers with extensive intraductal component (EIC) and rare instances of multicentric cancers in which the surgeon chooses to preserve the breast. After the patient is marked with one of the many available options (hook-wire, radioactive seeds, SNOLL, ROLL), the next step is to evaluate the specimen obtained during surgery. The most common technique is the radiography of the specimen, although ultrasound has also been used in nodular lesions and lately, tomosynthesis is also being used. The most important issues in preoperative evaluation of specimens are: to know well the orientation protocol used by the surgeon, to know with detail the patients' staging results and to be fast conveying the information on margins to the surgeon.
Learning Objectives:
1. To learn about different imaging techniques for pre-operative marking and intraoperative specimen evaluation.
2. To become familiar with methods for specimen orientation and handling.
3. To understand the need for immediate reporting/reaction from radiological department to surgical room.
Author Disclosure:
J. Camps Herrero: Advisory Board; Bayer, Hologic. Speaker; Bayer.

A-092 16:51
C. The breast radiologist sitting down with the pathologist
T. Tot; *Falun/SE (tibor.tot@ltdalarna.se)*

Most breast carcinomas exhibit complex subgross morphology already in the in situ phase. If the cancer is located in the terminal ductal-lobular units, it may manifest as unifocal or multifocal disease and may be associated with clustered calcifications. Cancer in situ that develops predominantly in larger ducts is most often diffuse, extensive, high grade, and may be associated with linear branching (casting type) calcifications or may cause architectural distortion. The invasive component of the tumour usually manifests as circular/oval or spiculated density, and rarely as architectural distortion only. One-third of invasive cases are unifocal, with a single invasive focus and in situ component within and/or in the vicinity of this focus. Another third of the cases are characterised by the presence of a single invasive focus, but associated with a diffuse or multifocal in situ component. The final third of the cases exhibit a multifocal invasive component. Almost half of these cases are extensive in which the individual foci occupy a tissue volume of greater than 4 cm in the largest dimension. Multimodality breast radiology is able to asses this complexity of subgross morphology with high and ever increasing accuracy. Small samples of the specimen with invasive cancer used in conventional pathology may be fully sufficient for typing and grading the tumour and for molecular and genetic analysis, but a special technique using non-fragmented contiguous tissue slices including the cut surface of the entire specimen (large-format histology) is required for detailed and systematic radiological-pathological correlation.
Learning Objectives:
1. To understand the importance of using imaging to guide the pathologist in complex lesions.
2. To know the different ways of correlating radiology and pathology.
3. To learn how to enhance this cooperation in order to achieve the best results in terms of tumour extension and tumour margins.

17:14
Panel discussion: How to enhance the interaction between radiologists and pathologists?

16:00 - 17:30 **Room D1**

Chest

RC 404
Pulmonary embolism - persistent controversies

A-093 16:00
Chairman's introduction
M. Rémy-Jardin; *Lille/FR (martine.remy@chru-lille.fr)*

Acute pulmonary embolism (PE) is a common disease whose diagnostic approach was revolutionised by the introduction of spiral CT in the early nineties. Since then, this imaging modality has become the diagnostic gold standard applicable to all patients suspected of acute PE. As a consequence, this imaging modality has totally replaced pulmonary angiography and dramatically reduced the indications of ventilation-perfusion scintigraphy in this clinical context. Over the last decade, CT technological advances have introduced new options for this modality, no longer exclusively limited to the identification of endovascular clots. In parallel, clinicians have introduced new

options in the management of acute PE which have to be known by the radiological community to provide the best patients' management. This session will discuss these recent trends in the radiological and clinical approaches of PE whose combination is necessary for a comprehensive management of PE.
Session Objectives:
1. To review the current controversies regarding PE diagnosis.
2. To appreciate the need for defining a standardised management.
Author Disclosure:
M. Rémy-Jardin: Grant Recipient; Siemens Healthcare.

A-094 16:05

A. Subsegmental PE, incidental PE: diagnosis and management
C.M. Schaefer-Prokop; *Amersfoort/NL (cornelia.schaeferprokop@gmail.com)*

Attention to subsegmental pulmonary embolism (SSPE) has increased with the ability of CT pulmonary angiography (CTPA) to show small emboli. The advent of multi-detector computed tomographic pulmonary angiography (CTPA) allows increased visualisation of the peripheral pulmonary arteries. The prevalence of SSPE in patients with suspected PE varies between 0.4% and 18% according to the literature. It is likely that this variability is caused by patient characteristics, reading methodology but last not least by scanner technology used. A systematic review mentions a prevalence of SSPE of 4.7% in a group examined with a single slice scanner, and of 9.4% in a patient group examined with a multi-slice CT scanner. Detection of unsuspected PE (UPE) is not uncommon in patients undergoing CT for routine staging of malignancy. Even if UPE is generally milder, it shares a similar impact on survival and recurrent venous thromboembolism as compared to symptomatic PE. Clinical relevance and management of patients with symptomatic SSPE and asymptomatic UPE is still controversial. A Cochrane meta-analysis of 2014 summarised that there is no randomised controlled trial evidence for the effectiveness and safety of anticoagulation therapy versus no intervention in patients with isolated subsegmental pulmonary embolism (SSPE) or incidental SSPE. More and more publications occur describing outcome of untreated patients with SSPE that have no associated DVT. Recent recommendations from the European Society of Cardiology suggest an individualised approach for the management of patients with newly diagnosed SSPE based on the risk/benefit ratio of anticoagulation and the presence of lower limb DVT.
Learning Objectives:
1. To review the characteristics of subsegmental and incidental PE.
2. To suggest an appropriate management in both situations.

A-095 16:28

B. CT not available, contraindicated, or inconclusive: what to do?
E.J.R. van Beek; *Edinburgh/UK (edwin-vanbeek@ed.ac.uk)*

The utility of CT pulmonary angiography (CTPA) as a first-line diagnostic test for imaging of pulmonary embolism (PE) is beyond doubt one of the great developments for this commonly encountered disease. It has enabled a fast triage service, allowing safe exclusion and early discharge for patients with symptoms, thus avoiding unnecessary treatment and complications. In approximately 5% of cases, CTPA is inconclusive. In most of these patients, repeat CTPA is an accepted method to detect or rule out PE. In some hospitals, CTPA may not be available around the clock, and in these situations the aim would be to positively diagnose the presence of venous thromboembolic disease using ultrasound, or definitively exclude the disease using perfusion scintigraphy in patients with a normal chest radiograph. Finally, there are situations where radiation dose is of concern, e.g. in young female patients or during pregnancy. Although the risk-benefit for diagnosis of PE is hugely in favour of CTPA, alternative approaches, such as ultrasound for the detection of DVT or MR angiography for detection or exclusion of PE may be considered. This lecture will describe some potential approaches using a combination of diagnostic tests, including D-dimer, ultrasonography, perfusion scintigraphy and MR angiography as an alternative to CTPA.
Learning Objectives:
1. To review the role of US and V/Q scan.
2. To learn about the current performance of MR.
Author Disclosure:
E.J.R. van Beek: Advisory Board; Vital Images. CEO; Quantitative Clinical Trials Imaging Services Ltd.

A-096 16:51

C. Can we predict outcome from imaging?
B. Ghaye; *Brussels/BE (benoit.ghaye@uclouvain.be)*

The mortality risk of unselected patients with proven pulmonary embolim (PE) is around 10%, although it may be superior to 50% in some selected patient categories. Recent international guidelines have refined the stratification of early mortality risk in patient with PE as this may influence the therapeutic strategies and the duration of hospitalisation. Clinical findings as cardiogenic shock or persistent arterial hypotension remain the most powerful predictors and identify patients at high-risk of mortality. Absence of such findings requires further risk stratification. Clinical prognostic scores, such as the PESI, cardiac biomarkers dosage and signs of right ventricle (RV) dysfunction on an imaging test (echocardiography or CT pulmonary angiography) are used to discriminate patients with intermediate or low risk. Therefore it is recommended to indicate the ratio between the diameters of RV and left ventricle (RV/LV) on each report of CT pulmonary angiography. Meta-analyses have confirmed RV/LV diameter ratio as measured on CT to be significantly associated with increased risk of mortality. However, taken individually, RV/LV diameter ratio is limited by a 95% NPV and a 5-30% PPV for predicting mortality. RV/LV diameter ratio should be therefore combined with other factors, including biomarkers and clinical findings in order to increase the prognostic value. This lecture will also discuss more recent and potentially more powerful predictor CT findings, including among others RV/LV surface and volume ratios, severity of "perfusion" defect and cardiac function parameters as calculated from ECG-gated acquisition.
Learning Objectives:
1. To learn how clinical findings influence the selection of the imaging strategy in PE.
2. To learn how imaging may predict the outcome of the patient.
3. To learn about the follow-up after treatment.

17:14
Panel discussion: How to optimise patient management?

16:00 - 17:30 **Room D2**

Physics in Radiology

RC 413

Artefacts and pitfalls in tomography

A-097 16:00

Chairman's introduction
V. Tsapaki; *Athens/GR (virginia@otenet.gr)*

An artefact is a component within an image, which does not exist in the scanned object and it is usually the result of inappropriate use of technical parameters. Very often artefacts degrade image quality leading in some cases to diagnostically useless images. Occasionally, they appear due to the inevitable consequence of natural properties of the human body. Whatever the case, it is important to be familiar with them. There are many different types of artefacts such as noise, beam hardening, scatter, pseudoenhancement, motion, cone beam, helical, ring or metal artefacts. A greater understanding of the origins and imaging characteristics of artefacts in CT, PET/CT, and MR/PET will reduce the likelihood of misdiagnosis and thus optimise the image parameters for the reporting physician. The particular refresher course intends to refresh the participants' knowledge of the physical origins of artefacts, teach them various methods for minimising these artefacts as well as how to image regions of the body close to metal implants, as well as solutions to frequent image distortion.
Session Objectives:
1. To learn about the origins of image artefacts in tomographic imaging.
2. To understand image distortions in hybrid imaging.
3. To learn about solutions and work-arounds.

A-098 16:05

A. CT
M. Kachelrieß; *Heidelberg/DE (marc.kachelriess@dkfz.de)*

Although CT is the most quantitative diagnostic tomographic imaging modality, its images still suffer from several kinds of artefacts. Among the CT artefacts the most severe one is the metal artefact, mainly because larger metal implants are almost opaque to the x-ray radiation. This means that metal causes significant beam hardening and x-rays that are scattered from the surrounding tissue into the metal shadow cause a very high scatter-to-primary ratio. Altogether these metal artefacts are the most prominent and probably the most well-known CT artefacts. In addition, there are many less dominating sources of artefacts. Among those are sampling issues causing aliasing artefacts, beam hardening and scatter causing dark streaks between denser objects such as bones, motion causing motion blurring and partial cycloid artefacts, very large patients causing truncation artefacts, as well as the finite detector size which causes linear and non-linear partial volume artefacts. Last but not least there are artefacts that are known mainly to experts in CT physics because the manufacturers typically correct for them: defect detector pixel artefacts, detector afterglow artefacts, and geometric misalignment artefacts. The lecture discusses the source of these artefacts and gives, wherever applicable, examples and points towards approaches of how to reduce such artefacts.

Learning Objectives:
1. To understand the source of artefacts in clinical CT.
2. To understand the most important correction methods.
3. To find out what artefact correction techniques are actually provided by the CT vendors in their systems.

A-099 16:28

B. PET/CT

T. Beyer; *Vienna/AT (thomas.beyer@meduniwien.ac.at)*

A proposal to combine PET with CT was made in the early 1990s by Townsend, Nutt et al. In addition to the intrinsic alignment of complementary images, the anticipated benefit of PET/CT was to use the CT images to derive the mandatory attenuation maps for the PET data. In short, CT-based attenuation correction (CT-AC) is based on the assumption that attenuation factors in CT images (acquired at an effective CT energy ~ 80 keV) can be scaled to attenuation factors at 511 keV (PET energy). This is supported by the fact that at the effective CT energy most photon interactions are Compton scatter that scale linearly with energy. Therefore, the CT image can be segmented into bone and non-bone tissues; voxels in each tissue class are then scaled with corresponding scale factors. CT-AC is prone to several errors arising from the methodological shortcomings of the segmentation-scaling method in light of CT-transmission measurements in clinical conditions. These include: truncation artefacts, artefacts from high-density implants and positive contrast agents and others. More frequently, errors from patient motion during the examination propagate through CT-AC into the final emission images and lead to distortions/bias of the reconstructed data. In addition, artefacts and biases may occur from involuntary mistakes made during the set-up/conduct of the imaging procedure. During this presentation, we will rehearse the principles of CT-AC in PET/CT and point to source of artefacts arising from the methodology of CT-AC and from specific imaging workflow scenarios not optimised for routine PET/CT.

Learning Objectives:
1. To understand image distortions, artefacts and bias from methodological pitfalls.
2. To appreciate and understand solutions to frequent image distortions.
3. To understand the methodological limitations of PET/CT.

Author Disclosure:
T. Beyer: Research/Grant Support; Siemens Healthcare, PET/MR. Speaker; Siemens, Philips.

A-100 16:51

C. MR/PET

H.H. Quick; *Essen/DE*

Each new imaging modality and technical system introduces new types of artefacts and in MR/PET hybrid imaging the potential for new artefacts is even higher than just considering two independent systems. Artefacts in MR/PET might affect the visual impression of either MR or PET data and, furthermore, may also have an effect on quantification in MR and even stronger on PET being a quantitative method. Artefacts in integrated MR/PET may result from technical crosstalk between MR and PET components. Both imaging centers might not be co-aligned correctly. Differences in the data acquisition speed between MR and PET might lead to local misalignments due to patient motion. MR-based attenuation correction (AC) is still a new concept that is supposed to support PET data quantification in the best possible way. All deviations from the real physical gamma quanta attenuation will ultimately lead to false values in PET quantification following AC. Administration of contrast agents before application of MR-based AC due to changes in tissue contrast potentially may lead to errors in tissue segmentation. The MR field-of-view is limited which may lead to truncation of patient tissues exceeding the constraints of the field-of-view. Consequently, the arms are not fully considered in AC leading to false PET quantification. Metal implants might introduce signal voids or local distortions in MR-AC that exceed the physical implant volume. Such signal voids might then be assigned with the low linear attenuation coefficients of air in image segmentation. Typical artefacts, pitfalls, and their avoidance will be presented.

Learning Objectives:
1. To identify common artefacts.
2. To understand the physical origin of and methods to resolve artefacts.
3. To understand the interrelation of MR artefacts and bias in PET quantification.

17:14

Panel discussion: Imagine imaging without artefacts: dos and don'ts in your clinical practice

16:00 - 17:30 **Room K**

E³ - ECR Master Classes (Genitourinary)

E³ 426b

MR-targeted focal therapies for prostate cancer

A-101 16:00

Chairman's introduction: the rationale for focal therapy

F. Cornud; *Paris/FR (frcornud@imagerie-tourville.com)*

The popularity of focal therapy (FT), which aims to only treat the tumour to avoid side effects of radical treatments, is not related to the efficacy of a particular physical agent but rather to the ability of mp-MRI to accurately localise and characterise PCa. Mp-MRI has thus a crucial role to plan FT. However, to incorporate MRI findings to accurately guide FT, MRI-TRUS image fusion, whose precision has not yet been validated, is mandatory. The in-bore MR-guidance of FT is thus an appealing alternative. Focal therapy may be questioned, because PCa is often multifocal. However, the so-called index tumour (largest size and highest Gleason grade) only should be treated. Most of tumour foci undetected by MRI are non-significant tumours and can be left untreated with no significant impact on cancer control for at least two reasons. First, metastases come from a single clone, that of the index lesion. Second, surveillance after FT by mp-MRI can detect any metachrone lesion or progression of the treated site which remains accessible to a further treatment. FT may be indicated in men with significant Ca, if one considers that FT for active surveillance is overtreatment. In reality, there is growing evidence that any visible tumour on mpMRI is a potential significant tumour which deserves consideration for FT. As a result, mp-MRI prior to biopsy could represent a triage test to detect measurable disease requiring targeted biopsies and consideration for focal therapy.

Session Objective:
1. To provide an overview of indications, techniques and outcome of MR-targeted treatment of prostate cancer.

A-102 16:05

A. The role of multiparametric MR in the planning phase of focal therapy

V. Panebianco; *Rome/IT (valeria.panebianco@uniroma1.it)*

Thanks to recent developments in minimally invasive techniques, today the goal of focal therapy for prostate cancer (PCa) is to minimise the risk of treatment-related side effects while effectively and selectively treating the volume of the prostate affected by the cancer. The therapy depends on life expectancy, comorbidities, risk adapted assessment as well as patient preferences. Risk assessment depends on the grade, stage and prostate-specific antigen (PSA). The topic is focused on the treatment selection of localised PCa based on multiparametric magnetic resonance (mp-MRI) criteria. Multiparametric magnetic resonance (mp-MRI) that combines anatomic T2-weighted (T2W) imaging with diffusion-weighted imaging (DWI), dynamic contrast-enhanced MRI (DCE-MRI) and MR spectroscopic imaging (MRSI), provides excellent depiction of lesion supplying local stage of disease. The volume and location of PCa define the candidates suitable for focal ablative therapy. Additionally, mp-MRI gave information about cancer aggressiveness, in fact ADC values have been found to identify the index lesion based on the aggressiveness. The "radiological phenotype" of a tumour - DWI and DCE-MRI findings - could play an important role in the patient selection for focal therapy; moreover, the use of diffusion tensor imaging (DTI) has been demonstrated to be able to evaluate the periprostatic plexus leading to its preservation.

Learning Objectives:
1. To present the mpMRI criteria in the planning phase of focal treatment.
2. To understand the role of MRI in patient selection.

A-103 16:23

B. MR-targeted high intensity focused ultrasound

M.C. Roethke; *Heidelberg/DE (m.roethke@dkfz.de)*

Focal therapy approaches are emerging for treatment of localised low-risk prostate cancer. High-intensity focused ultrasound (HIFU) causes increased temperature within a defined volume resulting in tissue coagulative necrosis. There are two principle mechanisms that are responsible for the irreversible tissue conversion: hyperthermia and acoustic cavitation. HIFU treatment has advantages over other thermal ablation techniques, i.e. laser ablation, photothermal therapy, radiofrequency ablation, and cryotherapy. However, there are limitations that are caused by the nature of ultrasound waves: air and solid structures, e.g. bone or calcifications, are not passed preventing structures behind from being treated. For treatment of prostate cancer, the HIFU transducer can be inserted in the rectum or the urethra. During HIFU

treatment, target lesions are displayed by standard real-time US as hyper-echoic areas. However, some cancer lesions are not accurately visible on standard US. Therefore, current HIFU systems incorporate MR data as MRI fusion approach for treatment planning and and/or real-time in-bore MR monitoring using MR-thermometry for temperature and dose monitoring. Indications for HIFU treatment include prostate cancer stage T1c-T3 patients that have contraindications for standard radical treatment or refuse being treated by standard of care. Contraindications include prostates with volumes over 40 mL and patients with prior rectal disease, e.g. fistulas, rectal stenosis and rectal resections. Common complications include urinary tract infection, urinary retention, incontinence, and erectile dysfunction. Less common complications include urethral strictures, bladder neck stenosis, chronic perineal pain, infravesical obstruction, epididymitis, and prostatitis. 5-year disease-free survival rates range from 61 to 95%.
Learning Objectives:
1. To become familiar with indications and technique.
2. To demonstrate findings during and after treatment.
3. To show complications and outcome.
Author Disclosure:
M.C. Roethke: Investigator; Phase I trial, Profound Medical, Toronto, Cananda.

A-104 16:41

C. MR-guided cryoablation and focal laser therapy
J.J. Fütterer; *Nijmegen/NL (jurgen.futterer@radboudumc.nl)*

Prostate cancer is the most common cancer among men aged 50 years and older in developed countries and the 3rd leading cause of cancer-related death in males. Focal therapy is an emerging local treatment option, which offers great hopes in term of decreased morbidity associated with standard whole gland therapy without jeopardizing cancer control. Focal treatment of prostate cancer using potentially less invasive ablative methods, such as laser-, cryo-, radiofrequency ablation, irreversible electroporation or high-intensity focused ultrasound is currently being developed. For both laser and cryoablation, short-term follow-up in focal treatment is known and promising.
Learning Objectives:
1. To become familiar with indications and technique.
2. To demonstrate findings during and after treatment.
3. To show complications and outcome.
Author Disclosure:
J.J. Fütterer: Research/Grant Support; Medtronic.

A-105 16:59

D. MR-targeted intensity-modulated radiotherapy with focal boost
V. Fonteyne; *Ghent/BE (valerie.fonteyne@uzgent.be)*

External beam radiotherapy (EBRT) is an established treatment option for prostate cancer (PC) patients. A dose-response relationship for biochemical control is extensively described. Also the incidence of local failure after EBRT is dose dependent but even when doses ε75.6 Gy are delivered, positive biopsies $>$ 2 years after EBRT are found in 11%, 19% and 30% of low, intermediate and high-risk PC patients, respectively, supporting the hypothesis that aggressive tumours are more radioresistant. The implementation of modern radiotherapy techniques and improvements in patient positioning during treatment enable the safe delivery of 74-78 Gy to the prostate. However, the close vicinity of surrounding organs at risk (OARs) limits further dose escalation to the entire prostate. To avoid excess in toxicity, one can increase the dose exclusively to the area that is at highest risk of local relapse, i.e. the location of the initial tumour site, called the dominant intraprostatic lesion (DIL). Theoretically this might improve local control and positively impact on the risk of developing distant metastases and PC death. In the meanwhile, several planning studies and a limited number of small clinical trials are published, all demonstrating the feasibility and safety of delivering a simultaneous integrated boost (SIB) to the DIL.
Learning Objectives:
1. To become familiar with indications and technique.
2. To illustrate findings during and after treatment.
3. To show complications/toxicity and outcome.
Author Disclosure:
V. Fonteyne: Speaker; Ipsen.

17:17
Panel discussion: What are the challenges in providing focal treatment in prostate cancer?

16:00 - 17:30 **Room G**

E³ - ECR Academies: Neuroradiology: from Morphology to Function

E³ 419

Functional MRI of the brain opens new horizons

A-106 16:00

Chairman's introduction
T.A. Yousry; *London/UK (t.yousry@ucl.ac.uk)*

Over the past 25 years, functional MRI of the brain has continued its spectacular developments with an inevitably very profound impact on our understanding of the mechanisms of cerebral function. The clinical impact followed swiftly being refined as the techniques and our understanding of them further evolved. Beyond the simple approach of "where" is a function located, it is important to understand how areas of a given function interact with each other. This "functional connectivity" will be reviewed in cognitive active and in resting states of healthy and sick people. We will then move to the most important clinical application of fMRI, now also supplemented by DTI tractography: the preoperative mapping to plan neurosurgical procedures in the context of epilepsy and tumours. In these circumstances, determining the language-dominant hemisphere, and identifying relevant tracts such as the corticospinal tract and the optic radiation can be crucial to decrease the morbidity of a given surgery. For the application of DTI, it is however crucial to understand the basics of DTI, its limitations and of course be aware of the latest advances, especially with respect to the Human Connectome Project.

A-107 16:03

A. No function without structure: challenges in diffusion MRI and fiber tractography for clinical research
A. Leemans; *Utrecht/NL (Alexander@isi.uu.nl)*

Diffusion MRI (dMRI) has been widely used to investigate microstructural tissue properties in vivo. In addition, dMRI has enabled the virtual reconstruction of tract pathways with so-called "fiber tractography" (FT) approaches. With this unique way of characterising tissue organisation, dMRI and FT have been used in a wide range of clinical, biomedical and neuroscience applications. In addition to a brief introduction to the basic concepts of dMRI and FT, I will cover practical guidelines on quality assessment and processing of dMRI data for subsequent analysis. Several considerations regarding limitations and data interpretation will also be presented.
Learning Objectives:
1. To present an introduction to the use of diffusion MRI and fiber tractography of the brain.
2. To illustrate how these techniques have provided new insights into functional neuroanatomy.
3. To raise awareness about methodological challenges and limitations for clinical applications.

A-108 16:32

B. Clinical utility of fMRI for pre-operative brain mapping
H. Urbach; *Freiburg/DE (horst.urbach@uniklinik-freiburg.de)*

Subtle lesions causing drug-resistant epilepsy (mainly focal cortical dysplasias (FCD)) are often missed on standard MRI. To find them 3 Tesla 3D T1-weighted MPRAGE (for morphometric analysis) and FLAIR SPACE sequences with 1 mm^3 voxels (for visual inspection) are needed. In further presurgical workup language lateralisation and spatial relationship of these lesions to eloquent cortex and white matter tracts must be evaluated. With clear left lateralisation language fMRI is sufficient, in atypical lateralisations electrical stimulation mapping rather than a Wada test are added. Primary motor cortex and corticospinal tract on one and visual cortex and optic radiation on the other side are displayed with fMRI and diffusion tensor tractography. For the corticospinal tract a "global" tracking algorithm, for the optic radiation including Meyer's loop, which may be damaged in anterior temporal lobe resections, a probabilistic algorithm is best suited. However, most neuronavigation systems only process white matter tracts calculated with the FACT algorithm.
Learning Objectives:
1. To reveal how morphometric analysis of 3D data sets can help to reveal the true extent of a cerebral lesion in the pre-surgical work-up.
2. To demonstrate how fMRI is useful for documenting the spatial relationship of brain lesions to the adjacent eloquent cerebral cortex.
3. To illustrate how diffusion tensor tractography can reveal important white matter tracts such as the corticospinal tract and optic radiation.

A-109 17:01

C. Introduction to resting state fMRI and functional connectomics

L. Nyberg; *Umeå/SE (lars.nyberg@diagrad.umu.se)*

Correlations in the functional magnetic resonance imaging (fMRI) blood oxygen-level-dependent (BOLD) signal yield information about brain 'functional connectivity'. Such correlations provide evidence for which brain regions are functionally coupled through direct or indirect anatomical correlations. The fMRI signal can be acquired while participants or patients are engaged in the performance of a specific cognitive task, but also at 'resting state'. Several studies have reported that the functional architecture of intrinsic activity is altered in neurological and psychiatric diseases, and intrinsic activity has been employed for preoperative localisation of functional brain networks in patients undergoing neurosurgery.

Learning Objectives:

1. To understand how spontaneous fluctuations in activity in different parts of the brain can be used to study functional brain networks.
2. To review how resting-state functional MRI (rfMRI) can be used to map the macroscopic functional connectome.
3. To highlight some upcoming challenges in functional connectomics, using high-quality rfMRI data being generated by the Human Connectome Project.

16:00 - 17:30 **Room M 1**

Vascular

RC 415

Basic principles of varicose vein diagnosis and endovascular treatment

Moderator:
D. Karnabatidis; Patras/GR

A-110 16:00

A. Diagnostic cross-sectional imaging

H. Hoppe; *Berne/CH (hanno.hoppe@web.de)*

Duplex ultrasound is an adequate modality diagnosing venous valvular incompetence. Preferably, multi-frequency linear array transducers are used for the examination of superficial and deep venous reflux. Usually, this study is performed with the patient in an upright position and in addition manual compression maneuvers are used to initiate reflux. Previously, cutoff values for reflux have been defined. Routinely, perforating veins are identified and flow direction during compression is recorded. Duplex ultrasound is utilised in case of leg ulcers to examine lower extremity veins including venous outflow obstruction and chronic changes in deep and superficial veins following deep venous thrombosis. The inability to quantify the haemodynamic significance of chronic venous obstruction is a major limitation of this study. However, additional cross-sectional imaging studies such as magnetic resonance or computed tomography venography are used with increasing frequency for reliable noninvasive identification of post-thrombotic changes and venous outflow obstruction and for treatment planning. In general, anatomic variations in superficial and deep veins are quite frequent and should be identified. Reporting should rely on a proper classification of venous disease including current anatomic description.

Learning Objectives:

1. To become familiar with the whole spectrum of varicose vein pathology.
2. To learn about technical principles of state-of-the-art lower limb venous imaging studies.
3. To learn how to extrapolate imaging findings into endovascular treatment.

A-111 16:30

B. Saphenous vein ablation

M. Akesson; *Höllviken/SE (akessonmd@gmail.com)*

Varicose veins are a common manifestation of venous incompetence in the lower limb, and appear as dilated, elongated or tortuous superficial veins. Venous disease of the legs causes considerable morbidity and is also costly, with approximately 2% of national healthcare resources being spent on treatment. The goal of varicose vein surgery is to remove reflux and visible varicose veins. The most common is the classic saphenectomy with high ligation at the sapheno-femoral junction (SFJ). The last decade management of superficial venous incompetence has changed dramatically into minimal invasive techniques. The patients have gain from this change in techniques especially in post-operative care and post-operative pain. Radiofrequency ablation (RFA) and endovenous laser ablation (EVLA) are the most common techniques for thermal ablation of GSV and SSV. New on the market is endovenous steam ablation (EVSA). The endothermal techniques have been successful but they all require some type of anaesthesia, general or more common local anaesthesia with the use of tumescent. This is normally well tolerated by most patients but not so few find the distribution of the tumescent quite painful. Due to this, alternative methods to endothermal techniques have developed. These techniques can normally be carried out without any form of anaesthesia. The non-endothermal techniques use either some chemical reaction for ablation like ultrasound-guided foam sclerotherapy (UGFS) or combining this using a mechanical device to obtain damage to the endothelium (MOCA). The latest contribution to non-endothermal techniques is a chemical adhesive method using catheter delivered glue (cyanoacrylate) to gain truncal occlusion.

Learning Objectives:

1. To understand the principles of ablation therapy.
2. To learn the technique for ablation and how to avoid complications.
3. To learn about outcomes and complications.

A-112 17:00

C. Ultrasound guided sclerotherapy

P.F. Sousa; *Ermesinde/PT (pedro_sousa22@yahoo.com)*

Great saphenous vein insufficiency is the most common form of venous insufficiency in people presenting with symptoms. If symptoms are severe, the main treatment options include surgery, endovenous laser treatment and radiofrequency ablation. When endothermal ablation is unsuitable, ultrasound-guided foam sclerotherapy (UGFS) is an adequate alternative. The aim of UGFS for varicose veins is to damage the endothelial surface of the vein causing scarring and leading to blockage of the treated varicose veins. Sclerosant in the form of a foam is intended to have good surface area contact with the veins' walls. After successful sclerotherapy, in long term, the veins are transformed into a fibrous cord, a process known as sclerosis. The vein is punctured under ultrasound control and the tip of the needle is placed in the centre of the lumen. Injection is performed under ultrasound control. If any vein is incompletely treated, further injections may be given in the same or subsequent sessions. There are some complications associated to UGFS, the most frequent are thrombophlebitis and skin pigmentation. Foam sclerotherapy of saphenous varicose veins is significantly more effective than liquid sclerotherapy and compared to endovenous thermal ablation shows only a slightly higher mid-term recanalisation rate. Foam sclerotherapy is effective in the treatment of recurrent varices after previous treatment, accessory saphenous varices, non-saphenous varices and incompetent perforating veins.

Learning Objectives:

1. To learn about the principles of venous sclerotheraphy.
2. To learn about technical principles of US-guided sclerosis of lower limb veins.
3. To learn about pros and cons of US-guided sclerosis versus endovascular ablation.

16:00 - 17:30 **Room M 2**

Cardiac

RC 403

Imaging of cardiac valves: new trends

Moderator:
G. Roditi; Glasgow/UK

A-113 16:00

A. Echocardiography remains the reference technique

F. Knebel; *Berlin/DE (fabian.knebel@charite.de)*

Echocardiography is the first-line imaging modality for pathologies of valvular lesions. In this session, I will discuss the current echocardiographic methods for the assessment of heart valves. There will be a detailed description of the current standards and guidelines for the quantification of aortic stenosis as well as mitral regurgitation. There will be a brief discussion of the pathologies of the other valves. I will present the additional value of the newer echo techniques (3D echo, deformation imaging) in the scenario of valve disease.

Learning Objectives:

1. To learn about state-of-the-art echo techniques to evaluate cardiac valves.
2. To provide a practical approach to assessing valve pathology based on echocardiography.
3. To become familiar with the role of echo in the diagnosis, clinical management and prognosis.

A-114 16:30

B. MRI is the best comprehensive approach

M. Francone; *Rome/IT (marco.francone@uniroma1.it)*

Valvular heart disease has a direct impact on cardiac morphology and haemodynamics requiring comprehensive morphological and functional imaging for its assessment, which includes the evaluation of anatomy (leaflets, chordae tendineae, and papillary muscles) and quantification of trans-valvular flow (i.e. degree of stenosis and regurgitation). Cardiac magnetic resonance (CMR) represents an ideal, non-invasive diagnostic tool on this regard, which has emerged as an alternative or complementary modality to echocardiography providing insight into the pathophysiology of the disease including the consequences of a valvular lesion, from the effects of ventricular volume or pressure overload to alterations in systolic function. A further unique strength of the exam is its ability to characterise myocardial tissue changes, which has further expanded with the recent implementation of T1/T2 mapping techniques providing potentially relevant information regarding the amount and distribution of replacement fibrosis in valvular pathology. CMR is also indicated to follow-up post-operative patients and as a reference tool for planning before TAVI procedures with some relevant advantages towards MDCT. Present lecture will overview principles of CMR technique and recommended acquisition protocol with particular emphasis on phase-contrast pulse sequences analysing its respective strength and weaknesses. Pathophysiology with common and less common imaging findings in left- and right-sided valve disease will also be presented and discussed.

Learning Objectives:

1. To learn about the role of MRI in diagnosis and evaluation of valvular disease.
2. To become familiar with state-of-the-art MRI techniques to evaluate valvular disease.
3. To learn about typical imaging findings in MRI with impact on clinical management.

Author Disclosure:

M. Francone: Speaker; Bracco Medical Imaging Invited Speaker.

A-115 17:00

C. Does CT have a role in diagnosing valvular disease?

G. Feuchtner; *Innsbruck/AT (Gudrun.Feuchtner@i-med.ac.at)*

Echocardiography is the primary imaging modality in patients with valvular disease, with inherent limitations such as flow dependency, limited views of the paravalvular region or valvular mass delineation. Assessment of valvular morphology, masses and function by cardiac CT provides incremental value in several settings, which will be discussed during this RC, encompassing 1) native valve disease 2) infective endocarditis 3) characterisation of valvular masses 4) prosthetic valve infection and dysfunction. Multimodality imaging approaches including PET/CT will be highlighted and scientific evidence will be discussed.

Learning Objectives:

1. To learn about state-of-the-art CT techniques to evaluate cardiac valves at low dose.
2. To review CT appearance of the most common conditions causing valvular disease.
3. To become familiar with the role of CT in the diagnosis and clinical management.

16:00 - 17:30 **Room M 3**

Interventional Radiology

RC 409

Basic principles of percutaneous tumour ablation

A-116 16:00

Chairman's introduction

T. de Baère; *Villejuif/FR (debaere@igr.fr)*

Image-guided thermal ablation is able to completely ablate small size tumour in well-selected candidates. Radiofrequency ablation (RFA) was the first technique introduced nearly 20 years ago, and have been demonstrated as able to provide complete ablation of most of the tumours below 3 cm and away from vessels larger than 3 mm in lung, liver and kidney. For larger tumours or tumours close to large vessels, efficacy decreased. Microwave (MWA) is developed in the hope to improve efficacy in such tumours, by better thermal profile namely by being able to reach rapidly temperature superior to the ones used for RFA. Benefit of MWA over RFA is not yet demonstrated in clinical practice. Synergy has been demonstrated when multiple MWA antennas are used simultaneously, but great care should be taken to avoid complications that can occur when very large volume of ablation are performed. Cryoablation is a new technique that allows for multiple needle placement with its benefit (tailored ablation zone) and difficulties (multiple needle insertion). Visibility of the ice ball during treatment is a unique feature of cryoablation that helps in controlling treatment delivery.

Session Objectives:

1. To understand the basic principles of various ablation techniques.
2. To learn how to choose the right ablation technique for a specific lesion.
3. To learn about advantages of each technique over different tissue properties.

Author Disclosure:

T. de Baère: Advisory Board; General Electric, Terumo, Boston Scientific. Consultant; Guerbet, Gall. Speaker; General Electric, Guerbet, Terumo.

A-117 16:05

A. Thermal ablation with RF

F. Orsi; *Milan/IT (franco.orsi@ieo.it)*

The percutaneous radio frequency ablation (RF) was introduced in 1990 and is currently playing a key role in clinical practice, at least for the treatment of liver tumours. The waves of the RF band within the electromagnetic field are ranging between the low frequency (< 300 kHz) and high frequency (< 300 MHz) until the microwaves (2,500 MHz). RF generators are usually tuned at the frequency of 480-500 kHz. In a monopolar elementary circuit, the active electrode is located at the needle tip, which is placed within the tumour, while the dispersive electrode is constituted by a skin pad, usually placed on the surface of the thigh. The electrode, represented by the exposed tip of the needle, allows for the passage of an alternating current at high frequency to the surrounding tissue with ionic agitation, leading for a turbulence-ionic around the tip of the needle and a local overheating defined as thermal resistance effect. The extension of the induced necrotic area is related to the diameter of the needle-electrode, the length of the exposed tip and the duration of the application of the thermal energy, as well as to the local average temperature generated during the procedure. The cellular homeostasis could be maintained up to 40 °C: higher temperatures are associated with irreversible damage do to instantaneous protein coagulation. The optimal necrosis is obtained if the temperature is maintained for 4-6 minutes between 70° and 95 °C. Indications, techniques and main limitations of radio frequency ablation will be described.

Learning Objectives:

1. To learn about the physical and technical basis of radiofrequency ablation.
2. To understand the advantages and limitations of the technique.
3. To become familiar with the current indications in oncology.

Author Disclosure:

F. Orsi: Advisory Board; Celonova Bioscience.

A-118 16:23

B. Microwave ablation: what is the difference?

P.L. Pereira; *Heilbronn/DE (philippe.pereira@slk-kliniken.de)*

Image-guided interventional ablation therapy is rapidly growing in the recent years, both in technical development and clinical acceptance. Mostly radiofrequency ablation (RFA) is accepted in clinical routine for the treatment of selected patients with primary and secondary liver and lung tumours as well as for the treatment of T1 renal cell carcinoma. Tissue destruction with microwaves (MW) has been explored at least for the last 40 years. However, the recent introduction of new generation of MW devices with high-power generators, new antenna designs and an even more and more sophisticated heating algorithm have increased the use of MW devices for tissue heating. Practical advantages using MW are potentially numerous: heat is produced by rotation of bipolar molecules such as water. Heat generation with MW depends on effective conductivity and less on tissue properties, while less conductive tissue will potentially generate less heat, attenuation of MW energy will be reduced with a large propagation through ablated tissue. Several experimental studies have demonstrated that the total amount of coagulative necrosis induced with MW is larger compared with RF technology. MW energies propagate through all types of tissue; dessication, dehydration and even cystic changes will not limit the diffusion of microwaves apart from the MW antenna. Nevertheless, current clinical indications for MWA are similar to those established with RFA, however, with potential advantages for the treatment of tumours closed to large vessels, tumours with cystic changes and tumours in a tissue with poor conductivity such as pulmonal metastasis or cancer.

Learning Objectives:

1. To learn about the physical and technical basis of microwave ablation.
2. To understand the advantages and limitations of the technique as compared to RF ablation.
3. To become familiar with the current indications in oncology.

Author Disclosure:
P.L. Pereira: Advisory Board; Bayer, Bayer Global, Medtronic, Terumo, BTG, Siemens. Consultant; Medtronic, Celonova, BTG, Terumo, Pharmacept, Cook, Covidien, Angiodynamics, Microvention. Investigator; Terumo, BTG, Siemens, Pharmacept, Covidien, Medtronic. Research/Grant Support; Celon Olympus, Biocompatibles, Siemens, BTG. Speaker; Covidien, angiodynamics, Terumo, BTG, Sirtex, Pharmacept, Angiodynamics, Bayer.

A-119 16:41

C. Cryoablation: ice can be better than heat
D.J. Breen; *Southampton/UK (David.Breen@uhs.nhs.uk)*

The rise in image-guided tumour ablation has been driven by the increasing ability to detect and confirm small volume cancers at 5-35 mm in solid organs. Given that these tumours are often best perceived by imaging it follows that focal ablative technologies will be best delivered by the same means. As with radiotherapy the ablative energy must be carefully delivered and titrated, namely the application of diligent treatment dosimetry. Cryoablation has unique properties in this respect given the conspicuity of the treatment with current imaging modalities and its readily titratable delivery. Both the treatment ice ball and thereby the lethal isotherms can be readily visualised, providing a precise surgical tool. Cryoablation also appears to provide relative preservation of collagenous structures and in this respect it bears some comparison with irreversible electroporation (IRE). Mid-term data are now confirming its definitive role in the treatment of renal and bone cancers, chest wall, pulmonary and focal prostatic disease. Practitioners have, however, remained cautious about treatments in the liver due to a poorly predictable, one percent incidence of 'cryo shock' - a disseminated intravascular coagulative and multi-organ reaction - seen very occasionally with larger volume treatments. Cryoablation, alongside careful microwave and IRE, appears set in upcoming years to have a major role in the treatment of smaller volume cancers.
Learning Objectives:
1. To learn about the physical and technical basis of cryoablation.
2. To understand the advantages and limitations of the technique.
3. To become familiar with the current indications in oncology.

A-120 16:59

D. Irreversible electroporation: principles, technique and clinical applications
A. Nilsson; *Uppsala/SE (anders.nilsson@radiol.uu.se)*

Irreversible electroporation (IRE) is a recently introduced tumour ablation method that uses short electrical pulses to induce cell death (apoptosis). 2-6 needles are placed around the tumour under image guidance and the pulses are sent between the needles. It is a non-thermal technique and can, therefore, be used near or indeed around critical structures like bile ducts or blood vessels. This means that the risk of heat sink is reduced and that we are able to ablate lesions in otherwise untreatable locations. Studies show a low complication rate and good local control and suggests, even though the number of patients is still limited, prolonged overall survival for patients with, e.g. unresectable pancreatic tumours or liver tumours close to large vessels or near the liver hilum.
Learning Objectives:
1. To understand the physical and technical basis of irreversible electroporation (IRE).
2. To understand the advantages and limitations of the technique.
3. To become familiar with the current indications in oncology.

17:17
Panel discussion: Selection of ablation modalities: operator's preference or evidence-based?

16:00 - 17:30 **Room M 4**

Emergency Radiology

RC 417

'Special patients' in the emergency room: when and how to image them?

Moderator:
U. Linsenmaier; Munich/DE

A-121 16:00

A. Children
V. Miele, C.L. Piccolo, M. Trinci; *Rome/IT (vmiele@sirm.org)*

The role of diagnostic imaging, in particular of ultrasound (US), is to determine whether the acute abdominal pain is due to a surgically or medically treatable disease and, when possible, to diagnose the exact nature of the pathology. US is extremely beneficial in the evaluation of acute paediatric abdominal diseases, allowing, in most cases, the visualisation of the direct cause, without ionic radiation use, and helping in delineating the management plan of the patients. The main gastrointestinal emergencies in paediatric age include: appendicitis, intestinal intussusception, Meckel diverticulum, volvulus, cholelitiasis and pancreatitis. The main genitourinary emergencies in paediatric age include: severe urinary sepsis, renal vein thrombosis, neonatal adrenal hemorrhage, ovarian torsion, ovarian cyst rupture, hydrometrocolpos, nephrolithiasis, acute urinary retention, testicular torsion. In abdominal emergencies in children, the clinical onset is often nonspecific, against a general situation that may be rapidly progressive. Unlike in adults, where the use of CT has become prevalent and consolidated, diagnostic imaging in emergency still is based mainly on conventional radiography and ultrasound. Therefore, it is necessary that the radiologist is familiar with the most common pathological conditions in this age group and the corresponding imaging findings that can guide the diagnosis and determine the therapeutic approach.
Learning Objectives:
1. To become familiar with common non-traumatic emergencies in the paediatric population.
2. To comprehend the rationale of using different diagnostic imaging methods in emergency situations.
3. To understand the impact of imaging findings on patient management.

A-122 16:30

B. Pregnant patients
H. Alkadhi; *Zurich/CH (hatem.alkadhi@usz.ch)*

The management of pregnant patients in the emergency situation represents a demanding diagnostic and clinical task, which includes several challenges. First, radiological tests utilising ionising radiation should not be used due to foetal safety issues. Second, many obstetric and gynaecological disorders add to the wide list of differential diagnoses. Third, the anatomical and physiological alterations during pregnancy such as the cranial displacement of the appendix vermiformis can change the "classical" clinical presentations of otherwise known disorders. Here, MR imaging plays a major role for the imaging workup of pregnant patients in the emergency situation, since the technique enables the evaluation of large body regions with high anatomic resolution and without exposing the foetus to ionising radiation. This lecture aims at a comprehensive review of the most common nontraumatic emergencies in pregnant patients, and will highlight the optimal tests for various indications including the evaluation of pulmonary embolism.
Learning Objectives:
1. To become familiar with the most common non-traumatic emergencies in pregnant women.
2. To learn which tests to choose in pregnant patients for the diagnostic evaluation of pulmonary embolism and acute abdomen.
3. To know current guidelines and recommendations for contrast media administration in pregnancy.

A-123 17:00

C. Elderly patients
K. Katulska; *Poznan/PL (katarzyna_katulska@op.pl)*

Older people presenting to the emergency department (ED) represent a constantly increasing population that give rise to clinical, organisational, qualitative and ethical challenges. Compared with younger adults, elderly subjects' ED visits are characterised by a higher level of urgency. They are 4.4 times more likely to use ambulance transport, 5.6 times more likely to be admitted to the hospital, 5.5 times more likely to be admitted to an intensive care bed, and 4.5 times more visit radiology department. Atypical clinical presentation of illness, a high prevalence of cognitive disorders, and the

presence of multiple comorbidities complicate their evaluation and management. Increased frailty, delayed diagnosis, and greater illness severity contribute to a higher risk of adverse outcomes. Most common, urgent real-life conditions, which affect this group of patients, will be discussed. In these cases very meticulous diagnostic workup is necessary, in which great importance is the time factor as one of the most important in saving their lives. Modern diagnostic imaging including all available methods (ultrasound, x-ray, CT and MRI) in elderly group of patients requires the use of specific procedures. Very often, clinical symptoms do not clearly correlate with imaging. Common and specific image findings in elderly people emergency clinical scenarios will be presented.

Learning Objectives:

1. To become familiar with typical and atypical clinical emergency situations in the elderly.
2. To understand imaging strategies and the role of different imaging methods in elderly patients.
3. To learn common and specific imaging findings in the elderly population.

16:00 - 17:30 **Room M 5**

Pros & Cons Session

PS 427

Risks and benefits of reporting incidental findings

Moderator:
S. Weckbach; Heidelberg/DE
Teaser:
J. Sellors; London/UK

A-124 16:00

A. Good reasons to ignore incidental findings

L. Berlin; *Skokie, IL/US (lberlin@live.com)*

An incidental finding, colloquially referred to as an incidentaloma, is an unexpected potentially pathologic finding serendipitously discovered in a radiographic, CT, MR, or sonographic examination unrelated to the reason for which the examination was ordered. Incidentalomas have increased markedly throughout the world over the past five decades because the number of imaging exams - particularly CTs and MRIs - has risen exponentially, along with remarkable advances in spacial and contrast resolution on scanning equipment. Incidentalomas are found in up to 70% of people undergoing screening CT exams. Some incidentalomas are easily identified as normal tissue or probable pathologic lesions. However, the great majority of incidentalomas are indeterminate, and of these, only 1% will be an early malignancy. Herein lies the medical and ethical dilemma: if the radiologist believes beyond reasonable doubt that incidentaloma is benign, then mentioning it in the radiology report may subject the patient to a cascade of costly tests and biopsy or surgical procedures, which could result in serious complications. It defies a basic tenet of medicine to question the benefit of diagnostic information, as any new information regarding a patient's health is considered valuable and worth having. However, new knowledge can worsen a patient's overall well-being by leading to more discomfort and injury than the earlier state of not knowing. Radiologists owe a legal and moral duty to place the health and welfare of their patients above all other considerations; this duty can be met by the radiologist's ignoring incidentalomas thought to be benign.

Learning Objectives:

1. To learn a correct definition of radiological 'incidental finding' (IF) and understand the underlying ethical problems of IFs.
2. To learn about the impact of IFs on patients' and study participants' lives.
3. To understand the risks of reporting IFs.

A-125 16:25

B. Good reasons to report incidental findings

A. van der Lugt; *Rotterdam/NL (a.vanderlugt@erasmusmc.nl)*

Incidental findings are defined as previously undetected abnormalities of potential clinical relevance that are unexpectedly discovered and unrelated to the purpose of the imaging. Incidental findings are increasingly detected in clinical practice, with screening, and in the research setting. Data on the prevalence of these abnormalities are scarce, the clinical course of the findings is often unknown, and the management of such lesions is not clear. The prevalence of incidental findings can be expected to vary depending on the purpose of the imaging exams. With improvements in imaging technology (higher field scanners, new pulse sequences), the number of detected incidental findings will increase dramatically. Although still incidental, these findings can unfortunately no longer be considered unexpected. We will soon face large medical, ethical, and practical problems as a result of further improvements in imaging technology. In this lecture, we will describe the most important incidental findings and their prevalence. The differences of incidental findings in the clinical and research setting will be discussed. The advantage and disadvantages of the different approaches will be explained. Finally, the benefits of reporting incidental findings will be assessed.

Learning Objectives:

1. To become aware of the differences between reporting an IF in a clinical setting and in a research setting.
2. To become familiar with different approaches of handling IFs.
3. To understand the benefits of reporting IFs.

A-126/A-127 16:50

Questions and answers

S. Weckbach; *Heidelberg/DE (sabine.weckbach@med.uni-heidelberg.de)*

J. Sellors; *London/UK (jonathan.sellors@ukbiobank.ac.uk)*

The discussion will address the following issues:
1. Is it better to report or to ignore IFs?
2. Should there be differences for IFs in clinical imaging than in research studies?
3. Do we need worldwide obliging guidelines for the handling of IFs?
3. Should different categories of IFs have different consequences for the patient/study participant?

Thursday, March 3

08:30 - 10:00 **Room A**

E³ - ECR Academies: Interactive Teaching Sessions

E³ 521
Integrating diagnostic tools in breast imaging

A-128 08:30
A. Multimodality breast imaging
K. Kinkel; *Chêne-Bougeries/CH (karen.kinkel-trugli@wanadoo.fr)*

Clear medical communication is essential to allow diagnostic information to be used for adequate management. In the breast, the main question concerns the risk of malignity translated into a final BIRADs category subjectively established by the radiologist taking into account a variety of information from each breast imaging modality. For clinical situations such as screening, diagnosis, extension and follow-up of cancer, or for breast pain or masses, the first step consists in choosing the optimal imaging modality or combination of imaging techniques. The information provided requires adequate ranking and organisation into a final report. Multi-modality imaging of the breast takes advantage of the strength of each imaging modality to allow an optimal diagnostic procedure. Examples of a variety of breast problems are documented using state-of-the-art imaging techniques and reporting.
Learning Objectives:
1. To appraise the real value of combining all the diagnostic modalities into a final report.
2. To learn how to use the new BI-RADS categorisation system appropriately.
Author Disclosure:
K. Kinkel: Other; Blinded reader of pelvic MRI for Bayer.

A-129 09:15
B. Multiparametric breast MRI
J. Camps Herrero; *Valencia/ES (juliacamps@gmail.com)*

Breast MRI's main sequence is dynamic contrast-enhanced T1-weighted 3D (DCE-MRI), but there are other MRI techniques that can add very useful information due to the fact that they convey different functional information based on varying approaches to the biological hallmarks governing breast cancer. Angiogenesis is the basis for DCE-MRI, as the newly formed blood vessels show endothelial gaps that allow for the passage of gadolinium-based contrast media thus making it possible for tumours to enhance earlier than normal tissue. Diffusion-weighted imaging reflects the thermally induced movement of water molecules in the tissues and through the ADC or Apparent Diffusion Coefficient is able to improve specificity of DCE-MRI in the characterisation of breast lesions, as well as response evaluation to neoadjuvant chemotherapy treatment. DWI and its 3D counterpart, diffusion tensor imaging or DTI, are breakthrough techniques in breast MRI characterisation, response evaluation and also in breast cancer screening. Spectroscopy MRI assesses elevated membrane metabolism through analysis of altered phospholipid metabolites; this technique remains, however, subject to cutting-edge research.
Learning Objectives:
1. To learn about the different technical and clinical aspects of the MRI sequences that are used currently in breast imaging.
2. To know how to unify the information thereof provided in everyday clinical practice.

08:30 - 10:00 **Room B**

Abdominal Viscera

RC 501
The many faces of benign liver lesions

A-130 08:30
Chairman's introduction
M. Karcaaltincaba; *Ankara/TR (musturayk@yahoo.com)*

This session will cover the most commonly seen lesions such as haemangioma, hepatic adenoma, focal nodular hyperplasia and cysts with emphasis on atypical findings. Also other vascular lesions, pseudolesions, and the importance of ductal plate formation will be reviewed. CT and MR imaging (with extracellular and hepatocyte-specific agents) characteristics can provide biopsy-less diagnosis. At the end of the session most commonly encountered problems in liver lesions will be discussed by case examples. Audience will gain insight into basics and recent advances regarding hepatic lesions.
Session Objective:
1. To briefly introduce the diagnostic challenges in patients presenting with benign liver lesions.
Author Disclosure:
M. Karcaaltincaba: Speaker; GE Healthcare, Koninklijke Philips, Pfizer.

A-131 08:35
A. Vascular
F. Caseiro-Alves; *Coimbra/PT (caseiroalves@gmail.com)*

In general, the vascular nature of a focal liver lesion can be established after careful evaluation of plain and contrast-enhanced imaging CT/MR. Although haemangiomas are readily appreciated by their typical vascular pattern, variants and less typical forms can be a diagnostic challenge and impose other differential diagnosis. Knowledge of the hepatic vascular microstructure is instrumental to understand and recognise perfusion abnormalities that may simulate liver nodules or conceal pathology due to flow-related focal disturbances transitorily seen on dynamic imaging after contrast enhancement. MR appears to be the most complete imaging modality acting as a problem-solving tool in different clinical settings whenever a primary vascular lesion or pseudo-lesion is suspected. Additionally, the functional information provided by hepatic-specific CA also plays a role in the differential diagnosis in selected clinical settings.
Learning Objectives:
1. To become familiar with typical and infrequent manifestations of benign hypervascular focal liver lesions.
2. To learn how to differentiate between benign and malignant lesions.
3. To appreciate the limitations and complementary roles of CT and MR.

A-132 08:58
B. Cystic-Biliary
G. Brancatelli; *Palermo/IT (gbranca@yahoo.com)*

The ductal plate is a layer of cells surrounding the portal vein branches like a cylindrical sleeve around the eighth week of gestation. The ductal plate malformation occurs due to lack of remodeling of the ductal plate, resulting in the persistence of an excess of embryonic bile duct structures remaining in their primitive ductal plate configuration. Abnormal embryologic development of the ductal plates results in a spectrum of related lesions of the liver and biliary tract known as fibropolycystic liver disease. These lesions (congenital hepatic fibrosis, biliary hamartomas, autosomal dominant polycystic disease, Caroli disease, choledochal cysts) can be clinically silent or can cause nonspecific signs and symptoms. The different types of fibropolycystic liver disease show typical findings at CT and MR imaging.
Learning Objectives:
1. To explain the embryological process of ductal plate formation.
2. To describe the imaging features of congenital bile duct pathology.
3. To address how imaging helps make the differential diagnosis.
Author Disclosure:
G. Brancatelli: Speaker; Lecture fees from Bayer.

A-133 09:21
C. Hepatocellular
R.L. Baron; *Chicago, IL/US (rbaron@uchicago.edu)*

Solid benign hepatocellular lesions are classified as regenerative (focal nodular hyperplasia (FNH) and nodular regenerative hyperplasia (NRH)) or neoplastic (hepatocellular adenoma (HCA)). Cirrhosis and malignancies exceed the scope of this lecture. FNH and HCA comprise the vast majority of benign solid lesions in non-cirrhotic liver. Correct diagnosis is important to differentiate these from malignant lesions. HCA, while benign, can cause symptoms or complications such as bleeding or malignant degeneration requiring their diagnosis and treatment, unlike FNH. While small FNH and HCA often appear similar, larger lesions can be differentiated based on imaging criteria (FNH: lobular shape, homogeneous enhancement rapidly becoming isodense/intense with liver, central fibrous scar; HCA: heterogeneous enhancement, some with delayed washout, some with retention, mosaic appearance often with surrounding capsule). Small homogeneous FNH/HCA are difficult to differentiate but usually can using hepatobiliary-specific MR contrast agents, with substantial retention on delay imaging in FNH, and predominate washout in HCA. Genotyping and phenotyping have become an important tool for HCA management with strong correlations predicting risk for bleeding or malignant degeneration. MRI shows strong correlation with discriminating features between inflammatory adenomas (at risk for haemorrhage and low risk for carcinoma) and HNF-1α mutated adenomas (steatotic, with no risk for carcinogenesis and low bleeding risk). Other differentiating imaging characteristics of adenoma subtypes and FNH will be discussed in light of their clinical significance. Other forms of regeneration including nodular regenerative

hyperplasia (NRH), large regenerative nodule (LRN), and nodular regeneration following fulminant hepatitis will also be discussed.
Learning Objectives:
1. To understand the typical aspect of hepatocellular benign lesions on US, CT and MRI.
2. To learn when a liver-specific contrast medium can help us in the proper characterisation of hepatocellular benign liver lesions.
3. To understand the classification of liver adenomas, prognosis and imaging characteristics.

09:44
Panel discussion: How do I manage an incidental and potentially benign liver lesion?

08:30 - 10:00 **Room C**

Special Focus Session

SF 5
Taking imaging to the cloud

A-134 08:30
Chairman's introduction
J. Reponen; *Raahe/FI (jarmo.reponen@oulu.fi)*

The radiology workflow is changing from local to regional and even to mobile. The digitalization of healthcare services is seen as a possibility to decrease costs and improve access to care. PACS and RIS were first taken into use as a single hospital-based service, perhaps linked to a teleradiology connection. Today, the technical platform for image archiving and also for image interpretation can be outsourced. Even the radiology information system mastering the workflow and the reading software for reading workstations can be remotely obtainable over a secure connection. The technical evolution has made it possible to establish large vendor neutral archives which are connected via standardised protocols to patient care units. For radiologists, there is a challenge to adapt to increasing amount of remote work and competition. This session will discuss the definition and concept of cloud computing from radiological perspective. What are the new possibilities with modern internet technology? How this is changing the design of radiology departments and how the work of radiologists will change in the future? What are the benefits to radiology and clinical departments and what risks are involved? How security and reliability is assured and what is the role of the patient and how legal issues matter when images and their interpretation are distributed? The idea of having image storage and workflow management as well as image interpretation as a service is discussed with further examples.
Session Objectives:
1. To introduce different models of image management and distribution.
2. To discuss new possibilities provided by evolving technology.

A-135 08:35
How does it work?
J. Fernandez-Bayó; *Sabadell/ES*

The use of computing resources that are delivered as a service over a network is called cloud computing. We refer to computing resources in a broader sense meaning networks, servers, storage, applications, and services. Frequently the different services provided by cloud computing are summarised by three acronyms: IaaS (Infrastructure as a Service), PaaS (Processing as a Service), and SaaS (Software as a service). Cloud computing promises lower costs in infrastructure and management, high scalability, high availability, and disaster recoverability. All these advantages are highly demanded in health IT applications and are a natural solution for some of the problems we face for medical image archive needs and PACS. A variety of different cloud computing PACS approaches are currently being used. Cloud-based computing in the imaging market has evolved from a service that provided cost-effective disaster recovery for archived data to full-featured PACS and vendor-neutral archiving services that can address the needs of healthcare providers of all sizes. Additionally, the combination of cloud computing with mobile technology enables new paradigms where image sharing between radiologists is easy and image distribution to referring physicians and other professionals both inside and outside the hospital is simpler.
Learning Objectives:
1. To learn about the basics of cloud computing.
2. To understand different ways in which these technologies could be applied to medical imaging.
3. To appreciate how PACS architecture and work environment are changing.
4. To become familiar with some practical case examples.

A-136 08:58
What are the benefits?
E.R. Ranschaert; *'s-Hertogenbosch/NL (ranschaert@telenet.be)*

In the era of digitization, radiology appears to have reached a turning point in its adoption of cloud computing. Where the cloud technology already has consolidated its share in a variety of sectors from retail to education, the healthcare segment has remained rather slow in embracing the cloud for clinical and operational purposes. The main reasons for the radiological sector to move forward on this front are threefold: economics, efficiencies and improvement of patient care. Cloud-based image sharing ensures increased availability of imaging studies in space and time, geographically and among multiple healthcare providers at the point of care. For this reason, the technology represents a major evolutionary step in healthcare informatics. During this session the most important triggers for integrating cloud computing will be presented and discussed in greater detail.
Learning Objectives:
1. To learn about the new possibilities cloud computing brings to radiologists.
2. To understand how this concept can be applied in radiology practice.
3. To understand the benefits of imaging studies being available independent of time and place.
4. To learn about different strategies for image storing and sharing.

A-137 09:21
What are the applications of cloud in radiology?
O. Ratib; *Geneva/CH*

The developments of cloud-based services have radically changed the way we deal with communication and data management in our daily life. While it becomes common to store personal pictures and data online, it is becoming even more common to use such services to share these data among groups of users. Off-site storage of medical data and in particular of medical images is not new, several PACS vendors have offered such services for decades already as part of their integrated solution with what was then referred to as online application service providers (ASP). What has really changed these recent years is the emergence of such services for the wide public offering very attractive solutions at a very low cost. Such services are radically changing the way users perceive the added value of being able to easily store and share data remotely. Wider accessibility to Internet services has certainly contributed to the raise of such demand. In medical applications, however, such systems must comply with strict regulations and guidelines geared toward protecting patient confidentiality and data security. Furthermore, the exchange and communication of medical images adds a level of complexity due to the size of data being handled and the required software tools required for visualisation and proper analysis of these data depending on the tasks and clinical requirements. Exchanging selected images in support of a diagnostic report differs significantly from the need for exchanging imaging data between specialists or communicating these images to assist in planning and performing surgical procedures.
Learning Objectives:
1. To learn about the technical challenges of cloud computing.
2. To understand what the risks are from a security and legal point-of-view.
3. To appreciate the issues related to service agreements with the cloud providers.
4. To discuss the special needs of radiology.

09:44
Panel discussion: Will cloud computing be the future of image storage?

08:30 - 10:00 **Room O**

Paediatric

RC 512
Imaging of foetus and infant

Moderator:
A.M. Taylor; London/UK

A-138 08:30
A. Foetal neuro imaging
A. Rossi; *Genoa/IT (andrearossi@ospedale-gaslini.ge.it)*

Foetal MRI (FMRI) provides a useful adjunct to prenatal neurosonography for the detection and characterisation of central nervous system abnormalities in utero. FMRI can be safely performed after 19 weeks' gestation and does not require sedation or other preparation; 4 hours fasting prior to the examination is advisable to reduce foetal motility. Fast MR sequences are available for FMRI protocols; a basic brain study will typically include triplanar T2, axial and sagittal T1, and axial DWI sequences and may last as short as 10 minutes

depending on foetal motility. Familiarity with the normal appearance of the brain at the various gestational weeks is an absolute prerequisite to FMRI interpretation; structural modifications with cortical mantle layering, germinal matrix evolution, and sulcal development must be carefully evaluated. An ultrasound diagnosis of ventriculomegaly, defined as an atrial diameter larger than 10 mm on an axial plane at level of the thalami, is the most common indication to FMRI. FMRI will detect additional features in as many as 10% of cases. Causes of ventriculomegaly are manifold, and include malformations (callosal dysgenesis, aqueduct stenosis, posterior fossa malformations) and clastic events (haemorrhage, ischaemia). Clastic events, including a wide range of abnormalities from polymicrogyria and schizencephaly to porencephaly and multicystic encephalomalacia, enable to characterise the timing of the causal insult. Finally, FMRI is useful in the characterisation of vascular malformations, especially the vein of Galen aneurysmal malformation, and their consequences in terms of parenchymal tropism which are crucial for a prognostic evaluation.

Learning Objectives:

1. To learn how to perform prenatal brain MRI and to recognise normal features during gestation.
2. To highlight the complementary role of brain MRI to prenatal ultrasound.
3. To become familiar with the MRI features of the main congenital malformations and clastic injury.

A-139 09:00

B. Foetal body imaging

F. Avni; *Lille/FR (favni@skynet.be)*

Applications of MRI to the foetal body/abdomen are extending. The entire foetal abdomen can be evaluated using mainly T2- and T1-weighted sequences in all anatomical planes. The use of diffusion-weighted imaging is at present time more limited. The technique should be used after a complete US survey performed by experienced sonologist. Foetal MRI can provide additional useful information in cases of large peritoneal and retroperitoneal masses (e.g. sacro-coccygeal teratoma), complex urinary tract malformation, cloacal anomalies and intestinal obstruction. The technique will provide an "all in one" evaluation of associated malformations. The results of the examination will help for the assessment of the prognosis and the management of the malformations.

Learning Objectives:

1. To have an overview of foetal abdominal diseases and malformations.
2. To learn about the complementary roles of US and MRI.
3. To understand how prenatal imaging helps in the management of the foetus and the newborn.

A-140 09:30

C. Neonatal urinary tract imaging

M. Riccabona; *Graz/AT (michael.riccabona@medunigraz.at)*

With increasing foetal imaging many neonates are referred for postnatal assessment, sometimes just for parent reassurance, in spite of prenatally normal findings such as mild (physiologic) pelvicalyceal "dilatation". This demonstrates that the range of normal UT appearances must be known to avoid unnecessary examinations, which will be addressed and demonstrated. Considering the necessity to image neonates often with some degree of physiologic renal immaturity, as little invasive as possible and sparing ionising radiation, ultrasonography (US) is the main and, using modern methods, often only method - potentially complemented by fluoroscopy or MRI. The most common findings are UTD and renal parenchymal anomalies. Thus, either some urine transport problem (UT obstruction, VUR) or a possibly inherited (cystic) renal parenchymal disease must be addressed, with the respective differentials (e.g. hypodysplasia, renal vein thrombosis, congenital/neonatal glomerulonephritis). Imaging for UTD will benefit from sufficient urine production, thus the assessment can and should be delayed - unless there is a severe bilateral problem with renal insufficiency or severe upper UT infection (e.g. PUV, bilateral PUJO); for assessing VUR some sort of bladder filling becomes mandatory (VCUG/ce-VUS). In cystic/hyperechoic kidneys, a detailed comprehensive US with high-resolution high-frequency linear transducers including size assessment will often reveal/confirm the diagnosis - together with the family history, potential extra-renal findings, and possibly genetics; other imaging usually does not add much in these neonates. In conclusion, neonatal UT imaging relies on knowledge of prenatal/family findings, of appearance of respective entities and their embryology/pathogenesis, and on properly timed skilful US applying dedicated devices.

Learning Objectives:

1. To learn about normal appearances and imaging pitfalls of the urinary tract (UT) at birth.
2. To become familiar with the findings and conditions that cause UT dilatation (UTD) and neonatal renal parenchymal anomalies.
3. To discuss imaging strategies in the neonatal period.

08:30 - 10:00 **Room N**

Head and Neck

RC 508

Pathways for tumour spread

Moderator:
R. Hermans; Leuven/BE

A-141 08:30

A. Pathways for oral cavity and oropharynx tumour spread

A. Borges; *Lisbon/PT*

90% of oral cavity and oropharyngeal malignancies originate from the epithelial lining and can spread superficially along the mucosa, deeply into the submucosa, adjacent muscles and bone and along neighboring cranial nerves used as elevator shafts for tumour spread. There are 8 tumour subsites in the oral cavity with different patterns of spread. Those with direct impact on tumour staging or surgical management are the midline raphe, extrinsic tongue muscles, maxilla, mandible and oropharyngeal spread via the glosso-tonsillar sulcus. Tumours of the retromolar trigone, have a complex pattern of spread as they sit on the crossroad between the oral cavity, bucco-masseteric space and oropharynx. Whereas gingival tumours of the superior alveolar ridge can invade the maxilla and spread along the superior alveolar nerves and V2, tumours of the inferior alveolar ridge can invade the mandible, the inferior alveolar nerve and spread along V3. When tumours invade the neurovascular bundle of the tongue they are more likely to spread along the lingual and hypoglossal nerves. There are 4 different oropharyngeal subsites. The palatine tonsil has the highest association with lymph node metastases. Local spread is through the palatoglossus muscle and transgression of the constrictor muscles and pterygomandibular raphe leads to tumour extent into the retromolar trigone and pterygoid plates. Tongue base tumours can spread anteriorly to the tongue root and floor of the mouth and posteriorly into the supraglottic larynx. Palatal tumours spread inferiorly into the palatine fossa, laterally into the parapharyngeal space and are prone to perineural spread along the greater and lesser palatine nerves.

Learning Objectives:

1. To become familiar with the anatomy of the oral cavity and oropharynx.
2. To learn which imaging technique to use.
3. To understand the typical local and remote spread of oral cavity and oropharynx tumours.

A-142 09:00

B. Pathways for nasopharyngeal tumour spread including perineural spread

V. Chong; *Singapore/SG (vincent_chong@nuhs.edu.sg)*

Most nasopharyngeal carcinomas (NPC) originate in the fossa of Rosenmuller and they spread along well-defined routes. Tumours often spread anteriorly into the nasal fossa and pterygopalatine fossa. In the pterygopalatine fossa infiltration of the maxillary nerve can take place resulting in perineural infiltration of the maxillary nerve which may eventually extend into the intracranial cavity. From the pterygopalatine fossa tumours tend to extend along the inferior orbital fissure and enter the intracranial cavity through the superior orbital fissure. Lateral spread involves the parapharyngeal and masticator spaces. When tumour enters these spaces, there is a risk of infiltration along the mandibular nerve. Perineural spread along the mandibular nerve is a frequent route of intracranial extension. When NPC spreads superiorly, it erodes the skull base with subsequent direct extension into the intracranial cavity. Lesions may also be seen to spread intracranially through the foramen lacerum. Cervical nodal metastasis is very common and up to 80% of patients have enlarged nodes at presentation. Nodal metastasis shows an orderly inferior spread and the affected nodes are larger in the upper neck. Spread to the supraclavicular nodes has grave prognostic significance. Up to 50% of patients with supraclavicular lymphadenopathy will eventually have distant metastases. NPC shows a high frequency of distant metastasis compared with other tumours of the head and neck. The frequency of distant spread varies between 5% and 41%. Common sites of distant metastases include bone (20%), lung (13%) and liver (9%).

Learning Objectives:

1. To become familiar with the anatomy of the nasopharynx.
2. To learn which imaging technique to use.
3. To understand the typical local and remote spread of nasopharyngeal tumours, including perineural spread.

A-143 09:30

C. Pathway for laryngeal and hypopharyngeal tumour spread

R. Kohler; *Sion/CH (romain.kohler@hopitalvs.ch)*

Squamous cell carcinoma is by far the most frequent malignant neoplasm of larynx and hypopharynx. Imaging plays a critical role in the diagnosis and management of these malignancies as only their superficial part is accessible to endoscopic evaluation and invasion of some specific structures may modify the staging. The present lecture is divided into three chapters. In the first one, we will discuss the anatomy of the three compartments of the larynx (supraglottis, glottis and subglottis), the laryngeal cartilages (mainly thyroid, cricoid and arytenoids) and deep spaces of the larynx (paraglottic and preepiglottic spaces). The three regions of the hypopharynx (piriform sinus, retrocricoarytenoid region and posterior wall) and the lymphatic drainage of larynx and hypopharynx will also be presented. The advantages and drawbacks of CT and MRI as well as some useful technical points will be developed in the second part. Finally, a comprehensive overview of the pathways of tumoural spread of laryngeal and hypopharyngeal tumours will be showed. It will include intralaryngeal spread, extralaryngeal spread, criteria of cartilage invasion and lymphatic spread. In addition to the many examples of squamous cell carcinoma, a few words about non-squamous cell neoplasms, especially chondrosarcoma, will also be included.

Learning Objectives:

1. To become familiar with the anatomy of the larynx and hypopharynx.
2. To learn which imaging technique to use.
3. To understand the typical local and remote spread of laryngeal and hypopharyngeal tumours.

08:30 - 10:00 **Studio 2016**

Professional Challenges Session

PC 5

Personalised radiology: myth or reality?

A-144 08:30

Chairman's introduction

C.J. Herold; *Vienna/AT (Christian.Herold@meduniwien.ac.at)*

Personalised radiology is a core concept of P4 Medicine. Together with the other P parameters, -predictive, pre-emptive, and participatory, it shaped a new paradigm of patient care. Personalised medicine refers to the provision of the right care to the right patient at the right time. For this purpose, molecular and functional imaging provides phenotypical data in order to elucidate the interconnectivity between systems biology (e.g. genomics, proteomics, metabolomics), and phenotypes seen at imaging studies. Precision imaging can be regarded as a further development of personalised medicine, and refers to the most detailed possible characterisation of patients and their disorders by a combination of genotypical and phenotypical information. The ultimate goal is to define increasingly small subpopulations which share the same or similar disease characteristics and are most likely to benefit from targeted therapies that are developed aiming at providing a more effective form of treatment. Radiologists are already practicing personalised radiology and precision imaging on a daily basis by describing phenotypes with continuously increasing precision, e.g. by developing phenotypic classifications in diseases like COPD and stratifying patients into subpopulations for clinical trials. We have also learned how to use images as data source (i.e. radiomics) and have identified prognostic, predictive and diagnostic quantitative biomarkers. Last but not least, we routinely practice personalised and participative medicine during our multidisciplinary conferences and tumour boards. In this course, we will strive to explain the concepts, principles and practice of personalised and precision medicine using examples from daily practice. Moreover, the impact of personalised and precision imaging on clinical decision making and outcome will be discussed.

Session Objectives:

1. To discuss the current state of personalised imaging in Europe.
2. To critically appraise the evidence associated with individualised imaging.
3. To discuss practical aspects of personalised radiology in Europe.

A-145 08:35

Personalised imaging in practice: a myth?

F.J. Gilbert; *Cambridge/UK (fjg28@cam.ac.uk)*

Precision medicine has many definitions but in essence it is the tailoring of treatment to the individual patient - the right prevention or medicine to the right patient at the right time. Radiologists have a key role to play in personalised imaging. While the traditional role of imaging is in diagnosis, staging and monitoring response to treatment, imaging can be used to better characterise the disease in individual patients. Detailed phenotyping is possible with information from imaging investigations opening opportunities to better tailor management and treatment options. Imaging can give information on perfusion, diffusion, metabolism, proliferation and the tissue environment. What remains to be established is whether or not this results in improved outcomes for individual patients in terms of better survival or improved quality of life and does this add to the other important information from the clinical history and examination, lab tests and histopathology. The ability to better characterise patients' disease to tailor their treatment and improve prognostic measures means that dose sparing regimes in radiotherapy are possible, reduced chemotherapy regimes might become more prevalent, smaller numbers of patients are required to show efficacy of a new treatment. In lymphoma follow-up FDG PET can give a robust indication of whether or not further treatment is required. The detection of somatostatin receptors in neuroendocrine tumours has allowed targeted treatment with dramatically improved treatment response rates with greater cost-benefit.

Learning Objectives:

1. To define what personalised imaging means in daily radiology practice.
2. To analyse the gaps between theory and practice of an individualised imaging approach.
3. To determine the current level of evidence regarding the concept and practice of individualised imaging.

A-146 08:52

Personalised imaging and standardised protocols: a contradiction?

S.O. Schönberg; *Mannheim/DE*

Personalised imaging refers to the assessment of patient subpopulations with specific requirements in terms of safety, accuracy of efficacy. This ranges from radiation dose reduction in particularly sensitive patients groups such as children and young females, reduction of contrast media dose in elderly patients with impaired renal function to selection and stratification of patients for specific treatment protocols as well as quantitative assessment of therapeutic response to targeted therapies. In the past, imaging procedures like CT, MRI and PET have been flawed by substantial variation of applied radiation and contrast media dose, inconsistency of quantitative parameters in perfusion CT/MRI and diffusion MRI as well as variable timing and intervals of follow-up studies, e.g. CT after immunotherapy or PET after tyrosine kinase inhibitors. For these shortcomings, standardization of personalised imaging protocols and follow-up time points are mandatory prerequisites. Beyond hard- and software innovations such as parallel transmit techniques for homogenizing apparent diffusion coefficient measurements, innovations in information technology need to ensure patient-group-specific, rather than contradictory one-size-fits-all protocols. This includes overarching software concepts for the entire clinical pathway, automatic pre-selection of dedicated imaging protocols and reproducible registration of consecutive imaging studies as well as precise post-processing of standard parameters such as histogram-based voxel analysis. At the same time, multi-centric data bases need to be consistently established to ensure adequate sample size and power of studies in individual patient groups.

Learning Objectives:

1. To investigate whether standardised protocols can cater to individualised imaging.
2. To analyse which parameters influence individualised imaging.
3. To discuss the necessary adaptations of protocols to phenotypic subpopulations.

Author Disclosure:

S.O. Schönberg: Other; The Institute of Clinical Radiology and Nuclear Medicine has research agreements with Siemens Healthcare Sector.

A-147 09:09

En route to personalised imaging: the role of multidisciplinary conferences

J.A. Verschakelen; *Leuven/BE (johny.verschakelen@uz.kuleuven.ac.be)*

A multidisciplinary conference (MDC) can be defined as a conference where a group of people of different health-care disciplines (the multidisciplinary team (MDT)) meets together at a given time (in one place or by video- or tele-conferencing) to discuss a given patient to contribute independently to the diagnostic and treatment decisions about this patient (adapted from a definition by the UK Department of Health). While team composition very much depends on the disease of the patient and on the diagnostic and therapeutic decisions that need to be made, it is generally accepted that the radiologist is an important member of such an MDT. Nowadays, MDCs form part of the daily work in most hospitals caring for cancer patients and many potential advantages of this multidisciplinary work have been recognised and published. However, in some (chronic) diseases a multidisciplinary approach can also be central to the diagnosis and even the treatment planning. In this presentation, not only the role and the advantages but also the potential pitfalls of such a multidisciplinary conference together with the requirements for effective MDT working will be discussed.

Learning Objectives:
1. To review the potential benefits and drawbacks of interdisciplinary conferences.
2. To determine the role of multidisciplinary conferences for patient treatment.
3. To discuss the political implications in the multidisciplinary management of patients.

A-148 09:26

From personalised to precision imaging: impact on clinical practise
G.P. Krestin; *Rotterdam/NL (g.p.krestin@erasmusmc.nl)*

"Personalised medicine" describes the concept of delivering the right treatment, to the right patient, at the right time. It implies the prospect of devising a different management for each individual patient. In this respect, medical imaging has always been personalised as it provides individual assessment of the location and extent of an abnormality, whether the 'alteration' is a disease, a malformation, or an injury. "Precision medicine" or stratification medicine revolves around the idea that the consideration of individual characteristics - molecular and otherwise - can improve medical practice. In this context, medical imaging is intrinsically enabling precision medicine as a wide variety of new imaging techniques and methods produce important biological information. Medical images are sources of data not qualitatively perceptible by human observers that can be extracted from by advanced computational methods. One of the main aspects of precision imaging is to identify these imaging biomarkers able to characterise a cellular or molecular alteration leading to subclinical or manifest disease status as well as its specific reaction to treatment. Making medicine more personalised and precise will entail increasing emphasis on, and precision in, diagnostics. Diagnoses, however, depend on multiple components that include not only imaging, but also clinical observation, pathology, laboratory, and genomic tests. To date, there is too little coordination between the medical specialties responsible for ordering and performing these tests. What is required is a new concept of "integrated diagnostics": the convergence of imaging, pathology and laboratory tests with advanced information technology.
Learning Objectives:
1. To explain the concept of precision imaging.
2. To underline the importance of precision imaging for the future of radiology.
3. To demonstrate how precision imaging is already impacting on our daily clinical practice.
Author Disclosure:
G.P. Krestin: Advisory Board; Zebra Medical Vision. Consultant; Bracco SA. Equipment Support Recipient; GE Health Care. Research/Grant Support; GE Health Care, Siemens Health Care, Bayer.

09:43
Panel discussion: How to enhance personalised radiology in clinical routine

08:30 - 10:00 **Room L8**

New Horizons Session

NH 5
Imaging beyond morphology

A-149 08:30

Chairman's introduction
O. Clément; *Paris/FR (olivier.clement@egp.aphp.fr)*

Imaging techniques have evolved from purely anatomical to functional information, displayed in one dimension (calculated parameter), or 2D (parametric map) and even 3D or 4D (time-resolved 3D parametric maps). Such multidimensional information, once clinically validated can become an imaging biomarker for the staging and therapy monitoring of diseases. The aim of this session is to learn about the new methods for quantitative imaging and data integration.
Session Objectives:
1. To learn about new imaging methods for quantitative imaging.
2. To understand that multimodality and data integration will play a major role in the future.
Author Disclosure:
O. Clément: Speaker; lectures on allergic reactions for Bracco and Guerbet.

A-150 08:35

MRI fingerprinting: the future?
S. Trattnig; *Vienna/AT (siegfried.trattnig@meduniwien.ac.at)*

Current routine MRI examinations rely on the acquisition of qualitative images that have a contrast "weighted" for a mixture of (magnetic) tissue properties. Recently, a novel approach was introduced, namely MR fingerprinting (MRF) with a completely different approach to data acquisition, post-processing and visualisation. Instead of using a repeated, serial acquisition of data for the characterisation of individual parameters of interest, MRF uses a pseudorandomised acquisition that causes the signals from different tissues to have a unique signal evolution or 'fingerprint' that is simultaneously a function of the multiple material properties under investigation. The processing after acquisition involves a pattern recognition algorithm to match the fingerprints to a predefined dictionary of predicted signal evolutions calculated by the Bloch equation. These can then be translated into quantitative maps of the magnetic parameters of interest. MR fingerprinting (MRF) is a technique that with a single scan can theoretically be applied to most traditional qualitative MRI methods in a fast scan with the simultaneous acquisition of multiple MR parameters such as T1 and T2 relaxation time maps, diffusion maps with the acquisition of truly quantitative tissue measures. MRF is a method which helps to enhance the paradigm shift from qualitative to quantitative imaging in radiology and is expected to be more accurate and reproducible than traditional MRI. This should help to improve multi-center MR-based studies in clinical research and significantly reduce reader bias when diagnostic imaging is performed.
Learning Objectives:
1. To learn about the basic concept of MR fingerprinting for quantitative MR imaging.
2. To understand the potential of MR fingerprinting for standardisation in MR.
3. To become familiar with preliminary clinical applications of MR fingerprinting.

A-151 09:00

Receptor-targeted multimodal imaging
M. de Jong; *Rotterdam/NL (m.hendriks-dejong@erasmusmc.nl)*

Cancer is one of the major causes of mortality and morbidity in our healthcare system. Molecular imaging of cancer and other diseases is an emerging field for the early detection and staging of cancer, stratification of patients for therapy, guidance of therapy, and monitoring of therapy-induced response. Of high interest is the use of a diagnostic imaging tool that helps to define the right therapeutic tool for a specific disease: the theranostic approach. Theranostics match well with the concept of personalised medicine: the right treatment for the right patient at the right time and at the right dose. The development of new instruments and tumour-targeted molecular probes that can be labeled for multi-modality imaging is critical to these processes. Today, in molecular imaging novel, targeted imaging agents can broadly expand our ability to detect and manage cancer. This integrated imaging strategy will permit clinicians to not only localize lesions within the body but also to manage their therapy by characterising tumours, and by visualizing the expression and activity of specific targets, including membrane receptors. At this time, a number of molecular probes have been developed using various labels attached to high target affinity ligands for visualisation in different imaging modalities. This presentation will give an overview of the current status of receptor-targeted molecular probes for multimodality imaging platforms as well as for therapy.
Learning Objectives:
1. To appreciate developments in imaging platforms for multimodal imaging.
2. To appreciate developments in imaging agents for targeted (multimodal) imaging.
Author Disclosure:
M. de Jong: Patent Holder; Co-inventor on several patents on radiopharmaceuticals. Research/Grant Support; AAA. Shareholder; AAA.

A-152 09:25

Radiomics

L.S. Fournier; *Paris/FR (laure.fournier@egp.aphp.fr)*

Radiomics is a new 'data-driven' approach for extracting large sets of complex descriptors from routine (or not) clinical images, based on the assumption that there is a relationship between the imaging features of tumours and their underlying gene expression patterns and biology. The radiomics process aims to establish links between the imaging phenotype and genotypic and phenotypic characteristics of a tumour governed by its molecular substratum. Advanced methods of image processing are applied to images to extract a large number of descriptors, such as texture analysis from histograms, co-occurrence matrices, fractal analysis, etc. This large set of data can be analysed using bio-informatics and bio-statistics methods into clusters defining metadata sets describing combinations of imaging features, or imaging 'profiles'. Finally, these data can be correlated to gene expression profiles, often called radiogenomics, or to outcomes, such as treatment response or survival.

Learning Objectives:

1. To learn about new methods of image analysis derived from '-omics' methods.
2. To understand processing of big data derived from images.
3. To become familiar with new vocabulary such as Radiomics, radiogenomics, clusters, heat maps, etc.

09:50

Panel discussion: Imaging biomarkers: a key role for radiologists in the future?

08:30 - 10:00 **Room E1**

Musculoskeletal

RC 510

Inflammatory arthritis: beyond the radiograph

A-153 08:30

Chairman's introduction

M. Reijnierse; *Leiden/NL (m.reijnierse@lumc.nl)*

Radiographs have been the cornerstone of rheumatology for a long time. Hand and foot radiographs are scored in rheumatoid arthritis patients to assess baseline bone destruction and are used in follow-up. In spondyloarthritis, pelvic radiographs are used to detect sacroiliitis. Radiographs and scoring methods are based on the identification of structural changes secondary to disease. Since new effective medication has become available, the focus in rheumatology has shifted towards early disease detection to treat early and prevent damage. Ultrasound and MRI might play a role in this since they detect active inflammation. With the use of color Doppler in ultrasound, hypervascularisation can be appreciated and (teno)synovitis diagnosed. MRI has the additional value of the detection of bone marrow oedema and show subclinical inflammation. The exact position of these imaging techniques in rheumatology is still under debate; however, they are increasingly used in research and daily practice. This refresher course aims to give an update on the diagnosis of inflammatory arthritis beyond the radiograph.

Session Objectives:

1. To gain insight into the merits of various imaging modalities in the daily practice of radiology of rheumatology.
2. To appreciate the crucial radiological contribution we need to provide in order to support optimal clinical decision making.

Author Disclosure:

M. Reijnierse: Grant Recipient; Dutch Arthritis Foundation.

A-154 08:35

A. Rheumatoid arthritis: what does MRI show and how do I do it?

I. Sudoł-Szopińska; *Warsaw/PL (sudolszopinska@gmail.com)*

Magnetic resonance imaging is being increasingly used both in RA research and in clinical practice due to its capacity to provide insight into pathogenesis of RA, the ability to identify the key pathologic features of this entity at presentation, to follow-up patients' treatment results, and to establish remission. This presentation will cover two issues: 1) MRI techniques used in the assessment of rheumatoid arthritis, including sequences and protocols most frequently applied in imaging of various peripheral joints and the spine; 2) MRI findings in rheumatoid arthritis within synovial joints, tendons' sheats, subchondral bone marrow, articular and extraarticular fat tissue. This part will make us aware that next to the synovium, which is a well-known source of inflammatory cells and a site for aggressive pannus formation, the same process may occur within the subchondral bone marrow or adipose tissue. In addition, the following issues will be addressed: 1. The importance of MRI in subclinical and early diagnosis of RA. 2. Monitoring the disease activity and progression, including the clinical relevance of synovitis and BME in terms of their role as an erosion precursor. 3. Assessing remission/ residual synovitis, tenosynovitis, osteitis. 4. Identification of disease complications, especially within the spine.

Learning Objectives:

1. To become familiar with MRI techniques used in the assessment of rheumatoid arthritis.
2. To learn about the MRI findings in rheumatoid arthritis and their significance.

A-155 08:58

B. The axial skeleton in spondyloarthritis: conventional radiograph to MRI

R. Campbell; *Liverpool/UK (Rob.Campbell@rlbuht.nhs.uk)*

Inflammatory spondyloarthropathy (SpA) includes ankylosing spondylitis, psoriatic and reactive arthritis, enteropathic SpA, juvenile SpA and undifferentiated SpA. The assessment of spondyloarthritis (ASAS) International Society criteria for diagnosis of SpA includes MRI for disease staging. Imaging should include the sacro-iliac (SI) joints, and the dorsal and lumbar spine, utilising a combination of T1W and STIR or T2W fat-saturated sequences. In the SI joints, bone marrow oedema and sclerosis are present in areas of sub-chondral inflammation. Identification of bone erosion helps differentiate inflammatory disease from stress related or degenerative change. In the spine, inflammatory corner lesions of the vertebral bodies are one of the earliest signs of SpA, with bone marrow oedema on MRI. They may become sclerotic (previously termed Romanus lesions on radiographs), or fatty replacement may occur in inactive lesions. Inflammatory lesions also involve the facet joints, spinous processes, and costovertebral joints. Other features include disco-vertebral erosion, and syndesmophyte formation. Syndesmophytes may progress to profuse spinal ossification, with ankylosis across the intervertebral disc. Ankylosis of the facet joints, intervertebral ligaments and costovertebral joints also occurs in advanced disease. The proliferative bone formation in psoriasis and reactive arthritis tends to show more asymmetry than ankylosing spondylitis and enteropathic SpA, with more pronounced bony excrescences and paravertebral ossification. The radiologic patterns of inflammatory SpA must be differentiated from the bone formation associated with spondylosis deformans and DISH. Disco-vertebral erosion may mimic Modic changes associated with disc degeneration, cartilaginous Schmorl nodes an even infective discitis.

Learning Objectives:

1. To become familiar with imaging findings seen in the axial skeleton in spondyloarthritis.
2. To understand features on imaging which distinguish spondyolarthrtitis from other spinal diseases.

A-156 09:21

C. Ultrasound in inflammatory arthritis: what does it show and what does it mean?

A. Klauser; *Innsbruck/AT (andrea.klauser@i-med.ac.at)*

Ultrasound (US) is an established imaging modality for early detection, characterisation and follow-up of various forms of inflammatory arthritis, performed by radiologists and rheumatologists as well. It allows for the detection and characterisation of changes like synovial thickening, synovial proliferation, destructive pannus, effusion, erosions and enthesitis. Using PDUS, a further assessment of synovitis and erosions can be obtained by classifying them into active versus nonactive, what has implication for the therapeutic management. Beside intraarticular inflammatory changes also periarticular and extraarticular inflammation in terms of tenosynovitis and enthesitis can be sensitively detected, not always easy to differentiate from articular inflammation by clinical investigation. However, as every imaging modality when assessing arthritis, the initial analysis has to start from the "joint - organ" concept, by dividing the imaging findings in synovial disease, cartilage disease or entheses disease. This allows not only for basic differential diagnosis but is fundamental especially in more challenging cases, which will be also discussed in this presentation.

Learning Objectives:

1. To become familiar with US techniques used in the assessment of inflammatory arthritis.
2. To learn about the US findings in inflammatory arthritis and their significance.

09:44

Panel discussion: How practical is it for radiologists to support ultrasound and MRI for clinical rheumatology? Is it something the rheumatologists should undertake themselves?

08:30 - 10:00 **Room E2**

State of the Art Symposium

SA 5
Abdominal diffusion-weighted imaging (DWI): an update

A-157 08:30
Chairman's introduction
L. Martí-Bonmatí; *Valencia/ES (marti_lui@gva.es)*

Diffusion-weighted (DW) MR imaging is becoming a standard not only in abdominal oncology but also in several other inflammatory conditions. Recent technological advances in MR image quality over the past few years, mainly due to refinements in hardware and coil systems, have made DW imaging an extremely relevant imaging tool for the detection and characterisation of abdominal conditions. Clinically, several DW images can be obtained today by altering the applied gradients' strength and magnitude (b value), referred as DW images at particular b value. At higher b values, the effect of diffusion is more pronounced in the images. More b values within the same sequence can be obtained to modulate the signal decay. This intravoxel-incoherent-motion (IVIM) sequence is able to differentiate, after the proper processing techniques, the main contributions to the diffusion signal loss (intravascular-interstitial). In this session, we will find how the main technical difficulties in MR pulse sequence and clinical relevance interpretation of the different Diffusion-weighted (DW) approaches to both qualitative and quantitative image interpretation and practice. We will become familiar with the role of DW imaging modalities in the detection and quantification of different pathological entities, and the main reasons behind this efficiency. We will understand, on the main clinical scenarios, the impact of DW biomarkers, as measurements of cellularity-perfusion, in the disease evaluation on the different abdominal organs and lesions aggressiveness.
Session Objectives:
1. To learn about the technical difficulties and clinical relevance of DW qualitative and quantitative approaches in clinical practice.
2. To become familiar with the role of DW imaging modalities in the detection and quantification of different pathological entities.
3. To understand the impact of DW biomarkers in disease evaluation on different organs.

A-158 08:35
Technical advances: the many faces of DWI
N. Papanikolaou; *Stockholm/SE (npapan@npapan.com)*

Apparent diffusion coefficient (ADC) is the most widely used quantitative marker associated to tissue cellular density. ADC can be estimated by acquiring two or more b values. A more complex model has been proposed to quantify the microcapillary perfusion which is responsible for the deviation of the signal decay in the low b values area, especially in highly vascularized organs like the liver and pancreas. Intravoxel incoherent motion (IVIM) is taking into account flow phenomena that contributed to DW image contrast. IVIM has been successfully applied in a variety of studies including liver cirrhosis, renal perfusion, and prostate cancer. The IVIM model assumes that tissue is primarily characterised by two distinct compartments (an intravascular and an interstitial-extracellular space) with negligible water exchange between them. Both the mono-exponential and the IVIM models rely on the assumption that water molecule mobility follows a random, unrestricted pattern which can be considered as a Gaussian displacement distribution. However, in biological tissues the presence of barriers like cell membranes or compartments (intracellular and extracellular spaces) restrict the Brownian motion of water. When incorporating the assumption of a restrictive environment, the displacement probability distribution for the water molecules deviates from the Gaussian shape and the degree of this deviation is quantified by kurtosis. Since diffusion signal drops exponentially as a function of the b value, the influence of the noise to the real signal increases. This contamination of image signal may lead to estimations of poor accuracy for diffusion biomarkers especially when high b values are utilised.
Learning Objectives:
1. To review basic and advanced diffusion models on abdominal organs.
2. To become familiar with techniques and methods for body diffusion applications.
3. To learn about post-processing aspects of diffusion imaging.
Author Disclosure:
N. Papanikolaou: Owner; N. Papanikolaou & Associates LP.

A-159 09:00
Biliary ducts and pancreas: main advantages in clinical practice
C. Matos; *Lisbon/PT (celso.matos@fundacaochampalimaud.pt)*

MRI has high-contrast resolution to detect the majority of biliary and pancreatic diseases through changes in T1 and T2 relaxation. However, these changes might be insufficient to detect and characterise lesions that are of small size or occur in a background of chronic or acute inflammatory changes. DWI provides another mechanism for developing image contrast that may increase the sensitivity and the specificity of MRI of the bile ducts and of the pancreas. In this lecture will be underlined technical challenges related to specific acquisition parameters, practical issues of implementing DWI in the clinics, and clinical applications in oncology as well as in inflammation will be illustrated and summarised.
Learning Objectives:
1. To define how to incorporate DWI in clinical MR scanners to investigate the bile ducts and the pancreas.
2. To list and compare reported data on the role of quantitative DWI approaches.
3. To identify major diagnostic clinical applications in a multidisciplinary environment.

A-160 09:25
Small bowel: main advantages in clinical practice
S.A. Taylor; *London/UK (csytaylor@yahoo.co.uk)*

Diffusion-weighed imaging (DWI) is abnormal in CD. However, the relationship between DWI and the histological phenotype in CD is complex. Increased bowel wall cellularity as well as abnormal tissue perfusion and oedema all influence DWI signal, often with competing effects. Data using endoscopic, histopathological and MRI standard of references suggest that active CD in general has restricted diffusion with typical ADC values below 2. However, recent data using surgical resection specimens suggest fibrosis also results in restricted diffusion and so the crucial differentiation between active and non-active disease using DWI is potentially compromised. Furthermore, normal findings in the bowel such as lymphoid hyperplasia also lead to restricted diffusion and may mimic CD. This presentation will describe clinical protocols used to acquire DWI in inflammatory bowel disease and review the histopathological changes underling the imaging abnormalities. A suggestion role of DWI in clinical practice is suggested.
Learning Objectives:
1. To learn about the histopathological changes underlying abnormal diffusion in inflammatory bowel disease.
2. To appreciate optimised DWI protocols for small bowel imaging.
3. To understand the clinical role of DWI in the small bowel, focusing on inflammatory bowel disease.
Author Disclosure:
S.A. Taylor: Investigator; Robarts plc.

09:50
Panel discussion: Should we do it qualitative or quantitatively?

08:30 - 10:00 **Room F1**

Oncologic Imaging

RC 516

A multidisciplinary approach to prostate cancer: can we make a difference?

A-161 08:30

Chairman's introduction

B. Hamm; *Berlin/DE*

This refresher course is a state-of-the-art presentation from the point of view of the urologist and of the diagnostic and interventional radiologist. The problems and challenges in the diagnosis of prostate cancer and the conclusions to be drawn with regard to the different therapeutic options are presented from the urologist's perspective. An understanding of this perspective is immensely important for radiologists. Multiparametric MRI has an increasing role in the diagnostic assessment of prostate cancer. This refresher course presents the different techniques of multiparametric MRI including the interpretation of findings based on PI-RADS 2.0. Management options beyond radical prostatectomy and active surveillance, in particular focal treatments of prostate cancer, are gaining in importance. This course presents different types of focal treatment approaches including their indications and limitations.

Author Disclosure:

B. Hamm: Grant Recipient; 1. Abbott 2. Actelion Pharmaceuticals 3. Bayer Schering Pharma 4. Bayer Vital 5. BRACCO Group 6. Bristol-Myers Squibb 7. Charité research organisation GmbH 8. Deutsche Krebshilfe 9. Dt. Stiftung.

A-162 08:35

A. The urologist: evidence-based clinical decision making

B.A. Hadaschik; *Heidelberg/DE (Boris.Hadaschik@med.uni-heidelberg.de)*

Prostate cancer (PC) is the third leading cause of male cancer deaths in developed countries. PSA-based screening results in a modest reduction of PC mortality, but is associated with considerable overdiagnosis of low-risk PC, which, in turn, results in a significant burden of overtreatment. PC diagnosis is currently made by systematic TRUS-guided biopsies. Indication for biopsy is an individual risk assessment based on various parameters, predominantly PSA, age, prostate volume, digital rectal examination, family history, and co-morbidity. However, the majority of biopsies taken are negative. Moreover, random biopsies may miss important tumours and they also result in cancer detection in men who are unlikely to benefit from the diagnosis. Precise information of grade, stage and location of tumours is mandatory to individualize therapy. To prevent overtreatment of low-risk disease and to decrease treatment-related morbidity, active surveillance is the treatment modality of choice for men with insignificant tumours. Unfortunately, it is not used frequently and men who are unlikely to die of their cancer undergo invasive treatment, including radical prostatectomy and radiation therapy, which can significantly impair quality of life. At the same time, up to 40% of men shift to radical therapy during their active surveillance due reclassification towards higher risk disease. To prevent underdiagnosis of aggressive disease, to safely increase widespread use of active surveillance and to pave the way for focal therapy, PC diagnostics need to be refined by integrating MR imaging to correctly identify biologically significant disease.

Learning Objectives:

1. To understand how a diagnosis is established by PSA evaluation and biopsy.
2. To learn about different treatment options: surgery, radiotherapy, local ablative and hormonal treatment; as well as active surveillance.
3. To learn how imaging impacts treatment selection.
4. To understand what the urologist needs to know from the radiologist.

Author Disclosure:

B.A. Hadaschik: Advisory Board; Janssen, Astellas. Grant Recipient; DFG, DKH. Research/Grant Support; MedCom.

A-163 08:58

B. The radiologist: evidence-based use of multiparametric MRI

H.-P. Schlemmer; *Heidelberg/DE (h.schlemmer@dkfz.de)*

Patient stratification for choosing the best individual treatment becomes increasingly challenging as various less invasive treatment alternatives and active surveillance have been established. In this context, multiparametric MR imaging has been proven to be considerably advantageous for detecting significant cancer, for characterising its biologic heterogeneity and aggressiveness, for guiding the biopsy needle to the most aggressive part of the tumour (the dominant intraprostatic lesion, DIL) and for evaluation of local tumour spreading (T staging). It has been proven that current approaches of TRUS/MR image fusion biopsy improve the confidence of the pathology results concerning both the diagnosis and grading of prostate cancer as well as the exclusion of prostate cancer in case of a negative result. The gained information supports individualised decision making in prostate cancer patients concerning diagnosis, treatment selection, planning, guidance, monitoring as well as follow-up. In case of active surveillance, functional MR parameters yield important objective and reproducible biomarkers for monitoring the temporal changes of individual tumour aggressiveness. Standardised image interpretation (PI-RADS) has been proven to be highly valuable for objective documentation and precise communication of imaging findings. This lecture will provide detailed knowledge about the "state-of-the-art" technique and standardised interpretation of multiparametric MR in clinical routine. It will furthermore specify how the method can be integrated into current diagnostic and therapy strategies for supporting the complex management of prostate cancer patients.

Learning Objectives:

1. To learn how to perform and interpret multiparametric MRI.
2. To become familiar with the PiRADS classification system.
3. To become familiar with the role of imaging for patient stratification and treatment planning.

A-164 09:21

C. The interventional radiologist

C. Catalano; *Rome/IT (Carlo.Catalano@uniroma1.it)*

The goal of focal therapy is to selectively treat the portion of the prostate that is affected by cancer while minimising the risk of treatment-related side effects. Various approaches with different energy sources are proposed to achieve whole gland, subtotal or focus ablation with the guidance of imaging modalities. Laser, cryoablation and high-intensity focused ultrasound (HIFU) have been used for focal therapy with promising results. Multiparametric magnetic resonance (mp-MR) with a combination of anatomic T2-weighted (T2W) imaging, dynamic contrast-enhanced MRI (DCE-MRI), diffusion-weighted imaging (DWI) and MR spectroscopic imaging (MRSI), provides excellent detection and staging of PCa; for this reason it has been introduced not only as a diagnostic tool but also as a guide for minimally invasive therapies. Recently MR-guided FUS has been clinically used for thermal ablation of PCa. It combines high-intensity focused ultrasound that heats and destroys targeted tissue and magnetic resonance to identify and target tumours; MRgFUS provides temperature monitoring of the treated tissue in real time. The histopathology report showed extensive coagulative necrosis, with no residual tumour in the ablated area. MRgFUS ablation of focal localised PCa is feasible and, if confirmed in appropriate studies, could represent a valid option for the focal treatment of localised PCa. In addition, after this treatment, MR is able to verify the immediate, short- and long-term ablation effects.

Learning Objectives:

1. To learn the rationale and scientific basis for focal therapies for prostate cancer.
2. To learn how focal therapies are performed in prostate cancer.
3. To learn through personal experience and from literature how multiparametric MRI can guide focal therapies of the prostate.

09:44

Panel discussion: Prostate cancer: evidence-based multidisciplinary approach to imaging and treatment

08:30 - 10:00 **Room D1**

Chest

RC 504

HRCT - patterns in chest radiology: back to basics and beyond

A-165 08:30

Chairman's introduction

H. Prosch; *Vienna/AT (helmut.prosch@meduniwien.ac.at)*

The diagnosis of diffuse parenchymal lung diseases (DPLD) is one of the most challenging tasks in radiology. As DPLD include more than 200 diseases, the diagnosis frequently requires an extensive workup in which HRCT plays a central role. HRCT is not only essential in the detection of DPLD, but even more important in providing a brief differential diagnosis. Some DPLD, like Langerhans cell histiocytosis or lymphangioleiomyomatosis, can even be diagnosed confidently with HRCT alone. Given the large number of DPLD, the HRCT diagnosis of DPLD requires a systematic approach, and should be based on an analysis of the CT patterns, which can be classified into four categories: increased lung densities; decreased lung densities; a linear pattern; and a nodular pattern. A prerequisite for the analysis of the CT pattern is a

knowledge of the anatomy of the lung, with a fundamental understanding of the architecture of the secondary pulmonary lobule in particular. The secondary pulmonary lobule is the smallest anatomical unit of the lung, bordered by connective tissue septa. An analysis of HRCT images should aim to narrow the differential diagnosis by attributing CT patterns to the components of the secondary pulmonary lobule: the interlobular septa, the centrilobular structures, or the lobular parenchyma. Such a structured approach can provide a narrow list of differential diagnoses and thereby guide additional steps to diagnose the underlying disease.

Session Objectives:

1. To emphasise the importance of anatomy in reading HRCT.
2. To appreciate the necessity of defining patterns to improve radiological HRCT diagnoses.

Author Disclosure:

H. Prosch: Advisory Board; Boehringer Ingelheim, Roche. Speaker; Boehringer Ingelheim, Roche.

A-166 08:35

A. Secondary pulmonary lobule anatomy: essential to tackle with the nodular pattern

T. Frauenfelder; *Zurich/CH (thomas.frauenfelder@usz.ch)*

The goal of this lecture is to provide information about the anatomy of the lung and to provide a structured approach to nodular pattern. High-resolution CT gives detailed morphologic information about lung structures. This allows distinguishing findings by their typical predominance in certain anatomical compartments. The anatomy of secondary lobule, therefore, plays a key role. Based on the distribution of nodular lesions in relation to the bronchial, vascular and lymphatic structure of the secondary lobule the number of possible pathologies can be narrowed down. For example, centrilobular predominance of nodules, is a frequent sign of bronchiolitis. Perilymphatic predominance in the periphery of the lobules is associated with sarcoidosis or lymphangitic spread of cancer. Random distribution of nodules is interpreted as a sign of haematogenic spread of disease. Therefore, a subtle interpretation can contribute substantially to clinical decision making. Nevertheless, these signs may not always replace biopsy and histologic workup. During this lecture, a stepwise algorithm for differentiating nodular pattern will be provided that allows a pragmatic approach for a successful reading of HRCT.

Learning Objectives:

1. To become confident in recognising the anatomical compartments of the lung on HRCT.
2. To describe typical nodular imaging patterns of lung disease on HRCT using appropriate terminology.

A-167 08:58

B. Linear and reticular pattern

F. Molinari; *Lille/FR (francescomolinari.dr@gmail.com)*

The reticular pattern is one of the imaging findings that may suggest the presence of a diffuse parenchymal lung disease at HRCT. Reticulations are typically formed by a collection of innumerable small linear opacities that by summation produce an appearance resembling a "net". Lines may vary from smooth to nodular and irregular. The resulting "net" may alter the normal HRCT appearance of the lung and become suspected for an underling lung disease. Chest radiologists typically use a structured approach to interpret this finding and eventually to propose a diagnosis. The radiologic approach consists in identifying the dominant types of lines, in establishing what portion of the lung interstitium is predominantly involved, and in correctly classifying the type of reticulation (namely inter-lobular, peri-lobular, intra-lobular). When all the radiologic features are correctly interpreted, the radiologist can differentiate reticulations that represent an acute disease from those that indicate a chronic inflammatory or fibrotic change in the lung. In addition, by integrating clinical and laboratory data, it is possible to significantly narrow the final differential diagnosis.

Learning Objectives:

1. To recognise and interpret typical reticular imaging patterns on HRCT.
2. To differentiate acute and chronic diseases which cause septal pattern.

A-168 09:21

C. Ground glass opacities (GGO) and consolidation

J. Vogel-Claussen; *Hannover/DE (vogel-claussen.jens@mh-hannover.de)*

Ground glass opacity (GGO) is a nonspecific finding on computed tomography (CT) scans of the chest that indicates a partial filling of air spaces in the lungs by exudate or transudate, as well as interstitial thickening or partial collapse of lung alveoli. The term derives from the similarity in appearance of the small objects to small chips of glass that are a byproduct of glass grinding. The differential diagnosis of the many causes of GGO includes pulmonary edema, infections (including cytomegalovirus and Pneumocystis jirovecii pneumonia), various noninfectious interstitial lung diseases (such as hypersensitivity pneumonitis, Hamman-Rich syndrome), diffuse alveolar haemorrhage, and cryptogenic organising pneumonia. Thus, clinical correlation and disease dynamics are important to narrow down the differential diagnosis. The aim of this refresher course is to distinguish ground glass opacities from consolidations on chest CT and give practical instructions for daily clinical routine.

Learning Objectives:

1. To appreciate the different conditions which cause GGO pattern and consolidation.
2. To learn how to interpret GGO and consolidation in different clinical settings.

Author Disclosure:

J. Vogel-Claussen: Consultant; Novartis, Boehringer Ingelheim. Grant Recipient; Siemens Healthcare.

09:44

Panel discussion: Is it always easy to detect a pattern? Tips for success

08:30 - 10:00 **Room D2**

Physics in Radiology

RC 513

How to assess and communicate examination risks to patients and referring physicians?

A-169 08:30

Chairman's introduction

A. Torresin; *Milan/IT (alberto.torresin@unimi.it)*

The patient risk evaluation related to ionising radiation exams needs new attentions connected to the introduction of new technologies and with the large use of CT. It is important to remember that CT procedures are the more relevant exams able to increase the caput dose. Before defining the risks communication strategy, a high-quality dosimetric evaluation is mandatory. The Council Directive 2013/59/Euratom dated December 5, 2013 writes: "Member States shall ensure that depending on the medical radiological practice, the medical physics expert takes responsibility for dosimetry, including physical measurements for evaluation of the dose delivered to the patient and other individuals". This means that physicians must ask to medical physicist expert the dosimetric results of ionising exposure for the different class of exams (defining the order of magnitude of patient organ dose) or the personal patient dose evaluation for the specific procedure. The personal patient risk evaluation must be connected to the patient organ dose evaluation. On the other hand, we can use effective dose only for statistical evaluation of population risk because this is not patient related. The patient risk evaluation related to non-ionising radiation exams needs a preliminary risk evaluation before carrying out MRI. If MRI staff is able to verify that there are no patient risks involved, then the application of different MRI protocol is safe for the patient itself. For ionising and non-ionising procedure, training of medical staff is mandatory to explain to the patient the correct information of the specific risks.

Session Objectives:

1. To understand risks from the use of ionising and electromagnetic radiation.
2. To balance patients' perspectives with professional attitudes.
3. To discuss approaches and methods for communicating risks to patients and public.

A-170 08:34

A. Radiation risk: a patient's perspective

E. Briers; *Hasselt/BE (erikbriers@telenet.be)*

It is well known that any examination brings some risks to both the executing health care professionals and to the patient. The importance of the risks depends, however, on the kind of examination. It is obvious that examinations requiring the use of ionising radiation or radioactive elements carry specific risks that are sometimes difficult to understand by patients because the risks are not immediate but long term. It is difficult to explain that repeated exposure to ionising radiation could be the cause of a de novo primary tumour in the exposed area. On the other hand, even using magnetic resonance imaging can cause great risks to patients allergic to the used contrast enhancers. This effect is almost immediate and should be ascertained before the injection. For the patient risks are unknowingly compared to the level of assumed benefit from the treatment. In this, diagnostic procedures are part of the process. So repeated exposure to diagnostic x-rays is acceptable in the treatment path of a lethal tumour but not in the diagnosis of the cause of a repeated headache, or to see if a shoe fits nicely. Allergic reactions can, however, never be accepted. The treatment team should be aware and question the patient about possible short-term risks linked to the upcoming procedure. Long-term risks can be indicated but the treatment team should be aware that patients balance risks

and benefits. In communicating the treatment team should be aware that not all patients are equally capable of understanding the complex issues.
Learning Objectives:
1. To understand the fears of patients.
2. To learn what is expected from physicians and techs.
3. To learn about ideal communication strategies.

A-171 08:47

B. Radiation risks for patients and staff
P. Gilligan; *Dublin/IE (PGilligan@materprivate.ie)*

Justification for radiological procedures requires evidence-based assessment of benefit versus risk. Patients and referring physicians may seek information on the risks from an exposure prior to and after a radiological procedure. Effects to be assessed include the possibility of skin damage or hair loss, developmental effects in utero, increased cancer risk and radiation-induced eye damage. In most cases the risks are small and can be further reduced by optimisation. There are a number of practical steps in assessing radiation risks relevant to a modern radiology department. These include 1) assessment of the patient undergoing the procedure 2) assessment of typical and possible radiation doses associated with the procedure 3) identification of hazards and organs at risk 4) use of quantitative dose information to estimate the risk and 5) communication of risk information to the patient or referring physician. A number of worked examples of risk assessments are presented: 1) paediatric CT brain scan 2) CTPA of a pregnant patient 3) CT pelvis of a pregnant patient and 4) a high-dose interventional procedure.
Learning Objectives:
1. To get the latest information on stochastic and deterministic risks in radiology.
2. To learn about quantitative risk assessment in typical scenarios.

A-172 09:10

C. Risk in MRI
R. Peeters; *Leuven/BE (ronald.peeters@uzleuven.be)*

With the advent of higher field scanners in clinical practice and the construction of 'MRI compatible' implanted devices, the list of the dos and don'ts while performing an MRI examination changes constantly. In this presentation basic safety guidelines and rules will be explained regarding static magnetic field effects, time varying magnetic field effects, radiofrequency field effects and acoustic noise effects both with regard to the patient as well as the personnel using the equipment. Due to the advances in medical technology the list of possible 'safe' and 'unsafe' items changes almost daily. Therefore, it is very important to have all the information about the patient's condition and implants prior to the MRI procedure to asses possible contraindications in advance. While until a couple of years ago cardiac pacemakers and neurostimulators were contraindicated in the MRI environment, the advent of 'MRI compatible' pacemakers and other implanted devices introduces challenges in patient safety. In fact these devices are only safe in certain configurations and also in a lot of cases specific MRI scan sequences and RF antennas are only allowed. Following the European EMF directive, where the MRI part is derogated, the protection of staff working with EM fields also became a topic of debate. What are the possible risks for staff working with MRI magnets and how can one implement practical rules for the safe use of the MRI equipment are also discussed.
Learning Objectives:
1. To learn about the risks for patients from MRI procedures.
2. To learn about the contraindications for MRI scans.
3. To learn about risks for staff in an MRI department.

A-173 09:33

D. Communicating risks to patients and the public
N. Leitgeb; *Graz/AT (norbert.leitgeb@tugraz.at)*

Risk communication is much more than just talking about an issue. It requires specific factual knowledge and communication skills. It needs to address the strength of evidence and remaining uncertainty of risks. The still frequent use of gynaecologic ultrasonic imaging for non-medical purposes such as for generating videos for parents (baby cinema) in spite of the ban recommended in established guidelines demonstrates that risk awareness varies among physicians and parents. The reason is that risk perception is complex. As a consequence, individual's risk perception is almost uncoupled from quantitative risk levels. Consequently, risk communication should avoid the numerous communication pitfalls such as using inadequate language in particular gobbledygook, incorrect simplifications, inadequate parameters, misleading wording, ambiguous messages and tricky comparisons. Awareness needed for confusing mental models needs also to be taken into account such that the conviction that vulnerability of newborn and children is higher with regard to any exposure or that dose-response is linear in any case. Another challenge is targeting risk communication to stakeholders and to account for their limitations such as due their impaired cognitive abilities caused by emotions, fear and pain and the limitations of children and adults regarding literacy and numeracy.
Learning Objectives:
1. To become familiar with communicating risk according to the imaging modality.
2. To become familiar with important rules in communication.
3. To understand the relationship between hazards and parents' perceptions regarding imaging of their child.
4. To learn how to select a risk-communication strategy suited to parents and children.

09:44
Panel discussion: How real are the risks and how do we communicate them?

08:30 - 10:00 **Room K**

E³ - Rising Stars Programme

Basic Session 1: Neuroradiology: brain

A-174 08:30

White matter disorders
A. Rovira-Canellas; *Barcelona/ES (alex.rovira@idi.gencat.cat)*

MR imaging is highly sensitive for the detection of white matter signal abnormalties, which can be identified in 5-10% of the adult population. Evaluation of this focal white matter hyperintensities (WMHs) on MR imaging, particularly in young adults, is always challenging since clinical and imaging features are commonly non-specific. Although most of these signal abnormalities are incidental and age-related, or secondary to different types of vascular disorders, they also may be caused by a wide variety of infectious, inflammatory, neoplastic, and demyelinating disorders. In this regard, the most common difficulty, by far, is to distinguish multiple sclerosis from acquired hypoxic/ischaemic small-vessel disease, due to the high prevalence of this last group of disorders even in young adults. While it is recognised that a combination of findings from clinical history, physical examination, and laboratory tests is commonly required to correctly establish a firm and clear aetiological diagnosis, a detailed analysis of different MR imaging features should also be considered essential: e.g. lesions shape, size, and distribution; contrast-uptake; and associated structural lesions (microbleeds, infarctions, etc). Knowledge of these features will assist the diagnostic workup of patients presenting with WMHs, and should be considered a first step to take full advantage of the potential of MRI, and in doing so should result in a reduced chance of misdiagnoses and facilitate the correct diagnosis of sometimes treatable disorders.

A-175 09:00

Tumours
J. Walecki; *Warsaw/PL (jerzywalecki@o2.pl)*

The term "white matter lesions" (WML) is comprised of many different disorders resulting in different consequences for brain function. WMLs are both aquired and inherited. Most of these lesions can look very similar in MR imaging. If the clinical picture isn't suggestive the diagnostic proces can be difficult and prolonged taking an emtional and financial toll on the patients and their families. In these cases an in depth analysis of the white matter lesion patterns becomes key in zeroing in on the right diagnosis. White matter lesions seen in MR imaging can have different foundations on the tissue level. Most WML seen in MR imaging are the result of: myelin destruction, glial response, edema, formation of cysts as well as a few changes specific to certain disease states such as microhemorrhages or hypervascularity. White matter lesions commonly seen in MR studies in the elderly are usually related to various geriatric disorders including: cerebrovascular diseases, cardiovascular diseases, dementia, and psychitric disorders. In young and middleaged patient populations we usually observe a wide spectrum of demyelinating diseases which are autoimmune, inflamatory or mixed in nature. The most common morphological classification of white matter lesions can be divided into: juxtaventricular, periventricular, deep white matter, and juxtacortical lesions. Although the meaning of these terms varies, by studying the pathogenic mechanisms between periventricular white matter lesions and deep matter white matter lesions we gain a better understanding of the pathophysiology of the disorders responsible for these lesions. The main objective of this lecture is to delineate the distinctions between different types of WMLs in terms of their etiology, functional correlates, and imaging methodologies. MR imaging provides us with an enormous diagnostic potential, but at the same time posesses some diagnostic dilemas and traps which will also be discussed here.

A-176 09:30

Stroke

E.T. Tali; *Ankara/TR (turgut.tali@gmail.com)*

Ischaemic stroke results from a sudden cessation of adequate amounts of blood reaching the brain. Imaging workup should be fast, readily available and reliable to detect early and subtle abnormal findings to suggest parenchymal hypoperfusion and, therefore, facilitate early diagnosis and intervention. Initial ischaemic stroke imaging using non-contrast CT has been effectively applied to exclude haemorrhage, estimate parenchymal abnormality and other intracranial pathologies that may mimic stroke. Even though non-contrast CT remains the mainstay of imaging, it has limited sensitivity in the acute setting of the ischaemic changes. Detection depends on the territory, time of the examination from onset of symptoms and experience of the interpreting radiologist. CT perfusion and angiography as a second step is a critical tool in increasing the accurate diagnosis. CT perfusion shows both the core of the infarct and the surrounding penumbra, the region which can be salvaged. CT angiography may be helpful to identify the thrombus within an intracranial vessel, establishing the stroke aetiology and also may guide treatment planning. MRI has significantly higher sensitivity and specificity in the diagnosis of hyperacute stage of ischaemic stroke. However, MRI is more time consuming and less available than CT particularly in the emergency departments. Diffusion-weighted MR imaging shows infarct core within minutes following the onset of ischaemia. MR perfusion imaging also provides information almost similar to the CT perfusion. Treatment is planned under the guidance of the imaging findings and can be performed as various reperfusion techniques (intravenous or intra-arterial thrombolysis, mechanical thrombectomy, etc).

08:30 - 10:00 **Room G**

E³ - ECR Academies: Neuroradiology: from Morphology to Function

E³ 519

Advanced imaging techniques in brain tumours

A-177 08:30

Chairman's introduction

P.C. Maly Sundgren; *Lund/SE (Pia.Sundgren@med.lu.se)*

I will in this short chairman presentation focus on an brief overview of the imaging techniques related to the presenting lectures during this session and give a brief personal view on where we stand and on the future developments in advanced magnetic resonance imaging techniques in brain tumours.

A-178 08:33

A. Clinical utility of perfusion imaging for differentiating brain tumours

I.N. Pronin; *Moscow/RU*

"no abstract submitted"

Learning Objectives:

1. To provide practical tips and tricks for performing CT and MR perfusion in patients with brain tumours.
2. To illustrate how certain perfusion derived parameters (rCBV) can be correlated with tumour histology (e.g. angiogenesis, capillary leakage, malignancy grade).
3. To show that intense contrast enhancement is not identical to perfusion.

A-179 09:02

B. Hybrid imaging with MRI/PET of brain tumours

N.L. Albert; *Munich/DE (Nathalie.Albert@med.uni-muenchen.de)*

Positron emission tomography (PET) using radiolabelled amino acids or their analogues (i.e. [^{11}C]MET, [^{18}F]FET or [^{18}F]DOPA) has emerged as important diagnostic tool in brain tumour patients. The strength of amino acid PET lies in the delineation of vital tumour tissue, which enables an accurate demarcation of tumour borders in gliomas characterised by infiltrative growth pattern, the evaluation of response to treatment (including antiangiogenic therapy) and the differentiation between post-therapeutic changes/radionecrosis and tumour recurrence. Furthermore, dynamic imaging using [^{18}F]FET provides useful information on tumour heterogeneity and malignancy and therefore, improves, the diagnostic workup of brain tumour patients. New PET tracers are constantly being developed targeting tumour hypoxia, proliferation, neovascularisation and a variety of structures associated with tumour growth and may provide useful complementary information. By accurate and simultaneous data acquisition of different imaging modalities, the use of hybrid MRI/PET promises to assess tumour characteristics more precisely and to better elucidate the pathophysiological processes in brain tumours, which represents an important step for advances in treatment and management of brain tumour patients.

Learning Objectives:

1. To show that hybrid imaging with MRI/PET is gaining increasing importance in assessment of tumour activity and malignancy.
2. To demonstrate how MRI/PET can be useful in glioma grading.
3. To provide information on new PET tracers (targeting tumour hypoxia, enzymes in neoplastic metabolic pathways, etc). and the combination of tracers with therapeutic agents.

A-180 09:31

C. Assessment of brain tumour perfusion and abnormal vascular structure using arterial spin-labelling

P. Hales; *London/UK (p.hales@ucl.ac.uk)*

Arterial spin labelling (ASL) is a non-invasive MR imaging modality, which provides fully quantitative assessment of blood flow, in physiological units of ml blood/100 g tissue/minute. Unlike gadolinium-based MR perfusion techniques, no injection of exogenous contrast agent is needed, making ASL well suited for paediatric and longitudinal studies. In this lecture, I will provide an introduction to ASL, and discuss the advantages and disadvantages of the technique compared to gadolinium-based perfusion modalities. I will also describe how ASL has been used in the clinic to measure perfusion in brain tumour patients, and introduce more complex models for data analysis, which allow us to extract information regarding vascular structure in the brain tumour environment.

Learning Objectives:

1. To offer a short update on the physical principles and technique of arterial spin-labelling in assessing brain tumour perfusion.
2. To review the advantages and disadvantages of ASL as compared to contrast-enhanced perfusion imaging.
3. To provide clinical examples where ASL has contributed significantly to management and clinical decision making in brain tumour patients.

08:30 - 10:00 **Room M 1**

E³ - ECR Master Classes (Molecular Imaging)

E³ 526

Perfusion imaging

A-181 08:30

Chairman's introduction

X. Montet; *Geneva/CH (xavier.montet@hcuge.ch)*

In this session, perfusion imaging with different class of contrast agent will be discussed in relation with CT and MRI. The advantages/disadvantages of each class of contrast media will be reviewed. The potential pitfalls and problems for imaging and analysis for unspecific, blood pool and targeted contrast media will be reviewed. Then specific example of perfusion imaging will be provided for liver, lung and cerebral perfusion.

A-182 08:35

A. Perfusion imaging: how I do it - by CT and/or by MRI?

C.C. Cyran; *Munich/DE (clemens.cyran@med.uni-muenchen.de)*

For the development of imaging from pure morphology towards the non-invasive characterisation of functional and molecular tissue properties in vivo contrast media are assuming an important role. Functional imaging with CT and MRI using unspecific, intravenous contrast agents can be applied to quantitatively assess tissue microcirculation in neurologic, cardiologic and oncologic diseases with possible application as in vivo imaging biomarkers. Depending on molecular weight and total hydrodynamic diameter, contrast media molecules follow different pharmacokinetics from extracellular to intravascular distribution profiles (small molecular, intermediate and macromolecular contrast agents). Macromolecular contrast media of a certain size range (≈ 60-350 kDa) remain intravascular in physiologic vessels with a more selective extravasation from vessels with enhanced endothelial permeability (e.g. tumours, inflammation). However, macromolecular contrast media with slower kinetics require longer imaging periods to acquire sufficient data to allow for reliable modeling of pharmacokinetics, which is frequently beyond clinical applicability. Particular challenges for the quantitative assessment of tissue microcirculation parameters with high reproducibility, sensitivity and specificity include the multi-center standardisation of acquisition protocols and analysis tools of the pharmacokinetic data. Single-center studies have provided promising data for clinical utility. However, multicenter prospective validation trials validating perfusion imaging biomarkers to

outcome endpoints are still scarce. In conclusion, profound knowledge of the different pharmacokinetic properties of unspecific intravenous contrast media is of central importance for the comprehensive assessment of quantitative parameters of tissue microcirculation.

Learning Objectives:
1. To review the fundamentals of perfusion imaging.
2. To review the advantages and disadvantages of CT perfusion imaging.
3. To review the advantages and disadvantages of MR perfusion imaging.

Author Disclosure:
C.C. Cyran: Research/Grant Support; Novartis. Speaker; Siemens.

A-183 08:53

B. Liver perfusion

V.J. Goh; *London/UK (vicky.goh@kcl.ac.uk)*

The normal liver has a dual blood supply from the portal vein and hepatic arterial system. The typical balance in favour of portal perfusion is altered in the development of diffuse and focal disease. Fibrosis and cirrhosis alter haemodynamics due to an increase in collagen deposition and disruption of the normal liver architecture, with an increase in portal pressure. As focal tumours (primary or secondary) grow within the liver, an adequate supporting blood supply has to develop which manifests as an increase in arterial versus portal supply to the surrounding liver. These changes in hepatic haemodynamics may be assessed by dynamic contrast-enhanced imaging of liver. Kinetic modelling of the dynamic data will provide physiological parameters which reflect perfusion. This lecture will focus on the methodology, challenges and clinical indications for liver perfusion imaging.

Learning Objectives:
1. To learn the clinical indications for liver perfusion imaging.
2. To become familiar with perfusion protocols for liver imaging.
3. To learn about difficulties in liver perfusion imaging.

Author Disclosure:
V.J. Goh: Research/Grant Support; Siemens Healthcare.

A-184 09:11

C. Lung perfusion

M. Rémy-Jardin; *Lille/FR*

Even if dual-energy acquisition does not correspond to a true perfusion imaging, since it visualises only blood volume and not blood flow, several advantages of this imaging technique can be underlined. Compared to scintigraphy and MRI, it is the only imaging modality able to provide high-quality morphological analysis and functional information on the pulmonary circulation from the same data set. Initially investigated in the diagnostic approach of acute pulmonary embolism, its current role is directed toward the prognostic approach of the disease. Chronic pulmonary embolism can also benefit from this modality when the patient is referred with pulmonary hypertension. In this clinical context, perfusion imaging provides a more precise extent of the disease than cross-sectional imaging. Moreover, it is a powerful adjunct to morphologic imaging in the differential diagnosis between peripheral chronic CTEPH and pulmonary arterial hypertension. Several vascular diseases of the pulmonary circulation can also benefit from perfusion imaging, among which emphysema and smoking-related disorders. Whereas more recently considered, perfusion imaging offers a new tool to investigate lung tumoural perfusion and can play a major role in the management of patients under new therapeutic agents such as antiangiogenic drugs. The purpose of this lecture is to provide an overview of the clinical situations in which this CT mode can be currently proposed.

Learning Objectives:
1. To learn the clinical indications for lung perfusion imaging.
2. To become familiar with perfusion protocols for lung imaging (including dual-energy CT).
3. To learn about difficulties in lung perfusion imaging.

A-185 09:29

D. Cerebral perfusion

H.R. Jäger; *London/UK (r.jager@ucl.ac.uk)*

Perfusion MR is firmly established in the work-up of neuro-oncological and neurovascular diseases and being increasingly used in neurodegenerative conditions. Dynamic Susceptibility Contrast (DSC) imaging is the most widespread technique in brain tumours and measurements of relative cerebral blood volume (rCBV), reflecting tumour vascularity, have been shown to correlate with histological tumour type and grade, molecular tumour features, and patient survival. More recently Arterial Spin Labelling (ASL) has been applied in neuro-oncology with good evidence that rCBF measurements obtained by ASL correlate well with rCBV measurements of DSC. Dynamic Contrast Enhanced (DCE) imaging provides information about the leakiness of tumour vessels. Both DSC and DCE have been used to differentiate treatment-induced effects (pseudoprogression; radiation necrosis) from recurrent tumour and to monitor treatment response, particularly to antiangiogenesis drugs. DSC is presently the most widespread technique in neurovascular disease but the use of ASL is increasing. DSC has been used to identify potentially salvageable "tissue at risk" in the setting of acute stroke. There is an ongoing debate about its capability of identifying the ischaemic penumbra, mean transit time (MTT) being a commonly applied parameter. Both DSC and ASL can assess hypoperfusion and cerebrovascular reserve in chronic cerebrovascular disease. ASL offers the additional possibility of mapping arterial territories but can be challenging in the presence of severe arterial stenoses. Perfusion MR, in particular ASL, is increasingly used in neurodegenerative conditions. Specific regional patterns of rCBF reduction have been described for Alzheimer's disease and various types of fronto-temporal lobar degeneration. Other emerging clinical applications are inflammatory disorders and epilepsy.

Learning Objectives:
1. To learn the clinical indications for cerebral perfusion imaging.
2. To become familiar with perfusion protocols for cerebral imaging.
3. To learn about difficulties in cerebral perfusion imaging.

09:47
Panel discussion: The pros and cons of perfusion imaging

08:30 - 10:00 **Room M 2**

Cardiac

RC 503

Novel ways to assess myocardial tissue

Moderator:
N.N.

A-186 08:30

A. T1 mapping: technical considerations

M.R. Makowski; *Berlin/DE (marcus.makowski@charite.de)*

T1/T2 and T2* relaxation times represent important biomarkers for the evaluation of cardiac disease. Native T1/T2 mapping of myocardial tissue can be used to evaluate different kinds of cardiomyopathies as well as ischaemic heart disease. T1 mapping following the administration of extracellular Gd gadolinium-based contrast agent can provide additional information on the disease by the extracellular volume fraction (ECV). The assessment of T1/T2/T2* and ECV was shown to be of high prognostic significance for disease evaluation.

Learning Objectives:
1. To learn about the principles of T1 mapping.
2. To learn about specific issues of T1 mapping.
3. To learn how to do and assess T1 mapping.

Author Disclosure:
M.R. Makowski: Grant Recipient; DFG.

A-187 09:00

B. T2 mapping: technical considerations

C. Tessa; *Lido di Camaiore/IT (ctessa@sirm.org)*

TSE-STIR sequences, traditionally employed in myocardial oedema evaluation, enable only qualitative or semi-quantitative analyses and have many limitations, including incomplete blood suppression, regional variations in signal intensity and signal loss from myocardial motion. Recently, techniques capable of rapid measurement of the myocardial T2 have been introduced and may have important advantages. Typically, bright-blood T2 magnetization preparation-based sequences with a steady-state free precession readout are used. These sequences generate multiple images, each one with different T2 preparation times, and the signal intensities of these images are fit to obtain a parametric T2 map. Motion correction algorithms are usually applied. T2 maps can be analysed both visually and quantitatively by means of ROIs or automatic thresholds. At 1.5 T, the mean T2 values of normal myocardium have been reported to range from about 52 to 56 ms, while T2 values at 3 T are lower. T2 relaxation time is very sensitive to cofactors and it is necessary to generate reference values specific for each site, technique and imaging setting. Studies in healthy controls have found higher T2 values in apical segments, possibly due to partial-volume effect, and a relatively large inter-subject variability in T2 measures. T2 maps are usually acquired in diastole, but they can also be obtained in systole.

Learning Objectives:
1. To learn about the principles of T2 mapping.
2. To learn about specific issues of T2 mapping.
3. To learn how to do and assess T2 mapping.

A-188 09:30

C. Clinical use of T1 and T2 mapping

A. de Roos; *Leiden/NL (A.de_Roos@lumc.nl)*

Parametric MRI techniques are under investigation for characterising diffuse myocardial disease. T1, T2 and T2* are useful approaches to characterise diffuse fibrosis, oedema and iron accumulation, respectively. Native T1 mapping helps to diagnose diffuse myocardial disease like various types of cardiac amyloidosis and myocarditis. Post-contrast T1 mapping has been validated to probe diffuse myocardial fibrosis, unseen by visual inspection. Diffuse fibrosis is considered as an important marker in a variety of myocardial diseases (e.g. valve disease, diastolic dysfunction) and is potentially reversible upon pharmacological therapy. Various T1 mapping pulse sequences (e.g. MOLLI, shMOLLI, SASHA, SAPPHIRE) have been implemented with variable accuracy and precision. Based on the combined use of pre-contrast and post-contrast T1 mapping, the extracellular volume (ECV) can be calculated as the preferred biomarker of interstitial myocardial infiltration. Some diseases may affect native T1, but not ECV (e.g. Fabry's disease shortens native T1 due to intracellular lipid). The combined use of these various parametric mapping techniques may be helpful to characterise various cardiomyopathies.

Learning Objectives:

1. To learn about the main fields of application for T1-T2 mapping
2. To learn the specific parameters useful for the clinical implementation of T1-T2 mapping.
3. To understand the incremental value of T1-T2 mapping over current methodologies.

08:30 - 10:00 **Room M 3**

Interventional Radiology

RC 509

Imaging and endovascular treatment of pulmonary embolism

A-189 08:30

Chairman's introduction

B. Peynircioglu; *Ankara/TR (borapeynir@gmail.com)*

Pulmonary embolism (PE) was clinically described in the early 1800s, and von Virchow first described the connection between venous thrombosis and PE. The true prevalence of venous thromboembolism is underestimated, as many cases are not apparent clinically, and unsuspected PE can be found in up to 3.4% of inpatient and 0.9% of outpatient CT scans. Not only does radiology play a vital role in diagnosis, but it also has a crucial role in the treatment of PE. Since the introduction of multi-detector computed tomographic (MDCT) angiography with high spatial and temporal resolution and quality of arterial opacification, computed tomographic (CT) angiography has become the method of choice for imaging the pulmonary vasculature in patients with suspected PE. Despite considerable progress in the diagnosis of PE, several areas of uncertainty persist. The diagnostic value and clinical significance of sub-segmental defects on MDCT are still under debate.There is also growing evidence suggesting over-diagnosis of PE. The PE treatment has been evolved in the last decade both by means of introduction of many new anticoagulants and endovascular techniques in addition to the thrombolytic therapies. Multidisciplinary teams enjoying the early and active involvement of cardiac surgeons have recently reintroduced the concept of surgical embolectomy for high-risk PE, and also for selected patients with intermediate-high-risk PE, particularly if thrombolysis is contraindicated or has failed. Interventional options include thrombus fragmentation with pigtail or balloon catheter, rheolytic thrombectomy with hydrodynamic catheter devices, suction thrombectomy with aspiration catheters and rotational thrombectomy. Prevention of PE in patients with deep venous thrombosis by filter placement is another hot topic for radiology as well.

Session Objectives:

1. To appreciate the value of imaging in therapy planning and follow-up.
2. To learn about patient selection and evidence in catheter directed therapies for PE.
3. To learn about recent and ongoing trials in the endovascular treatment of PE.

A-190 08:35

A. Imaging algorithm for pulmonary embolism

B. Ghaye; *Brussels/BE (benoit.ghaye@uclouvain.be)*

The diagnosis of pulmonary embolism (PE) is difficult since the clinical signs and symptoms are non-specific. Unstable patients usually undergo thrombolysis following demonstration of right ventricle (RV) dysfunction at echocardiography. Diagnostic algorithm strategies in stable patients have been developed in order to limit the number of patients requiring an imaging test. The first step includes the assessment of clinical probability of PE and D-dimers testing. Patients with either a high clinical probability or a positive D-dimers test should undergo further imaging test. Incompliance to such diagnostic algorithms has been demonstrated to increase the rate of PE recurrence and the rate of false positive CT pulmonary angiographies. In patients not at high-risk of mortality (i.e. without clinical findings as cardiogenic shock or persistent arterial hypotension), signs of RV dysfunction (at echocardiography or CT pulmonary angiography) are used together with clinical prognostic scores, such as the PESI, and cardiac biomarkers dosage to discriminate patients with intermediate or low risk. This is usually performed by measuring the ratio between the diameters of RV and the left ventricle (RV/LV). More recent and potentially more powerful predictor CT findings have been reported, including among others RV/LV surface and volume ratios, severity of "perfusion" defect and cardiac function parameters as calculated from ECG-gated acquisition. Evidence concerning the follow-up of unselected patients after treatment is limited in literature. Short-term follow-up after systemic thrombolysis or endovascular treatment has been performed using various techniques, including RV/LV dimensions, pulmonary arterial obstruction scores or pulmonary perfusion comparison.

Learning Objectives:

1. To learn how clinical findings influence the selection of the imaging strategy in PE.
2. To learn about the follow-up after treatment.
3. To learn how imaging may predict the outcome of the patient.

A-191 08:58

B. What is new in the recently published guidelines for pulmonary embolism treatment?

R. Uberoi; *Oxford/UK (raman.uberoi@orh.nhs.uk)*

For patients in whom DVT or pulmonary embolism (PE) is suspected, immediate therapeutic anticoagulation should be started. Anticoagulation reduces the mortality rates from 30% to 5 days after warfarin has been commenced. Assessment of PE severity, prognosis, and risk of bleeding is used to assess patients for possible thrombolytic therapy and when this should be started. Thrombolytic therapy should be used in patients with acute PE associated with hypotension (systolic BP $<$ 90 mm HG), and no high bleeding risks or in selected patients without hypotension and a low bleeding risk whose initial clinical presentation or clinical course after starting anticoagulation suggests a high risk of developing hypotension. Thrombolytic therapy is not recommended for most patients with acute PE not associated with hypotension.

Learning Objectives:

1. To learn about the recently published guidelines for PE treatment in stable patients.
2. To learn about the recently published guidelines for PE treatment in unstable patients.
3. To learn about recent therapeutic algorithms in PE treatment.

A-192 09:21

C. Updates on the endovascular treatment of massive and submassive pulmonary embolism

S.C. Spiliopoulos; *Patras/GR (stavspiliop@upatras.gr)*

Percutaneous endovascular techniques are promising minimally invasive treatment modalities, which in massive and submassive pulmonary embolism (PE) offer the benefit of low-risk, more aggressive management than systemic anticoagulation, as to reduce morbidity and mortality rates. Traditional endovascular methods include thrombus removal or dissolution using standard pigtail catheters or balloons, presenting reasonable technical success rates of approximately 86%. Pharmacomechanical thrombolysis with the addition of local low-dose catheter-directed thrombolysis (CDT) seems to improve outcomes, without increasing the risk of bleeding. The rationale of recent and ongoing trials is based on the fact that systemic thrombolysis, although more effective than anticoagulation alone, increases fivefold the risk of major bleeding and tenfold that of haemorrhagic stroke, while is contraindicated in many patients mainly due to recent surgery or intracranial haemorrhage. On the other hand, CDT and/or mechanical thrombus maceration using balloons or pigtail catheters can be time consuming and entails the risk of distal thromboembolism of numerous smaller pulmonary branches, resulting in rapid clinical deterioration and cardiovascular collapse. Moreover, large-scale, well-designed trials are awaited to improve the level of evidence of currently available interventional radiology techniques, which remains low, as reported data derive mainly from retrospective analysis and few prospective, non-randomised trials, while studies comparing various endovascular modalities versus systemic fibrinolysis are missing. Novel mechanical, pharmacological and pharmacomechanical thrombectomy devices are under investigation to overcome these difficulties and improve safety and efficacy of endovascular

PE treatment. In this lecture, outcomes of available clinical trials will be presented and future considerations will be discussed.
Learning Objectives:
1. To learn about the rationale of recent and ongoing trials.
2. To learn about the level of evidence for interventional radiology techniques in PE treatment.
3. To learn about clinical results and possible further developments.

09:44
Panel discussion: Appropriate diagnosis and risk stratification in the management of acute massive and acute sub-massive pulmonary embolism

08:30 - 10:00 **Room M 4**

Joint Course of ESR and RSNA (Radiological Society of North America): Emergency Radiology

MC 528
Abdominal emergencies

Moderators:
A. Palkó; Szeged/HU
R.J. Zagoria; San Francisco, CA/US

A-193 08:30
A. Abdominal injuries
A. Palkó; *Szeged/HU (palkoand@gmail.com)*

Abdominal injuries require a timely and reliable diagnosis to prevent the potentially lethal outcome. The armoury of clinical tools (physical examination, lab tests) does not fulfill these criteria, since they are either not fast, or not reliable. Imaging diagnostic modalities help the clinician to acquire the necessary amount of information to initiate focused and effective treatment. However, the selection of the appropriate imaging algorithm, modality and technique, as well as the precise detection and interpretation of essential imaging findings are frequently challenging, especially because the circumstances, under which these examinations are performed (open wounds, bandages, non-removable life-supporting equipment, lack of patient cooperation, etc)., are frequently less than optimal. Knowledge of critical imaging signs, symptoms and the role they play in the evaluation of the patient's condition, but also fast decision-making and ability to closely cooperate with the clinicians are skills of key importance for radiologist members of the trauma team.
Learning Objectives:
1. To understand the significance of injury mechanism and its role in the formation of consequent abdominal lesions and their complications.
2. To learn about the role of proper imaging technique and diagnostic algorithm in the sufficiently fast diagnosis of abdominal injuries.
3. To learn more about the typical and unusual findings of various abdominal traumatic conditions.
Author Disclosure:
A. Palkó: Advisory Board; Affidea.

A-194 09:00
B. The enemy within: non-traumatic abdominal emergencies
R.J. Zagoria; *San Francisco, CA/US (Ron.Zagoria@ucsf.edu)*

This segment of the course will go over the optimal imaging approach for patients presenting with acute abdominal pain. CT findings will be emphasized. Key imaging findings of non-traumatic causes of acute abdominal pain including gastrointestinal tract and urinary tract pathology will be explained. A systematic approach for the imaging evaluation of patients with abdominal emergencies will be illustrated and explained including proper scan protocols and analysis of imaging findings. Imaging diagnosis of urinary tract obstruction, infection, bowel obstruction, complications of bariatric surgery, and bowel ischaemia will be emphasized.
Learning Objectives:
1. To learn how to better analyse CT scans for non-traumatic causes of abdominal pain.
2. To learn about the CT signs and causes of bowel ischaemia.
3. To learn about the CT findings of common causes of an 'acute' abdomen.
4. To learn about the imaging findings of acute, non-traumatic urinary tract and GI tract emergencies.

A-195/A-196 09:30
C. Interactive case discussion
A. Palkó; *Szeged/HU (palkoand@gmail.com)*

R.J. Zagoria; *San Francisco, CA/US (Ron.Zagoria@ucsf.edu)*

Learning Objectives:
1. To learn how to better analyse CT scans for traumatic and non-traumatic causes of abdominal pain.
2. To learn about the CT signs and causes of bowel ischaemia and injuries.
3. To learn about the CT findings of common causes of traumatic and non-traumatic 'acute' abdomen.
4. To learn about the imaging findings of acute, traumatic and non-traumatic urinary tract and GI tract emergencies.

08:30 - 10:00 **Room M 5**

E³ - ECR Academies: Diagnostic Urogenital Radiology

E³ 522
Retroperitoneum and adrenals

Moderator:
J. Venancio; Lisbon/PT

A-197 08:30
A. Anatomy and imaging techniques of the retroperitoneum
F.M. Danza; *Rome/IT (fmdanza@gmail.com)*

To become familiar with new insights into radiological anatomy of retroperitoneum (RP), a short excursus of embryologic developments is provided to better explain the real compartmental anatomy of RP, which differs from classical three compartmental model. This new revision considers RP divided into TRUE and ACQUIRED RP, with the former developing as posterior to peritoneal cavity from the beginning and the latter, originally part of dorsal mesogastrium, entering the RP as consequence of rotations and adhesions of intestinal primitive media. The true RP extends from diaphragm to pelvis with his two symmetrical lodges, perirenal and posterior pararenal spaces. Acquired RP is divided into supra and undermesocolic asymmetrical spaces (pancreatic lodge, upper and right and left paracolic, under), previously named anterior pararenal spaces. This embryological lecture lets us realise differences between the terms fasciae and fascial planes (FP), as planes dividing the retroperitoneal lodges. FP is a double structure, with an inner virtual space, potentially expandable, resulting from adherence of two contiguous peritoneal layers during embryogenesis. These FP react to inflammatory and neoplastic processes with thickening, fluid accumulation and enhancement, becoming important diagnostic tools. Knowing the retroperitoneal lodges, their interconnections and relations with FP lets us understand patterns of diseases spread across retroperitoneal spaces. The optimal CT, and MR protocols for detailed imaging of retroperitoneum are discussed, with particular attention to isometric imaging, to facilitate MPR, MIP and VR reconstructions, and to modalities of contrast medium administration, to optimise anatomical details.
Learning Objectives:
1. To become familiar with new insights into the normal anatomy of the retroperitoneum.
2. To understand the spreading of retroperitoneal diseases across spaces.
3. To learn about the optimal CT and MR protocols for imaging of the retroperitoneum.

A-198 09:00
B. Differential diagnoses of retroperitoneal masses
M.-F. Bellin; *Le Kremlin-Bicêtre/FR (marie-france.bellin@bct.aphp.fr)*

There is a broad spectrum of retroperitoneal masses in adults, including many different infectious, haemorrhagic and neoplastic disease processes. Retroperitoneal masses not arising from major solid organs are uncommon. They can be divided into solid and cystic masses, each of which can be further subdivided into neoplastic and non-neoplastic masses. Because the management and therapeutic strategies for retroperitoneal masses vary depending on the cause, the ability to non-invasively differentiate between masses is crucial. Based on the imaging characteristics, enhancement patterns and demographics, the differential diagnoses of retroperitoneal masses can be narrowed down to a certain extent and an imaging pattern-based approach may facilitate the diagnosis and optimal management of these lesions. The most important clinical parameters include patient gender, age, symptoms, and clinical history. The most important imaging features include lesion location, size, and shape; the presence of fat, calcifications, or necrosis; the degree of vascularity; the presence of a cystic component and the presence and thickness of a wall; the presence of a fibrous or myxoid stroma; and involvement of adjacent structures. State-of-the art cross-sectional imaging

studies, including volumetric CT and multiplanar unenhanced and enhanced MRI acquisitions, play an important role in evaluating not only the size, extent, and characteristics of retroperitoneal masses but also the involvement of organs and vasculature when considering surgical options. However, because of overlap of imaging findings among these diverse retroperitoneal lesions, histological examination is often required to confirm the diagnosis.
Learning Objectives:
1. To become familiar with the typical imaging features of retroperitoneal lesions.
2. To learn about the differential diagnoses of benign and malignant retroperitoneal masses.
3. To understand how recognise the exact extent of retroperitoneal masses.

A-199 09:30

C. Differential diagnoses of adrenal lesions
G. Heinz-Peer; *St. Pölten/AT (Gertraud.Heinz@stpoelten.lknoe.at)*

With the high number of adrenal lesions being identified on imaging studies, it is of utmost importance for the radiologist to have a sound understanding of their imaging characteristics and their implications. Although most of these incidentally discovered lesions are non-functioning benign lesions of cortical origin, functioning (clinical or subclinical) and malignant lesions must be excluded. Clinical diagnostic and biochemical evaluation is used to further subdivide functional and non-functional adrenal lesions. 18 F-dihydroxyphenylalanine (F-DOPA) has been found to be of high sensitivity and specificity in PET imaging of pheochromocytoma. Improvements in imaging techniques often allow for a definitive diagnosis of benignity, and can obviate any additional workup. The ACR developed recommendations for the management of incidental findings. These guidelines promote greater consistency in recognizing, reporting and managing adrenal lesions. These guidelines will be presented. CT and MR imaging are first choice in characterisation of adrenal lesions. PET-CT has been shown to contribute to the diagnostic power especially in oncologic patients. Knowledge of the physiologic appearance of adrenal glands in 18-FDG PET is necessary to correctly identify pathologic processes. FDG PET also has the ability to detect metastatic lesions in non-enlarged adrenal glands. The role of MRI including MR DWI and MR spectroscopy in characterising adrenal lesions will be discussed. Differentiating benign from malignant adrenal masses using non-invasive imaging methods can reduce the need both for percutaneous adrenal biopsy in patients with underlying malignant disease and the follow-up imaging of incidentally detected adrenal adenomas.
Learning Objectives:
1. To learn about the imaging protocols of adrenal glands, including functional imaging.
2. To understand the typical imaging features of an adenoma on CT and MRI.
3. To become familiar with typical signs of malignancy.

10:30 - 12:00 **Room A**

E³ - ECR Academies: Interactive Teaching Sessions

E³ 621

Cardiac CT: from stenosis assessment to risk stratification

A-200 10:30

A. CT in stable chest pain
R. Marano; *Rome/IT (riccardo.marano@rm.unicatt.it)*

The coronary artery disease (CAD) is the disease with the greatest prevalence/incidence and the primary cause of death in the western countries. The CAD shows a long preclinical period; therefore, there are many opportunities to modify the course of disease, considering reliable diagnostic tools for determining which individuals with atherosclerosis will develop symptomatic CAD. Understanding which patients with CAD will suffer of coronary/cardiac event or remain asymptomatic throughout life is a topic of intense investigation to prevent CHD and its associated morbidity/mortality. Three different levels of intervention may be distinguished to prevent/reduce the CHD morbidity/mortality: lifestyle modification, early diagnosis, and medical management/revascularisation. Given the CAD's long preclinical period and its high prevalence, the severe potential outcomes of ACS, the increasing acceptance of CCTA by patients/physicians, the improved diagnostic accuracy and noninvasiveness of CCTA, there is a real possibility of CAD screening with CT. The CT is the unique noninvasive diagnostic technique able to detect and directly demonstrate coronary atherosclerosis, providing two distinct means for CAD assessment: the CACS and the CCTA. The technical evolution and x-ray dose reduction allows to scan patients with less restricted inclusion criteria for CCTA, with two compelling applications in the field of CAD detection: the risk stratification of asymptomatic individuals to target/personalise therapy to prevent CHD, and as gatekeeper to catheterization to minimise unnecessary invasive procedures. The lecture will focus on the potential role of CT for risk stratification and the pro/contra of a CAD screening using CT, in comparison with the proposed criteria for validity of a screening program.
Learning Objectives:
1. To learn the different criteria for risk stratification.
2. To learn the practical way of doing image assessment.

A-201 11:15

B. Cardiac CT in the emergency room
G. Feuchtner; *Innsbruck/AT (Gudrun.Feuchtner@i-med.ac.at)*

Acute chest pain (ACP) is one of the major causes of emergency room (ER) visits with a high socioeconomic burden. Computed tomography (CT) is increasingly requested in those patients; therefore, aims of this teaching session are: (1) To understand indications for coronary CT angiography (CTA) in the ER (when and why). (2) To learn about risk stratification by CT. (3) To review high-risk plaque features by CTA. (4) To understand myocardial perfusion imaging for detection of ischaemia in acute chest pain. (5) To review typical CTA cases in the acute care setting.
Learning Objectives:
1. To understand the imaging technique.
2. To become familiar with the differential diagnosis.

10:30 - 12:00 **Room K**

E³ - Rising Stars Programme

Basic Session 2: Head and neck imaging

A-202 10:30

Orbit
P.C. Maly Sundgren; *Lund/SE*

Familiarity with orbital and ocular anatomy is crucial to the understanding of disease processes of the orbit. Lesions of the orbit may be divided into those which are intraocular and those which are extraocular. The underlying aetiology varies depending on the location of the lesions and sometimes on additional non-orbital conditions. CT and MRI play crucial roles in the evaluation of orbital pathology where often MRI still is a complement to CT examination in the evaluation of orbital lesions. Familiarity with the radiologic appearance of common orbital lesions is important, as many of these lesions will not be seen on physical examination. After a very brief anatomic overview most of this lecture will focus on the more common benign and malignant lesions as well as differential diagnosis involving the orbit in both the paediatric and adult population. The lecture will also present suggested imaging protocol and standard of care with respect to imaging.

A-203 11:00

Ear
B. Verbist; *Leiden/NL (b.m.verbist@lumc.nl)*

The ear and hearing will primarily be examined by an ENT surgeon and audiologist. But since the otoscopic view is limited behind the tympanic membrane additional imaging studies may become necessary. Imaging of the temporal can be done either with CT or MRI. The choice of the most appropriate imaging modality for a certain patient depends on the presenting symptoms and suspected underlying disease based on clinical and audiometric examinations. Symptoms or signs related to suspected disease of the external ear canal or middle ear, such as conductive hearing loss or a visible mass behind the ear drum, will be best examined with CT. Symptoms related to the inner ear or suggestive of retrocochlear disease, such as sensorineural hearing loss, will be examined with MRI. A huge variety of diseases or injuries may affect the temporal bone: congenital malformations, infectious or inflammatory disease, benign or malignant tumours, trauma or bone dysplasias. In this lecture indications for temporal bone imaging will be discussed. It will be shown how clinical findings guide the choice of CT or MR protocols. Analysis and interpretation of imaging findings will be richly illustrated with patient cases.

A-204 11:30

Sinuses
R. Maroldi; *Brescia/IT (roberto.maroldi@unibs.it)*

Paranasal sinuses are air-filled cavities developed within the bones of the face and skull from invaginations of the nasal cavity. They are composed of four paired sinuses: maxillary and ethmoid (present at birth), frontal and sphenoid (develop during infancy). A mucous blanket covers their ciliated epithelium. The mucus is moved by cilia towards the ostium, from which it eventually drains into the nasal cavity along narrow passages, which may be longer (frontal recess, ethmoid infundibulum) or shorter (superior meatus, spheno-ethmoidal recess). Conditions impairing the drainage may lead to the

accumulation of mucus inside the sinuses. The most frequent condition is acute sinusitis (AS), usually due to viral infection, which causes inflammation (and thickening) of the nasal mucosa, consequently blocking the drainage passages. The diagnosis is clinical. Imaging is required only when symptoms suggest bacterial superinfection with possible involvement of the orbit or intracranial structures (veins, meninges). Chronic rhinosinusitis (CRS) is an inflammatory process involving the nose and paranasal sinuses, persisting for 12 weeks or longer. Though frequently a continuation of an unresolved AS, CRS may be noninfectious, related to allergy or other conditions. CRS may manifest as one of three major clinical syndromes: CRS without nasal polyps, CRS with nasal polyps, or allergic fungal rhinosinusitis. CT is indicated to identify the causes of impaired mucus drainage, to map the changes of the mucosa and bone, to precisely delineate the unique individual anatomy of sinuses, which may increase the risk in case of endonasal surgery or hamper the mucus drainage.

10:30 - 12:00 **Room M 4**

Joint Course of ESR and RSNA (Radiological Society of North America): Emergency Radiology

MC 628

Chest emergencies

Moderators:
A. Palkó; Szeged/HU
R.J. Zagoria; San Francisco, CA/US

A-205 10:30

A. Thoracic injuries
J.A. Soto; *Boston, MA/US (jorgeasoto@aol.com)*

Vascular injuries caused by blunt or penetrating trauma are common and highly lethal. In patients who survive the initial event, rapid evaluation with CT may be life saving. This presentation will focus on the importance of recognizing the CT signs used to diagnose major and minor aortic injuries and will introduce a classification method that helps direct patient management. Other important injuries that the radiologist needs to be aware of will also be reviewed, such as those affecting the major airways, heart and diaphragm. The emerging role of CT in the management of penetrating thoracic trauma will also be discussed. Finally, examples illustrating potential pitfalls leading to false-negative or false-positive interpretations will be highlighted. Potential diagnostic pitfalls will also be discussed.
Learning Objectives:
1. To learn how to differentiate traumatic aortic injuries from congenital variants that mimic injury, to distinguish minor from major aortic injuries, and to understand how injury classification can influence management.
2. To become familiar with the various CT appearances suggesting and verifying major airway injury.
3. To understand the various CT appearances of blood/bleeding in the chest and how the location, quantity of blood/bleeding and patient clinical status determine initial treatment.
4. To appreciate the spectrum of cardiac injuries that can be diagnosed on admission contrast-enhanced CT and those that require urgent intervention.

A-206 11:00

B. Non-traumatic thoracic emergencies
C.M. Schaefer-Prokop; *Amersfoort/NL (cornelia.schaeferprokop@gmail.com)*

Pulmonary symptoms such as chest pain or shortness of breath are common non-traumatic symptoms prompting ER visits. Because clinical symptoms are very non-specific, imaging plays a major role in differentiating life-threatening from less severe diseases and forming a diagnosis. The chest radiograph remains the first imaging despite its limited sensitivity for certain diseases and its susceptibility to inter-observer variability. Pneumothorax, acute pulmonary congestion, pneumonia or space occupying pleural effusion is mostly readily diagnosed based on radiographs. Comprehensive cardiothoracic CT examinations allow for fast and effective diagnosis of vascular life-threatening events such as aortic dissection and pulmonary embolism. Presentation and workshop will mostly focus on analysis and differential diagnosis of acute respiratory insufficiency caused by parenchymal diseases for which analysis of HRCT findings play an important role (e.g. exacerbation of diffuse interstitial lung diseases, drug-induced lung disease, acute interstitial pneumonia, airways diseases, infectious diseases). A systematic approach to pattern analysis and differential diagnosis will be presented.

Learning Objectives:
1. To illustrate typical CXR findings made in patients entering the ER with acute dyspnoea and to learn when CT is indicated and diagnostically useful.
2. To learn how to analyse and interpret HRCT patterns of pulmonary opacifications in patients with acute respiratory insufficiency.
3. To learn about radiological key features helpful for differential diagnosis and how to integrate clinical information.

A-207/A-208 11:30

C. Interactive case discussion
J.A. Soto; *Boston, MA/US (jorgeasoto@aol.com)*

C.M. Schaefer-Prokop; *Amersfoort/NL (cornelia.schaeferprokop@gmail.com)*

10:30 - 12:00 **Room M 5**

E³ - ECR Academies: Diagnostic Urogenital Radiology

E³ 622

Kidney

Moderator:
H.C. Thoeny; Berne/CH

A-209 10:30

A. Differential diagnoses of cystic renal masses
M. Claudon; *Vandoeuvre-les-Nancy/FR (m.claudon@chu-nancy.fr)*

The classification, proposed by Bosniak in 1986 and based on CT patterns, has been proved to be helpful for evaluating complex renal cystic masses and having a valuable dialogue about practical management. Simple cyst and cystic lesions presenting with thin septa or minimal thickened wall (respectively, type I and II) are clearly benign and do not need any further evaluation, while lesions containing enhancing soft tissues (type IV) require surgery because of a high probability of malignancy. Type III initially concerned a large differential list, including 1. benign lesions like haemorrhagic cysts, chronic infected cysts, scarred cysts, multiloculated cysts and multiloculated cystic nephroma; 2. malignant tumours like multilocular cystic renal cell carcinoma, cystic necrotic renal cell carcinoma, cystic papillary renal cell carcinoma. In the 1990s, the concept of category IIF (F for follow-up) was introduced for lesions that are more complex than a category II cyst but still thought to be benign and require only serial imaging to confirm stability. IIF category has appeared helpful, potentially avoiding unnecessary surgery, as BIIF cystic lesions behave mostly as benign lesions, with radiological progression in complexity reported in only 16%-25% of cases. Follow-up periods for non-progressing lesions can be limited to 5 years. The initial description based on CT findings can be easily used with MRI, and to a certain extent to contrast-enhanced sonography with a higher sensitivity to flow. The place of imaging-guided biopsy and of new therapeutic options include nephron-sparing surgery and radiofrequency ablation will be discussed.
Learning Objectives:
1. To become familiar with the updated Bosniak classification.
2. To learn about the differential diagnoses of complex cystic renal masses.
3. To become familiar with typical surgical and non-surgical lesions.

A-210 11:00

B. Differential diagnoses of solid renal masses
R.H. Oyen; *Leuven/BE (Raymond.Oyen@uzleuven.be)*

During last decades there has been a rise in the number of incidentally diagnosed small lesions, mainly at CT. At least 30% of renal masses are discovered incidentally during imaging for indications not related to the urinary tract. Imaging details suggestive of malignancy include atypical appearance on US examination (internal echoes, no posterior acoustic enhancement), attenuation numbers 20-50 HU on unenhanced CT images, heterogeneous internal pattern, slight variation of texture on postcontrast series, unsharp demarcation. Renal lesions may be difficult to characterise or indeterminate on CT because of size (i.e. too small to evaluate completely), artefacts (pseudoenhancement due to beam hardening) and/or because the procedure is not designed for complete evaluation (single phase). US and MRI have a crucial role in further evaluation of such masses. Contrast-enhanced US may be contributive to assess vascularity. MRI is a second step modality. Image subtraction is an essential tool for accurate assessment of subtle vascularity. Diffusion-weighted images may be contributive to demonstrate the solid nature of a renal neoplasm. For some lesions, however, whatever imaging modality or in whatever combinations, there are no reliable features allowing differentiation between benign and malignant. 'Surgical lesion' probably is a more proper description of truly indeterminate lesions, i.e. a lesion for which surgery is required. Percutaneous biopsy is valuable in selected patients: needle core

biopsy of (even small) masses is safe and accurate with a diagnostic yield of > 80% and minor complications (10%).
Learning Objectives:
1. To learn about the differential diagnoses of solid renal lesions.
2. To become familiar with typical imaging findings of the renal cell carcinoma subtypes.
3. To become familiar with potential criteria for active surveillance of solid renal masses.

A-211 11:30

C. Acute and chronic renal infection
N. Grenier; *Bordeaux/FR (nicolas.grenier@chu-bordeaux.fr)*

Acute bacterial pyelonephritis is the most frequent renal infection, affecting children and adults. The most prevalent uropathogen is Escherichia coli. Diagnosis is based on association of lumbar pain, fever and positive urinalysis. Imaging is limited to suspicion of complication (abscess and urinary obstruction) to absence of improvement in patient's symptoms and to symptom recurrence after initial improvement. In pregnancy, diffusion-weighted MRI is useful when diagnosis is questionable. Percutaneous drainage of abscesses is required when too large or non-responding to treatment. Kidney scarring may occur when inflammation does not recover and, in children, it is considered a cause of substantial long-term morbidity. Emphysematous pyelonephritis, often associated with diabetes mellitus or immunocompromised status, may be life threatening, and is characterised by necrotizing infection with gas formation. In severe forms, aggressive surgical treatment is required. In acute fungal renal infection, multiple small abscesses are seen within both kidneys and often the liver. Chronic renal infections are numerous. Renal infection susceptibility is defined by efficiency of host defense whose genetic factors influence propensity for scar formation. Imaging of chronic pyelonephritis shows focal polar scars and underlying calyceal distortion with global atrophy and hypertrophy of residual tissue. Pyonephrosis is characterised by hydronephrosis with a sediment of pus within dilated cavities better visible on sonography and MRI. Typical findings of xanthogranulomatous pyelonephritis include presence of central calculus, expansion of the calyces with hypodense material in a non-functioning enlarged kidney and inflammatory changes in perinephric fat. Tuberculosis and hydatid disease also display characteristic imaging features.
Learning Objectives:
1. To learn about the different aetiologies of acute renal infection, including typical imaging findings.
2. To learn about the time-point and possibilities for interventions.
3. To understand the causes of chronic renal infection, including typical imaging findings.
Author Disclosure:
N. Grenier: Advisory Board; Supersonic Imagine.

12:15 - 12:45 **Room A**

Plenary Session

HL 1

Wilhelm Conrad Röntgen Honorary Lecture

Presiding:
K. Riklund; Umeå/SE

A-212 12:15

Imaging the invisible killer: towards personalisation of ovarian cancer care
A.G. Rockall; *London/UK (a.rockall@imperial.ac.uk)*

For many cancers, there has been a steady improvement in patient outcomes, related to early detection and novel therapies. However, in ovarian cancer, the most lethal gynaecologic cancer in European countries, there have been limited improvements in patient outcome. Early-stage disease is rarely symptomatic and screening is not supported by trial evidence. Most patients present with disseminated peritoneal disease that can be surgically complex. CT is inconsistent for prediction of surgical findings, limiting its contribution to surgical planning. Initial response to chemotherapy is often followed by disease relapse that relentlessly develops resistance to treatment. A better understanding of this disease is urgently needed and imaging developments have an important role to play. Early detection of disease with high specificity, using ultrasound with a supporting role of MRI, may ultimately support successful screening. A radiological lexicon and an algorithmic approach to characterisation of masses, is gaining evidence through large multi-centre studies. Current exciting developments in defining the extent of peritoneal disease on MRI may allow optimisation of surgical approach. Radiomic studies are exploring imaging characteristics of underlying tumour biology, with the aim of stratification of ovarian cancer into distinct gene expression subtypes that may allow improved therapeutic targeting. In addition, the early detection of response to treatment using imaging has the potential to allow adaptive trial design evaluating novel therapies and thus play a role in early-phase drug development and personalised treatment. This lecture will outline the advances in imaging that face the challenges presented by ovarian cancer.
Author Disclosure:
A.G. Rockall: Other; Merck and Co sponsored and funded study using PET/CT in relapsed ovarian cancer.

12:30 - 13:30 **Room B**

E³ - The Beauty of Basic Knowledge: Breast Imaging

E³ 24B

Cracking the mystery of needles and gauges

Moderator:
J. Camps Herrero; Valencia/ES

A-213 12:30

Cracking the mystery of needles and gauges
R.M. Pijnappel; *Utrecht/NL (r.m.pijnappel@umcutrecht.nl)*

Due to screening, radiologists are frequently confronted with the assessment of non-palpable lesions. Therefore, image-guided breast intervention plays a central role in daily practice of breast radiology. It is the combination of lesion type (e.g. calcifications, mass), method of detection (US, mammography, MRI), availability and costs of biopsy equipment that ultimately determines the method of use. Tissue volume and underestimation of the true nature of the underlying pathology are closely connected. Apart from this, it is essential to remember that a definitive benign diagnosis avoids surgery and knowledge of the type of malignancy influences the choice of treatment. Fine-needle aspiration (FNA), automated core-needle biopsy, vacuum-assisted biopsy (VAB), radio frequency-assisted single large-core biopsy are commonly used techniques, all with their own possibilities and limitations. It is essential to know these limitations especially in relation to the imaging characteristics and possible underlying pathology of the lesion (e.g. atypical ductal hyperplasia, DCIS). It is the exclusive role of the radiologist to determine which technique (guidance as well as sampling) is most appropriate for the given lesion. Specimen radiography and clip placement after biopsy make it possible to correlate the biopsy site with the original lesion and facilitate to mark the site if surgery appears to be the next step. Correlation of image findings and pathology reports forms a crucial final step in the diagnostic process of assessment of non-palpable breast lesions.
Learning Objectives:
1. To learn about the choice of techniques used for guidance in breast interventions.
2. To know the different breast biopsy systems and their indications.
3. To learn the most common practical tips and pitfalls in these procedures.

12:30 - 13:30 **Room D1**

E³ - The Beauty of Basic Knowledge: Chest Imaging

E³ 25B

How to avoid misdiagnosis on the chest x-ray

Moderator:
N. Howarth; Chêne-Bougeries/CH

A-214 12:30

A. Neoplastic lesions
J. Vlahos; *London/UK*

"no abstract submitted"
Learning Objectives:
1. To review the reasons for misdiagnosis on the chest x-ray.
2. To learn how to focus on blind areas.
3. To know the consequences of a misdiagnosis.

A-215 13:00

B. Non neoplastic lesions

A.R. Larici; *Rome/IT (anna.larici@rm.unicatt.it)*

Although the clinical value of chest x-ray remains undiminished, errors in the interpretation of the chest x-ray is still one of the most frequent issue in clinical practice, also in the context of benign lesions. This presentation will cover the predefined learning objectives using side-by-side plain film and CT imaging to help understand how to systematically review chest x-ray and improve radiologist's performance and accuracy in interpreting images. Observer error is one of the most important causes of misdiagnosis at chest x-rays, and includes scanning error, recognition error, decision-making error and satisfaction of search. Technical considerations, such as image quality and patient positioning and movement, are also factors that can contribute to the likelihood of missing lung lesions. Lesion characteristics also play a critical role and include lesion size, conspicuity and location. Imaging features of the common chest diseases, including those of the diaphragm, pleura and chest wall, as well as diseases of the mediastinum, pulmonary hilum and vascular system, will be reviewed on a case-based approach. The possible consequences of misdiagnosing a benign lesion at chest x-ray will be shown by discussing some explicative clinical cases.The skills required for an accurate interpretation of imaging of the mediastinum, pleura and chest wall will be explored and provided.

Learning Objectives:

1. To review the reasons for misdiagnosis on the chest x-ray.
2. To learn how to interpret the chest x-ray more accurately.
3. To know the consequences of a misdiagnosis.

14:00 - 15:30 **Room A**

E³ - ECR Academies: Interactive Teaching Sessions

E³ 721
Cardiac imaging

A-216 14:00

A. Patterns of delayed enhancement

P. Hunold; *Lübeck/DE (peter.hunold@uksh.de)*

Delayed Gd enhancement (DE) in contrast-enhanced cardiac MRI has been established as a very valuable tool in myocardial disease. Scars after myocardial infarction have been described for many years and appear very specific in DE imaging. Consequently, by applying DE imaging, the distinction between ischaemic and non-ischaemic myocardial damage is relatively easy. However, DE is not specific for ischaemic damage since different fibrotic and inflammatory diseases with enlarged interstitial volume are also accompanied by DE. During recent years, many studies have been performed showing the clinical usefulness of the additional information given by DE imaging in the differential diagnosis of myocardial disease. Different cardiomyopathies present with specific patterns of DE enabling to differentiate different aetiologies. On one hand, the very specific DE patterns may lead to the diagnosis, such as in hypertrophic cardiomyopathy, amyloidosis, sarcoidosis, myocarditis, etc. On the other hand, the sensitivity of DE alone might be quite low. In addition, during the last years, promising data have been published concerning the prognostic value of the presence and extent of DE. Research is actively going on. In summary, DE cardiac MRI is the number one non-invasive technique for any kind of myocardial disease and it is worth to keep in mind the specific patterns of DE that can facilitate the differential diagnosis.

Learning Objectives:

1. To learn the different patterns of delayed enhancement.
2. To understand the influence regarding the prognosis.

Author Disclosure:

P. Hunold: Speaker; Bayer, Philips, Guerbet.

A-217 14:45

B. Cardiomyopathies: from diagnosis to prognosis

A. Jacquier; *Marseille/FR (alexis.jacquier@ap-hm.fr)*

Cardiomyopathies are frequent cause of heart failure and sudden cardiac death worldwide. Hypertrophic cardiomyopathy (HCM) is the first cause of sudden cardiac death in young adults in USA. MRI plays an important role for positive diagnosis notably to detect hypertrophy areas that are difficult to assess using US. MRI is also an important tool to diagnose other pathologies that could give hypertrophy and that might require specific treatment such as Fabry disease. In arrhythmogenic right ventricular dysplasia (ARVD), MR is the most precise method to quantify RV ejection fraction and volumes. Assessment of segmental contraction abnormalities requires learning curve, several movies showing abnormalities encountered during ARVD will be provided. Dilated cardiomyopathy (DCM) represents the final morpho-functional pathway of various cardiac diseases. In clinical practice, MRI and MDCT provide important information for diagnosis of the disease. MR is a reference tool to confirm the diagnosis and look for clinical variants such as non-compaction cardiomyopathy. MDCT plays an important role to rule out coronary artery disease. In cardiomyopathies, MRI using late gadolinium enhancement, T1 mapping, and extracellular volume quantification bring new insight for individual risk stratification assessment.

Learning Objectives:

1. To understand the diagnostic work-up of cardiomyopathies.
2. To review the association between diagnostic findings and clinical outcome.

Author Disclosure:

A. Jacquier: Grant Recipient; Guerbet. Research/Grant Support; PHRC national health system.

14:00 - 15:30 **Room N**

ESOR Session

Advancing clinical practice: role of education

Moderators:
L. Donoso; Barcelona/ES
N. Gourtsoyiannis; Athens/GR

A-218 14:00

Introduction

L. Donoso; *Barcelona/ES (ldonoso@clinic.ub.es)*

Radiologists permanently need to stay abreast of the newest medical and technological developments to ensure best clinical practice. Likewise, methods and contents of education need to be constantly adapted. The ESR and its European School of Radiology have been dedicated to harmonising and optimising radiological education in Europe. The present session deals with selected aspects that are playing an increasingly important role in radiological education and its role in advancing clinical practice.

A-219 14:05

ESOR in action 2016

N. Gourtsoyiannis; *Athens/GR (gournick@gmail.com)*

A-220 14:15

Role of remodelling in delivering of learning

P. Ros; *Cleveland, OH/US (Pablo.Ros@UHhospitals.org)*

The traditional, passive method of teaching is also referred as "spoon feeding". Spoon feeding is a descriptive term defining teaching centred on the teacher at the expense of the student's learning process. The students are passive while the teacher is the knowledge dispenser. In the current movement of replacing passive for interactive teaching, the next level of instructional strategy is the so-called "flipped classroom". Flipped classroom is a type of blended learning reversing the traditional passive educational arrangement. The students become the source of knowledge by delivering to the class content obtained often online either in or outside the classroom. In a flipped classroom, students collaborate in online discussions, research didactic topics at home bringing them back to the classroom and engage with other students with the guidance of instructor. Interactive models including the "flipped classroom", however, have drawbacks for both students and teachers. For learners a digital divide still exists. In addition, this type of education tends to increase computer time in an era where personal interactivity is being replaced by internet-based one. We will review the current role of remodeling the way we learn and its delivery in radiology.

Learning Objectives:

1. To review the principles of excellence in delivering medical education with emphasis in radiology.
2. To understand how remodelling the traditional, passive learning in medicine has given way to an interactive style.
3. To enumerate the resources available for multimedia, interactivity and presentations in radiology.

Author Disclosure:

P. Ros: Advisory Board; Koninklijke Philips NV, KLAS Enterprises LLC, Oakstone Publishing. Research/Grant Support; Siemens AG, Koninklijke Philips NV, Sectra AB, Toshiba Corporation.

A-221 14:27

Role of referral guidelines and clinical decision support systems

L. Donoso; *Barcelona/ES (ldonoso@clinic.ub.es)*

Referral guidelines for medical imaging and clinical decision support systems are excellent tools for education, especially if used in combination. With regard to clinical practice, the ESR advocates the introduction of clinical decision support systems to make guidelines readily available and easily usable. The same holds true for education, where modern, IT-supported learning methods are becoming more and more prevalent. Imaging referral guidelines offer users a condensed universe of the appropriateness of different imaging modalities for a majority of clinical situations likely to be encountered in clinical practice. Embedded in suitably adapted CDS software, these guidelines are transformed into a practical tool for education. ESR iGuide, the ESR's CDS system for European Imaging Referral guidelines, can be used for educational purposes both by teachers and by students themselves, and the ESR is starting an initiative to cooperate with universities across Europe to pioneer the use of CDS as a teaching and learning method. In addition, the ESR is exploring possibilities to utilise CDS as an e-learning tool.

A-222 14:39

MDTs and patient outcomes

R.H. Reznek; *London/UK (r.h.reznek@qmul.ac.uk)*

Multidisciplinary team meetings (MDTs) have become important in the management of all patients with cancer. This presentation will explore the data that exist investigating the impact that MDTs have had on patients' diagnosis and therapy. Where possible it will also present the available data on the effect of MDTs on patient outcome. It will look carefully at the cost effectiveness of the introduction of such MDTs. It will look at the constitution of such multidisciplinary groups and the effect this has had on the professionals engaged in the multidisciplinary approach to the care of cancer patients. It will concentrate on its organisation within the United Kingdom and, where possible, compare the national structure and maintenance of such multidisciplinary teams with systems that exist elsewhere.

A-223 14:51

Role of research and innovation: essential ingredients for our professional advancement

H. Hricak; *New York, NY/US*

Research and innovation in the field of biomedical imaging have revolutionized the practice of medicine. Thanks to the development of powerful imaging technologies as well as refined acquisition protocols and post-processing tools, biomedical imaging plays critical roles in the diagnosis and management of innumerable diseases and conditions. Not only is research vital to the continuous improvement of patient care as a whole and the specialty of radiology, it is also invaluable for individual radiologists' professional development. Today, medicine is changing faster than ever and becoming increasingly specialised, complex and interdisciplinary. At the same time, efforts to reduce costs and increase efficiency are placing unprecedented pressure on radiologists to increase the value they add to patient care. With the emergence of computer tools for identifying abnormalities on imaging, these pressures will only grow. In this setting, one of the best ways radiologists can maintain their relevance is to engage in clinically pertinent, multidisciplinary research. Such engagement helps radiologists stay up-to-date on the most recent advances in practice, understand the specific clinical dilemmas faced by referring physicians, and deliver more clinically meaningful reports. It helps them build stronger relationships with colleagues in other departments and institutions, gather data showing the value of imaging, and find ways to immediately improve clinical practice within their own institutions while contributing to longer term improvements in the broader healthcare system. On a personal level, research also stimulates intellectual creativity, fosters long-lasting friendships, and adds purpose, excitement and joy to a career in radiology.

Awards

14:00 - 15:30 **Studio 2016**

EIBIR Session

EIBIR 1

Joint VPH-PRISM/ASSURE Session - from screening to therapy: innovative breast care concepts

A-224 14:00

Introduction: challenges and innovative approaches in image-based breast care

H.K. Hahn; *Bremen/DE (horst.hahn@mevis.fraunhofer.de)*

Images play a central role for detection, diagnosis, and treatment decision making. They are crucial in treatment monitoring and follow-up, and help to determine response to chemotherapy. Dedicated computer systems provide accurate quantitative information that is decisive in these tasks. Image acquisition strategies are improved via computer simulations regarding tissue microstructure and imaging physics. Advanced software tools are employed for spatial correspondence assessment between current and prior exams, or between exams of different modalities. These spatio-temporally "unifying" data representation can be key in the determination of novel imaging biomarkers, when fused with clinical information, oncological information, and in future studies, with clinical outcomes. Moreover, deformation modeling and augmented reality applications on mobile devices help surgeons in treatment planning. We also address the importance of quantitatively evaluating digital histopathology data. Novel image computing methods allow extremely fast, yet highly accurate analysis of digital whole slide images. Fused with radiological images, a wealth of new information becomes available, and methods are being enabled that will utilize this confluence of information for better predictive health care.

Session Objectives:

1. To learn about the importance of quantitative predictors in image-based decision making.
2. To understand how predictors gained from different modalities and disciplines can be fused.

A-225 14:10

Density patterns, breast cancer risk and masking in screening mammograms

C. Van Gils; *Utrecht/NL (c.vangils@umcutrecht.nl)*

Women with high mammographic breast density have increased breast cancer risk and their tumours are more difficult to detect than those in women with low breast density. In the ASSURE project, we developed and tested automatic and robust ways of quantifying the different components and characteristics of the breast tissue, to use this information for breast cancer risk prediction. On the basis of a woman's individual risk, targeted screening and prevention strategies can be considered. In the project, we studied databases of over 100,000 unprocessed digital mammographic screening examinations collected since 2003. In this lecture, various ways of quantifying breast tissue characteristics will be discussed. The results show that taking into account both the volume of the dense tissue but also the volume of the non-dense (fatty) tissue is important in identifying the women with the highest risk. We also showed that women with a large amount of dense tissue and specific texture features are especially at high risk of a breast cancer that is diagnosed in the interval between screening rounds. This finding is most likely to be caused by masking. Combined with the finding that these same women also have a much higher probability of a false-positive screening outcome, our results indicate the need for further examination of the value of supplemental screening for these women.

Learning Objectives:

1. To learn about the contribution of different mammographic measures for estimation of breast cancer risk.
2. To understand the importance of knowing the risk of a breast cancer that is likely to be missed with mammography.

Author Disclosure:

C. Van Gils: Research/Grant Support; Bayer Healthcare is co-funder of the DENSE trial of which Dr. Van Gils is the PI. Matakina is providing Volpara software for this trial.

A-226 14:25

Novel ultrasound and MRI technologies for breast cancer screening

N. Karssemeijer; *Nijmegen/NL (n.karssemeijer@rad.umcn.nl)*

Whole breast automated ultrasound (ABUS) is emerging as a safe and cost-effective modality for breast cancer screening. This modality may help resolve problems in current screening programs related to low mammographic sensitivity in women with dense breasts. However, reading of ABUS exams is time consuming and demanding for radiologists. Therefore, in the ASSURE project novel CAD-driven workflows have been designed and evaluated which increase the feasibility of high-volume screening with ABUS. Similarly, a novel reading environment for breast screening with MRI was developed. Experimental results will be presented which demonstrate the potential of these new technologies for improved screening performance and productivity gain. In addition, new automated quality assurance tools for determining acceptability of ABUS and MRI screening exams will be discussed.

Learning Objectives:

1. To learn how effectiveness and quality breast screening with Automated Breast Ultrasound can be improved by using CAD.
2. To learn about optimising screening workflow with fast MRI protocols and dedicated reading tools for comparison with prior exams.
3. To understand the potential of automated quality assurance methods for MRI and automated breast ultrasound.

Author Disclosure:

N. Karssemeijer: CEO; ScreenPoint Medical BV. Consultant; Qview Medical Inc. Founder; Volpara Solutions Ltd., Qview Medical Inc., ScreenPoint Medical BV. Shareholder; Volpara Solutions Ltd., Qview Medical Inc., ScreenPoint Medical BV.

A-227 14:40

Breast cancer risk and masking risk-based stratification protocols: key drivers of cost-effectiveness

E. Gray; *Manchester/UK (ewan.gray@manchester.ac.uk)*

Personalised breast cancer screening has been proposed to both improve outcomes and screening programme efficiency (cost-effectiveness). A mathematical model of personalised screening was developed that included stratification by risk of cancer and also risk of masking. We simulated several promising stratification protocols to predict the health outcomes and costs associated with each. Within the developed framework we also sought to identify the key determinants of whether not a stratification protocol is cost-effective. Risk stratification was accomplished using a risk estimation model, produced in the ASSURE project, that incorporates existing known risk factors (the Tyrer-Cusick model), with mammographic density and texture. Masking stratification was achieved using automated breast density and texture measures. Other parameters in the mathematical model were informed by previously published modelling studies and data gathered within the ASSURE project. Incremental cost-effectiveness ratios (ICERs) are calculated for a variety of proposed stratification procedures compared to standard screening (either 3-yearly or 2-yearly). Risk based stratification was cost-effective compared to 3-yearly screening (£1,701 per QALY) while a masking-based stratification had favourable cost-effectiveness compared to 2-yearly screening (£10,610 per QALY). Parameters with a large influence on this ICER are sensitivity of mammography, biopsy rate, cancer growth parameters and costs of supplemental imaging. The cost-effectiveness of risk and masking based screening programmes appears promising. However, significant uncertainty remains while trial evidence is lacking.

Learning Objectives:

1. To learn how mammographic breast density and texture are risk factors for breast cancer independent from those included in the Tyrer-Cusick model and how risk estimation performance is modestly improved by including these variables.
2. To appreciate the substantial uncertainty about key parameters determining the cost-effectiveness of personalised breast screening.
3. To understand how optimising personalised screening based on effectiveness criteria with fixed resource constraints may offer a cost-effective improvement on one-size-fits-all screening.

A-228 14:55

Histopathology images: the new kid on the block of clinical multimodality imaging

J. van der Laak; *Nijmegen/NL (jeroen.vanderlaak@radboudumc.nl)*

For over 5 years now, technology is available to perform large-scale digitization of histopathological glass slides. Large-scale introduction of digital pathology, however, is still not a reality today. An important reason are the high costs for scanning and storage. In this talk I will show that computer-aided diagnosis (CAD) may turn out to be the 'tipping point'. Introduction of CAD algorithms will push the balance to a favorable business case. CAD will add efficiency to the diagnostic process. Also, advanced pattern recognition will expectedly aid the pathologist by yielding objective, quantitative data expressing sub-visual information. Within the VPH-PRISM project, we worked on algorithms for fully automated identification and segmentation of (pre)cancerous breast lesions. These algorithms facilitate detailed correlations between histopathology and radiological imaging. Further research in our group already resulted in software that is ready for validation in routine diagnostics. I will highlight opportunities and challenges that still exist for digital pathology.

Learning Objectives:

1. To understand the specific challenges of 'going digital' in histopathology.
2. To learn about the opportunities of computer aided diagnosis in pathology.
3. To know what the current 'state of the art' is in this exciting area of research.

A-229 15:10

Quantitative treatment planning, response prediction, and monitoring

K. Pinker-Domenig; *New York, NY/US (pinkerdk@mskcc.org)*

The accurate qualitative and quantitative assessment and longitudinal monitoring of changes in tumour burden are important factors in the clinical evaluation of cancer therapeutics. Treatment response and time to disease progression are important end points in clinical trials. However, such end points are only useful if based on ubiquitously accepted and utilised standard criteria. The Response Evaluation Criteria in Solid Tumours (RECIST) criteria have been published and are a well-established tool to evaluate treatment response. The revised RECIST 1.1 guideline includes a new imaging appendix and highlights the importance of moving from the assessment of two-dimensional changes in tumour size to either volumetric morphological or functional assessment with positron emission tomography (PET) or magnetic resonance imaging (MRI). The aim of this presentation is to discuss the value of the different MRI techniques (e.g. MR spectroscopy, diffusion-weighted imaging, angiogenesis mapping, hybrid imaging with PET/MRI) in evaluation and prediction of response to neoadjuvant treatment in breast cancer. The challenges for morphological, functional, metabolic and molecular imaging in the neoadjuvant therapy setting will be addressed and the clinical aspects of neo-adjuvant therapy monitoring using RECIST 1.1 will be explained.

Learning Objectives:

1. To understand the clinical aspects of neo-adjuvant treatment.
2. To appreciate evidence-based protocols for imaging in this clinical setting.
3. To learn about the imaging challenges of assessment and prediction of response to neoadjuvant treatment.

14:00 - 15:30 **Room M 4**

Joint Course of ESR and RSNA (Radiological Society of North America): Emergency Radiology

MC 728

CNS emergencies

Moderators:
A. Palkó; Szeged/HU
R.J. Zagoria; San Francisco, CA/US

A-230 14:00

A. CNS trauma and neurovascular injury

H.A. Rowley; *Madison, WI/US (HRowley@UWHealth.org)*

This lecture on CNS trauma and neurovascular injury is divided into 4 parts: Part 1 will briefly review traumatic brain injury (TBI) demographics and the most common TBI classification schemes. Part 2 will discuss the current imaging approach to acute TBI in clinical practice. Part 3 will illustrate the imaging manifestations of the different injuries located in the extra-axial space (e.g. scalp and skull injury; epidural, subdural, subarachnoid and intraventricular collections), and the intra-axial space (e.g. dysautoregulation, contusion, haematoma, penetrating TBI, axonal injury, fat emboli). Part 4 will review traumatic neurovascular injuries and fracture patterns correlated with high risk of vascular injury.

Learning Objectives:

1. To become familiar with traumatic brain injury demographics and classification schemes.
2. To learn how to apply appropriateness criteria for head trauma imaging in children and adults.
3. To identify key imaging patterns and pitfalls in the evaluation of brain and neurovascular trauma.

Author Disclosure:

H.A. Rowley: Consultant; GE HealthCare, Bracco, Guerbet, HL Gore, Genentech.

A-231 14:30

B. CNS non-traumatic emergencies

M. Smits; *Rotterdam/NL (marion.smits@erasmusmc.nl)*

Neurological emergencies are often associated with high morbidity and mortality, and thus require prompt diagnostic and therapeutic action. Non-traumatic emergencies may, however, have a subacute onset, and radiological signs may be subtle, which can lead to delay in diagnosis and treatment. Since clinical features are often nonspecific, the radiologist may be the first to point the clinician in the direction of the correct diagnosis. It is, therefore, of great importance that the radiologist is aware of and familiar with the various imaging findings, on both computed tomography (CT) and magnetic resonance imaging (MRI), of non-traumatic neurological emergencies. These include vascular, infectious and inflammatory diseases. Commonly encountered emergencies are ischaemic and haemorrhage stroke, venous thrombosis, arterial dissection, abscess, acute disseminated encephalomyelitis (ADEM), and encephalitis. Radiological findings in rarer diseases may mimic those in the more commonly occurring diseases, but need to be correctly interpreted as therapeutic strategies and prognosis may be entirely different. Such entities include for instance posterior reversible encephalopathy syndrome (PRES), reversible cerebral vasoconstriction syndrome, Susac's syndrome, and status epilepticus. Furthermore, initial findings of (impending) complications of brain disease, such as hydrocephalus and herniation of brain structures, may be subtle, while early recognition allows for prompt and adequate intervention. Finally, diagnostic and therapeutic interventions performed in an emergency setting may interfere with the diagnosis and interpretation of clinical and imaging findings. Associated limitations and pitfalls, therefore, need to be recognised to avoid false-negative or false-positive diagnosis, respectively.

Learning Objectives:

1. To learn about the modalities (MRI/CT) and protocols for non-traumatic neurological emergencies.
2. To learn how to diagnose the main non-traumatic neurological vascular and non-vascular emergencies.
3. To become aware of the pitfalls and limitations of clinical presentation and imaging findings in non-traumatic neurological emergencies.

A-232/A-233 15:00

C. Interactive case discussion

H.A. Rowley; *Madison, WI/US (HRowley@UWHealth.org)*

M. Smits; *Rotterdam/NL (marion.smits@erasmusmc.nl)*

14:00 - 15:30 **Room M 5**

E³ - ECR Academies: Diagnostic Urogenital Radiology

E³ 722

Emergencies

Moderator:
M. Otero-García; Vigo/ES

A-234 14:00

A. Male pelvis emergencies

M. Bertolotto; *Trieste/IT (bertolot@units.it)*

Acute scrotum is clinically defined by presence of acute scrotal pain, oedema and redness. The most common differential diagnosis include: testicular torsion, acute epididymo-orchitis, torsion of appendages, ischaemia and incarcerated scrotal hernias. Torsion requires treatment in emergency, and must be differentiated from other causes of acute scrotal pain. Colour Doppler ultrasonography is the modality of choice.Scrotal and penile injuries may result from penetrating or non-penetrating traumas, which often require imaging investigations. Differential diagnosis between albugineal tear and other injuries is clinically relevant because the former requires early surgical repair while the latter can be managed conservatively. Imaging allows accurate evaluation of albugineal tears, intra-or extra-albugineal haematomas, vascular lesions producing high flow priapism and other pathological changes. In scrotal trauma, testicular perfusion is investigated with colour Doppler and contrast modes. Compared to US, MR imaging has the advantage of increased panoramic view and higher contrast resolution between the tunica albuginea and the surrounding structures. It is, therefore, best suited for imaging traumas, but is not always available in emergency. Other situations in which imaging can be required in emergency are severe inflammation, Fournier's gangrene, and evaluation of postsurgical complications which are usually investigated first with contrast CT.

Learning Objectives:

1. To become familiar with various male pelvis emergencies.
2. To learn about the correct imaging techniques.
3. To understand the differential diagnoses.

A-235 14:30

B. Gynaecological emergencies

R.A. Kubik-Huch; *Baden/CH (rahel.kubik@ksb.ch)*

Several gynaecologic emergencies may occur in young females and in pregnant patients. The diagnosis is suspected on the basis of symptoms, e.g. acute pelvic pain, by means of physical examination and laboratory tests. The entities diagnosed may be related to the genital organs and pregnancy, respectively, or just be coincidental. The differential diagnosis of abdominal and pelvic pain is broad, primarily including gastrointestinal and urogenital disorders. Since imaging is an integral part of the workup, radiologists play an increasing role in the early management and several imaging findings require urgent verbal communication with the referring physician. This interactive lecture focuses on gynaecologic emergencies of the female pelvis in the non-pregnant patient. The most important gynaecologic emergencies which are depicted on ultrasound, computed tomography or magnetic resonance imaging will be discussed, with a special emphasis also on the imaging technique. Important differential diagnoses encompass ruptured or haemorrhagic ovarian cyst, ectopic pregnancies, adnexal torsion, endometriosis, complications involving uterine fibroids and pelvic inflammatory disease. The early and prompt management of these emergencies is vital to preserve ovarian function and fertility for the non-pregnant patient and to avoid life-threatening haemorrhage or sepsis in general. Prompt verbal communication, whether by phone or in person is crucial to improve patient care. Consequently, the goal of this presentation is to heighten the awareness for emergencies in gynaecology amongst radiologists.

Learning Objectives:

1. To be familiar with various female pelvis emergencies.
2. To learn about the correct imaging techniques.
3. To understand the differential diagnoses.

A-236 15:00

C. Imaging of obstetric and puerperal emergencies

M. Weston; *Leeds/UK*

"no abstract submitted"

Learning Objectives:

1. To learn about the imaging techniques performed in pregnancy.
2. To learn about the differential diagnoses of obstetric and puerperal emergencies.
3. To become familiar with typical imaging findings of most common pathologies.

16:00 - 17:30 **Room A**

E³ - ECR Academies: Interactive Teaching Sessions

E³ 821

Evaluation of patients with lung emphysema

A-237 16:00

A. Pretherapeutic evaluation of lung emphysema

C.P. Heussel; *Heidelberg/DE (heussel@uni-heidelberg.de)*

COPD is a disease with different phenotypes: centrilobular emphysema with and without paraseptal predominance, panlobular emphysema, and bronchial type. Each subtype required individual treatment while individual anatomical variations qualify patients for different approaches. This includes, e.g. surgical lobectomy or shaving, interventional vent, coil, steam, or glue application. Especially centrilobular emphysema is distributed within the lungs very individually. Amount of emphysema in each lung lobe, expandability of the ipsilateral untreated lobe, and fissure completeness to avoid collateral ventilation have to be analysed to plan interventional bronchoscopic emphysema treatment.

Learning Objectives:

1. To appreciate different phenotypes.
2. To learn how to quantify emphysema.
3. To understand how to assess collateral ventilation.

Author Disclosure:
C.P. Heussel: Consultant; CSL-Behring, Schering-Plough, Pfizer, Basilea, Boehringer Ingelheim, Novartis, Roche, Astellas, Gilead, MSD, Lilly, Intermune, Fresenius, Olympus. Grant Recipient; Siemens, Pfizer, MeVis, Boehringer Ingelheim. Patent Holder; Method and Device For Representing the Microstructure of the Lungs. IPC8 Class: AA61B5055 FI, PAN: 20080208038, Inventors: W Schreiber, U Wolf, AW Scholz, CP Heussel. Shareholder; Stada, GSK. Speaker; Gilead, Essex, Schering-Plough, AstraZeneca, Lilly, Roche, MSD, Pfizer, Bracco, MEDA Pharma, Intermune, Chiesi, Siemens, Covidien, Pierre Fabre, Boehringer Ingelheim, Grifols, Novartis.

A-238 16:45

B. Diagnostic work-up after treatment of lung emphysema
N. Sverzellati; *Parma/IT*

Chronic obstructive pulmonary disease (COPD) represents the first indication for lung transplantation worldwide. However, less invasive treatment options have been developed over the last decades. Lung volume reduction surgery (LVRS) has its rationale in the removal of high-volume emphysematous lung to allow expansion and ventilation of healthy lung. Although LVRS is still valid treatment modality, its use is limited by strict selection criteria of eligible patients, and associated morbidity. LVRS fostered scientific interest in the field of mechanical treatment of severe emphysema, notably towards further reduction of procedure invasivenes. Notably, bronchoscopic lung volume reduction by endobronchial valves or coils is progressively being used in routine clinical practice. Computed tomography (CT)) is of paramount importance in pre-therapeutic planning to characterise pulmonary abnormalities, target lung lobes to be treated (e.g. through endoscopic techniques), and drive the choice of the best therapeutic technique. Furthermore, radiologists should be aware of the most common early and late complications that may occur after any treatment of emphysema. This presentation will summarise both indications and complications of the different types of treatment for lung emphysema.
Learning Objectives:
1. To learn how to personalise treatment.
2. To appreciate successful treatment results.
3. To understand complications and failure of treatment.

16:00 - 17:30 **Room B**

GI Tract

RC 801
CT colonography today

A-239 16:00

Chairman's introduction
M. Hellström; *Gothenburg/SE (mikael.hellstrom@xray.gu.se)*

CT colonography has emerged as the method of choice for radiological evaluation of the colon. Because of its higher diagnostic accuracy, patient tolerability and limited radiation dose it has replaced barium enema in clinical settings, and it is increasingly being accepted as a complement, or sometimes replacement, for colonoscopy in screening for pre-cancerous polyps and colorectal cancer. The symposium will highlight recent developments in CT colonography, of importance for its technical performance and quality, its interpretation and its role in screening.
Session Objective:
1. To briefly present state-of-the-art in CT colonography, including standardised techniques, evidences on accuracy and guidelines on indications.

A-240 16:05

A. How I perform it
P. Lefere; *Roeselare/BE (radiologie@skynet.be)*

According to the ESGE/ESGAR guidelines and the second ESGAR CTC consensus on CT colonography (CTC), correct technique of performing CT colonography is essential to obtain good results of polyp/tumour detection. CTC technique is related to an adequate preparation of the colon, optimal colonic distension and the correct use of scanning protocols, adapted to the specific requirements of CTC. 1. Bowel preparation and faecal tagging: principles of state-of-the-art preparation: diet, laxatives, faecal tagging - application according to the clinical presentation of the patient - full cathartic preparation versus reduced cathartic preparation: when, advantages-disadvantages, the future? - pitfalls related to preparation. 2. Colon distension: principles of state-of-the-art colonic distension - practical application of optimal colonic distension - possible issues/complications and how to prevent - latest developments - pitfalls related to colonic distension. 3. Scanning protocols: acquisition of CTC in clinical practice, adapted to the different clinical presentations/indications - dose considerations: how to reduce radiation dose in CTC - latest developments - pitfalls related to acquisition.
Learning Objectives:
1. To learn about modern approaches to bowel preparation and faecal/fluid tagging.
2. To become familiar with colon distention, including prevention of possible complications.
3. To learn about different scanning protocols and their use according to patient status and clinical needs.

A-241 16:28

B. How I interpret it
T. Mang; *Vienna/AT (thomas.mang@meduniwien.ac.at)*

The evaluation of CT colonography (CTC) studies is based on detection, interpretation, and documentation of colonic findings. It is performed on a computer workstation equipped with dedicated CTC software by a primary 2D or a primary 3D approach. In either case, the alternative viewing technique must be available for rapid correlation and characterisation of any suspicious findings. Primary 2D evaluation is based on "lumen tracking" by interactively scrolling through the axial slices and multiplanar reformatted images, focusing only on the air-distended colonic lumen from one end to the other one. Primary 2D evaluation provides information about the attenuation of findings during the search process. It is time efficient. Primary 3D evaluation is based on 3D virtual endoscopy in an antegrade and retrograde fashion. It increases both, the conspicuity, especially of small- and medium-sized polyps, and the duration of visualisation. The use of advanced 3D displays like virtual dissection or unfolding techniques may reduce the interpretation time for primary 3D evaluation at the expense of increased image distortion. Colonic findings can be systematically characterised by their morphology, attenuation characteristics, and mobility. Knowledge of the CTC imaging features of common colonic lesions and artefacts is necessary for characterisation of findings and differentiation of genuine colonic lesions from pseudo-lesions. Computer-assisted detection (CAD) algorithms, used in CTC, can automatically detect polypoid findings. Specifically, if used as a second reader, CAD was found to reduce the number of perceptual errors by pointing out possible abnormalities that might otherwise be missed.
Learning Objectives:
1. To become familiar with different image presentations: 2D, 3D, enhanced views.
2. To appreciate the strengths and limitations of primary 2D and primary 3D reading.
3. To learn about the use of Computed Assisted Diagnosis (CAD) software.

A-242 16:51

C. Screening with CTC
D. Regge; *Turin/IT (daniele.regge@ircc.it)*

Colorectal cancer screening reduces cancer-specific mortality significantly and is cost-effective, or even cost-saving, with respect to not performing a screening test. In some European countries, tests with different lesion yield and costs (i.e. faecal occult blood test, sigmoidoscopy and colonoscopy) have been chosen for population screening programs. CTC has been approved by the American Cancer Society in 2008 as a test to detect polyps and colorectal cancer and has since then been adopted on an individual basis. Unfortunately CTC is not recommended by the US Preventive Services Task Force and is not reimbursed by medicare and most private insurances; therefore, it has gained little recognition. In Europe, CTC has been explored in a screening context mainly in randomised controlled trials were CTC lesion yield and subject participation into programs have been compared to that of other tests. These data are now available. The lecture will focus on the evidence cumulated in the last decade on the use of CTC as a screening test, to review current guidelines and present possible scenarios for its future adoption in colorectal cancer prevention.
Learning Objectives:
1. To understand basic principles of population and opportunistic screening.
2. To become familiar with data on accuracy of CTC in screening populations.
3. To learn about current guidelines on the use of CTC in screening.
Author Disclosure:
D. Regge: Author; Springer. Speaker; GE Healthcare.

17:14
Panel discussion: Challenging cases from clinical practice

16:00 - 17:30 **Room C**

Special Focus Session

SF 8a
Common mistakes in breast imaging

A-243 16:00
Chairman's introduction
G. Forrai; *Budapest/HU (forrai.gabor@t-online.hu)*

This session will help attendees to familiarize themselves with the common mistakes of the different modalities of breast imaging. It is important to know these entities, while it is the only way to avoid them in the daily routine. Most frequent are the perception errors, and the evaluation errors. Technical failures may also lead to erroneous interpretation.
Session Objectives:
1. To become familiar with the common mistakes in breast imaging.
2. To appreciate the main differences and similarities among different breast imaging modalities' mistakes.
3. To understand how to avoid these dangerous issues.

A-244 16:05
Common mistakes in mammography
E.J. Cornford; *Nottingham/UK (eleanor.cornford@nuh.nhs.uk)*

Errors in mammographic interpretation occur in different clinical settings. Depending on the clinical setting the reader is likely to operate at different levels of sensitivity/specificity. Hence, in a screening setting there is the necessity to work at slightly lower levels of sensitivity to achieve acceptable levels of specificity whereas when faced with a patient with a symptomatic problem attention is also paid to more benign appearing features. Many factors affect our error rates including the patient's mammographic density and tumour type, the technology available in the institutions we work in and personal skills. Errors can broadly be categorised as detection or interpretation but in reality the situation is more complex. Mechanisms for reducing false-negative error rates can, therefore, be targeted at increasing conspicuity of cancers to enable improved detection, training and education to improve interpretation and guidelines to aid optimum assessment of mammographic abnormalities. Examples of common errors in mammography detection/interpretation will be shown.
Learning Objectives:
1. To learn about the classification and types of errors.
2. To learn about the factors that affect our error rates.
3. To appreciate that there are mechanisms for reducing our error rates.
4. To become familiar with some examples of common mammography errors.

A-245 16:30
Common mistakes in second-look ultrasound after MRI
P.A.T. Baltzer; *Vienna/AT*

This talk aims to address the topic of second-look or targeted ultrasound. After attending this talk, delegates should be aware of the differences between primary ultrasound of the breast and secondary, targeted ultrasound in knowledge of additional MRI findings. The clinical value of second-look US will be demonstrated in example cases and the evidence for second-look US will be critically discussed. Finally, the talk will focus on common pitfalls that can be avoided in second-look US.
Learning Objectives:
1. To learn differences between primary- and second-look ultrasound after MRI.
2. To become familiar with common pitfalls in second-look US.
3. To understand how mistakes can be avoided in SLU.

A-246 16:55
Common mistakes in breast MRI
F. Pediconi; *Rome/IT (federica.pediconi@uniroma1.it)*

Breast magnetic resonance imaging (MRI) is rapidly expanding as an important additional tool for breast diagnosis and, the indications for its use are increasing during the years. Several studies have demonstrated that MRI is very sensitive in detection of breast cancer and has higher specificity compared to conventional imaging. However, technical difficulties in association with a lack of expertise in reading breast MR examinations can lead to misinterpretation and errors. Breast MRI is technically demanding, requiring excellent fat saturation, high spatial resolution and rapid performance of post-contrast sequences. Common causes of false-positive diagnoses are represented by artefacts that can be related to the patient or to technical parameters. Other factors of imaging interpretation error can be related to the menstrual cycle phase in which the breast MRI examination is performed or to the presence of background parenchymal enhancement (BPE) that can reduce the diagnostic accuracy. Finally, mistakes can occur in reading images because of insufficient history or lack of practice in reading MR images. This presentation will focus on the most common mistakes in reading breast MRI. An overview of different types of diagnostic errors will be presented as well as the way to avoid them and deal with them. At the end of the presentation, the audience should be able to differentiate artefacts and normal enhancing structures from pathologic causes of breast diseases.
Learning Objectives:
1. To learn about the principal artefacts in breast MR related to the patient and to technical factors, and how to deal with them.
2. To understand the importance of performing breast MR in the correct menstrual cycle phase and the problem of background enhancement.
3. To appreciate the most common pitfalls in breast MR interpretation.
4. To become familiar with possible mistakes related to radiologists' interpretations.

17:20
Panel discussion: How to avoid common mistakes in breast imaging?

16:00 - 17:30 **Room O**

ESR Working Group on Ultrasound

Minimising the risk of transmitting infections through ultrasound: is current practice sufficient?

A-247 16:00
Chairman's introduction
L.E. Derchi; *Genoa/IT (derchi@unige.it)*

This session will discuss about the potential risk of transmitting infections during ultrasound studies due to inadequate probes decontamination procedures. Although an often overlooked issue, cross infections from probes or ultrasound coupling gel may occur. This is a particularly important issue in interventional radiology and in endocavitary procedures, when probes may enter in contact with blood, body fluids and mucosal membranes. The current accepted decontamination practices will be presented, and the importance of a review of our procedures aimed at keeping patients as safe as possible will be underlined, together with considerations about the costs involved.
Session Objectives:
1. To understand potential risks of transmitting infections through ultrasound.
2. To appreciate the difference between low- and high-risk ultrasound examinations with regard to probe decontamination.
3. To discuss how current evidence may necessitate change in our current ultrasound probe decontamination procedures, despite costs involved.

A-248 16:05
Why is it important to consider infection control issues in ultrasound?
Low- vs high-risk examinations
C. Nyhsen; *Sunderland/UK (nyhsenc@doctors.org.uk)*

Ultrasound is generally considered as one of the safest diagnostic modalities available. Causing significant harm to imaged patients by performing ultrasound is not anticipated by professionals or by patients. However, in recent years several outbreaks of infection related to endoscopic procedures have been reported with subsequent significantly more stringent infection control measures put in place. One may question why a transvaginal/rectal ultrasound or interventional procedure involving ultrasound should be considered a lower risk than endoscopy. Outbreaks related to contaminated ultrasound gel have also been recorded. The aim of this lecture is to raise awareness of the risk of infection transmission through ultrasound probes/gel and highlight the need for stricter guidance to safeguard patients. Different risks when scanning patient's surface on unbroken skin versus endocavity and interventional procedures will be discussed. Results of the recent ESR survey on the ultrasound probe decontamination practices will be presented.
Learning Objectives:
1. To understand possible risks of infection transmission though inadequate probe decontamination.
2. To appreciate which ultrasound examinations are of low- versus higher-risk.
3. To recognise the importance of a review of current practice to keep patients as safe as possible.

A-249/A-250 16:25

Current accepted practice of ultrasound probe decontamination in endocarvitary and interventional radiology

N. Grenier; *Bordeaux/FR (nicolas.grenier@chu-bordeaux.fr)*

M. Claudon; *Vandoeuvre-les-Nancy/FR (m.claudon@chu-nancy.fr)*

Decontamination of endocavitary probes is not consensual because the risk of bacterial and viral transmission is unproved and remains controversial. Such probes can be considered as semi-critical devices because they are only into contact with mucous membranes. All recommendations include covering of probes with a CE-approved single-use sheath. Conversely, there is no consensus about guidelines, edited by the different scientific societies and authorities, for decontamination. Some recommend a high-level disinfection (HLD) by immersion in glutaraldehyde, hydrogen peroxide, or peracetic acid. Others recommend a low-level disinfection (LLD) procedure based on probe wiping with a single-use towel (pre)impregnated with products such as quaternary ammonium compounds or phenolics. Controversies have been reported about the risk of contamination of women with endovaginal probes, especially the clinical significance of detecting human papillomavirus (HPV) infection. The incidence of infectious complications of ultrasound-guided procedures is variable, depending on the type and site of procedures, with published rates ranging 0.1%-19%. A higher risk is observed during biopsies, especially in transrectal procedures. Prevention is usually obtained by antibiotics. Radiologists should provide accurate information to patients when asking for consent before procedures.

Learning Objectives:

1. To appreciate the use of ultrasound in different settings: endovaginal, endorectal, endoscopic and guiding interventional or surgical procedures.
2. To gain insight into currently used probe decontamination protocols after interventional procedures.
3. To learn about any known complications to date.

Author Disclosure:

N. Grenier: Advisory Board; Supersonic Imagine.

Author Disclosure:

M. Claudon: Speaker; Philips Ultrasound.

A-251 16:45

Why current practice may not be safe: main risks of infection transmission and published evidence

H. Humphreys; *Dublin/IE (hhumphreys@rcsi.ie)*

Physical contact is an important mechanism in the transmission of infection. This can involve contact between a patient and a contaminated surface/item of equipment or with a healthcare worker. Blood-borne viruses such as hepatitis B may also be transmitted by contact, especially with inadequate decontamination after a blood spillage. Decontamination of ultrasound probes represent a significant challenge as they are in contact with mucosal surfaces and are easily contaminated with pathogens, e.g. streptococci and enteric pathogens. When you apply the Spaulding risk assessment for decontamination, probes should either be sterilised or undergo high-level disinfection given contact with skin and mucosa. However, most probes are not suitable for exposure to steam or high temperatures, or are not fully immersible in high-level disinfectants. Surveys reveal considerable variation in methods of decontamination and confusion about what is optimal or safe. Furthermore, many healthcare professionals are not aware of the adverse non-infective consequences that may occur from inappropriate disinfection. Damaged probes may result in high-voltage shock with potentially fatal consequences. There is a need for greater co-operation between radiologists, infection prevention and control practitioners and industry, to agree decontamination methods which maximise patient safety and that are feasible. While alternative methods of decontamination such as hydrogen peroxide and various forms of plasma may have an increasing role, there is also an obligation on industry to design devices that are effective and that can also be adequately decontaminated with current methods.

Learning Objectives:

1. To gain insight into transmission of infection risks from an expert microbiologist.
2. To understand routes of infection and which most important pathogens need to be considered.
3. To learn about best decontamination practices in an "ideal world".

Author Disclosure:

H. Humphreys: Research/Grant Support; Grants from Irish national funding agencies to study cold plasma as a decontaminant.

17:05

Panel discussion: Safer practice vs considerable cost implications: are changes needed and feasible?

16:00 - 17:30 **Room N**

Head and Neck

RC 808

Paediatric: how we do head and neck imaging in children

Moderator:
N.J.M. Freling; Amsterdam/NL

A-252 16:00

A. Temporal bone

B. De Foer; *Antwerp/BE (bert.defoer@gza.be)*

Impaired temporal bone function may have important implications on the child's development and school evolution. Both techniques, CT and MRI are used for the evaluation of temporal bone pathology in children. For CT evaluation, preference is given to CBCT due to its higher resolution and its lower radiation dose. The MR imaging protocol is usually tailored to the clinical situation, the physical examination of the child and the findings at audiogram and otoscopy. The various imaging protocols - using (CB)CT and/or MRI - depending on the clinical question will be discussed and highlighted. Recognition of the most important temporal bone abnormalities - developmental, inflammatory and neoplastic - is of utmost importance. The most frequent developmental, inflammatory and neoplastic entities will be discussed and illustrated. The differences in anatomy, anatomical variants and pathological entities between adults and children will also be stressed.

Learning Objectives:

1. To understand how impaired function of the temporal bone has major clinical consequences.
2. To learn how to perform CT and MRI in children with hearing loss.
3. To become familiar with the most frequent developmental, inflammatory and neoplastic conditions of temporal bone in children.

A-253 16:30

B. Oral, paranasal sinuses and orbit

M. Lell; *Erlangen/DE (michael.lell@uk-erlangen.de)*

The indication for head and neck imaging in children is usually out of one of the following groups: I. Trauma; II. Infection; III. Tumour. Cross-sectional imaging plays a fundamental role in the assessment of head and neck trauma, infection and inflammation, and tumour imaging. Radiation protection and clinical workflow are important issues in the selection of the most appropriate cross-sectional imaging modality. Trauma imaging requires emergent imaging to exclude potential life-threatening conditions and to provide all necessary 3D information for reconstructive surgery. Infection and inflammation are common clinical problems and a presumptive diagnosis can be made clinically. Imaging studies are often requested to confirm the diagnosis and to exclude abscess formation or other potential complications. Lesion identification and localisation, assessment of lesion extent, involvement of adjacent structures and pretherapeutic planning are the fundamental tasks of imaging in tumour assessment. This presentation will focus on the indications for head and neck imaging, the selection of the most appropriate imaging modality, the application of relevant dose-reduction techniques, and a systematic approach of image analysis.

Learning Objectives:

1. To have an idea of the clinical presentation of oral, paranasal sinuses and orbit in infants and children.
2. To learn how to perform CT and MRI in children with pathology of the face.
3. To become familiar with the most frequent developmental, inflammatory, vascular and neoplastic abnormalities.

Author Disclosure:

M. Lell: Advisory Board; Bracco. Research/Grant Support; Bayer, Siemens. Speaker; Bayer, Guerbet, Siemens.

A-254 17:00

C. Cysts and lumps in the neck

A. Ailianou; *Geneva/CH (angeliki.ailianou@hcuge.ch)*

Palpable lumps are frequently encountered in the paediatric population. Ultrasonography (US) is the first-line imaging modality for their assessment; however, cross-sectional imaging is necessary for the exploration of deeper cervical regions. Computed tomography (CT) is helpful whenever calcifications or bone abnormalities are suspected and magnetic resonance imaging (MRI) plays a major role for the characterisation of vascular malformations. The purpose of this presentation is to become familiar with the most common head and neck lumps in children, their typical imaging features and characteristic localisations. The following entities will be discussed: common congenital

lesions, such as branchial cleft cysts, thyroglossal duct cysts, dermoid cysts and vascular malformations, lymphadenopathies, neoplasms such as haemangiomas, nerve sheath tumours, neuroblastomas, teratomas and rhabdomyosarcomas. Other miscellaneous lesions such as fibromatosis colli and head and neck manifestations of systemic diseases such as Langerhans cell histiocytosis will be equally addressed.

Learning Objectives:

1. To learn an approach to differentiating masses in children based on topography.
2. To be able to differentiate benign congenital, neoplastic and vascular conditions.
3. To learn how to investigate soft tissue masses and which technique to use.

16:00 - 17:30 **Studio 2016**

Professional Challenges Session

PC 8a
Clinical decision support (CDS)

A-255 16:00

Chairman's introduction

L. Donoso; *Barcelona/ES (ldonoso@clinic.ub.es)*

Clinical decision support (CDS) systems are used in medical imaging to make imaging referral guidelines available and usable at the point of care. Their value is that they provide information to referring physicians on the appropriateness of different modalities for a given clinical situation. In Europe, imaging referral guidelines exist in all member states as mandated by the Euratom directives. However, awareness of guidelines is limited, with only 70 percent of respondents in an ESR-led European Commission study having knowledge about guidelines in their country; beyond this, use of guidelines is minimal. CDS is a proven way to increase the use of guidelines and thereby improve appropriateness in medical imaging. While they can be used as stand-alone portals, CDS systems are most effective when implemented within existing workflows through integration into electronic medical records or CPOE (computerised physician order entry) systems. ACR select has demonstrably proven to be cost-effective in the United States where its use has significantly reduced the number of unnecessary imaging exams. But CDS does much more than saving costs - data analysis shows that appropriateness improves significantly following the introduction of CDS. Appropriateness recommendations enable referrers and radiologists to manage their workload more efficiently by allowing them to focus on the more complex cases. Furthermore, through the data captured in CDS systems it is possible to collect information on appropriateness to manage workload and improve performance, or to determine the need for procuring certain types of imaging equipment.

Session Objectives:

1. To understand what CDS is and how it works.
2. To learn more about imaging referral guidelines in Europe.
3. To understand how CDS can be successfully implemented in practice.
4. To understand the added value and cost-effectiveness of CDS.

A-256 16:05

What is a clinical decision support system?

F. Sardanelli; *San Donato Milanese/IT*

A clinical decision support system (CDSS) is a computerized tool translating knowledge into evidence-based (EB) practice. The rationale is that the physician who should decide about an individual patient could be not aware of the best external evidence regarding the problem to be decided. This gap is theoretically filled in by EB guidelines, systematic reviews/meta-analyses, decision analysis studies, and high-quality original researches (top-down model) or by a personal critical appraisal of the literature for a well-defined answerable question (bottom-up model). However, both models are time consuming and not routinely applicable. This is easy to be understood considering that clinical guidelines are commonly composed of tens of pages and tables, comprising many different clinical questions: also if available in digital version, they require a long time for reading and for understanding how they can be applied to an individual patient, so frequently having comorbidities and limiting conditions. A CDSS offers a fast aid to consider and, possibly, to comply with EB rules, guiding physicians in decision making. The crucial aspect is that a CDSS gives you a tailored assessment and treatment recommendations based on individual patient data you enter into the system. Relevant applications of CDSSs to radiology are those related to recommendation of diagnostic tests for a clinical context (i.e., for a symptomatic patient) of for screening, considering the risk level of disease estimated in an individual asymptomatic subject. Thus, CDSSs will probably play a pivotal role in the era of P4 medicine: personalised, predictive, preventive, participatory.

Learning Objectives:

1. To understand the principles of and rationale for CDS.
2. To learn how CDS fits into the clinical workflow.
3. To understand why CDS provides much more than just a digital version of guidelines.

A-257 16:20

Imaging referral guidelines in Europe

M.G.M. Hunink; *Rotterdam/NL (m.hunink@erasmusmc.nl)*

Diagnostic medical imaging is essential in health care and guides patient management decisions. Imaging enables early diagnosis but may also lead to overdiagnosis. Costs of diagnostic imaging represent 5-10% of total health care costs, and the annual growth rate is 8-16%. An estimated 20-50% of imaging procedures are unnecessary. Multiple guidelines have been published to help the clinician choose the right test for the right patient at the right time. Although these guidelines are presumably based on the same underlying evidence, their recommendations demonstrate substantial variation and are furthermore rapidly outdated with the introduction of new imaging technologies and new insights into imaging. To facilitate appropriate and safe use of imaging procedures, the ESR has undertaken the task of developing European imaging referral guidelines, to update these on an ongoing basis, and to implement them for day-to-day practice through appropriateness criteria. Appropriateness criteria are implemented through computerized decision support systems (CDSSs) so that the advice is presented at the point-of-care. ACR select and ESR iGuide are such systems. Nevertheless, the results of implementation of CDSSs for guiding imaging referrals is not (yet) convincing: considerable uncertainty remains as to whether CDSSs really are effective in guiding the justified use of imaging procedures, the effect on patient outcomes and values is unmeasured, the net cost consequences are largely unknown, and the current systems lack personalised advice.

Learning Objectives:

1. To understand the challenges of developing guidelines for heterogeneous European countries.
2. To learn about the varying experiences of implementing CDS and imaging referral guidelines in different countries.
3. To understand the differences between an in-depth scientific guideline development process and practical recommendations for daily use of guidelines.

Author Disclosure:

M.G.M. Hunink: Advisory Board; EIBIR. Author; Textbook: Decision Making in Health and Medicine. Integrating Evidence and Values. Research/Grant Support; ESR, ZonMW, STW.

A-258 16:35

An effective clinical decision support system

G. Boland; *Boston, MA/US (gboland@partners.org)*

Clinical decision support systems are increasingly being used as a tool to manage clinical variance, particularly at the point of care, as healthcare tries to deliver better outcomes for patients, whilst managing cost. However, development and composition and framework for implementation are all critical ingredients to success. CDS tools should be consensus driven, effective, transparent, adaptable, iterative, reproducible, standardised, integrated, easy to use, educational and can be data mined. This discussion will focus on the background to CDS tools with a focus on radiology. It will explore the lessons learned from a decade of experience with CDS order entry to guide imaging appropriateness. The challenges and opportunities from these lessons will be highlighted. Future direction for CDS tools will be explored, including radiologists recommendation CDS tools.

Learning Objectives:

1. To understand the practical advantages and benefits of implementing CDS.
2. To understand the managerial and medical challenges of introducing CDS.
3. To learn more about the educational and behavioural changes brought about by CDS.

Author Disclosure:

G. Boland: Consultant; Radiology Consulting Group.

A-259 16:50

Cost-effectiveness of clinical decision support

P. Mildenberger; *Mainz/DE (peter.mildenberger@unimedizin-mainz.de)*

Clinical decision support (CDS) is used in different context. Mostly, CDS is implemented to support referring physicians in selection of the appropriate imaging method. It has been demonstrated that such CDS support can decrease the number of non-indicated/non-appropriate procedures, which directly reduces costs. In addition, CDS can be used to support reporting. In such manner, CDS can help to improve the quality of recommendations for further steps in diagnostic procedures or follow-up examinations. This has impact on cost too. Clinical examples for such workflows will be demonstrated and discussed.

Learning Objectives:

1. To understand the cost-benefit relation of implementing CDS.
2. To learn more about the various costs-financial and otherwise-of implementing CDS.
3. To understand the direct and indirect benefits of CDS.

Author Disclosure:

P. Mildenberger: Board Member; IHE-Europe. Speaker; Fédération des Hôpitaux Luxembourgeois, Bracco.

17:05

Panel discussion: Is CDS really adding value to healthcare in addition to radiation safety?

16:00 - 17:30 **Room E1**

Musculoskeletal

RC 810

Sports injuries to the knee: improving my report

A-260 16:00

Chairman's introduction

V. Vasilevska Nikodinovska; *Skopje/MK (v_vasilevska@yahoo.com)*

The musculoskeletal radiologist has a pivotal role in diagnosis, prognosis, and in management of knee sports injuries. MR imaging has been accepted as the best imaging tool to assess knee injuries. However, numerous potential pitfalls may affect the interpretation of knee MR imaging and may lead to diagnostic errors. Radiologist should be familiar with the pitfalls due to various factors such as: technique, imaging artefacts, normal variants, and lack of clinical or radiographic correlation. Report of meniscal tear location and morphology, and associated injuries (anterior cruciate ligament (ACL) injury or osteoarthritis) can help in formulating treatment plans. In young patients, normal increased signal of meniscus and at growth plate can easily be mistaken for pathology. Knowledge of complex anatomy of supporting structure of the knee, lateral collateral ligament and posterolateral corner, as important stabilizers, is crucial for accurate analysis of MR images of the knee. Their injuries may go unrecognised until they present as a chronic problem with knee instability. Injuries of these structures may be seen in conjunction with cruciate ligaments injuries. Chronic ruptures of the ACL results in knee instability. Instability of the posterolateral corner may lead to overload of the ACL graft and may be one of the reasons for failure of the cruciate ligament reconstruction. In knee sports imaging, the orthopaedist needs to know what pathology is present, healthy anatomy should be recognised and normal variants are to be interpreted.

Session Objectives:

1. To understand how the structure of reporting influences clinical interpretation and treatment.
2. To appreciate the value of assessing both familiar and less familiar structures in the traumatised knee.

A-261 16:05

A. Reporting meniscal tears: pitfalls and how I avoid them

G. Andreisek; *Zurich/CH (gustav.andreisek@usz.ch)*

Standardised image evaluation and interpretation as well as reporting is crucial for proper diagnosis as well as communication amongst health care providers. In the knee, many structures are usually evaluated including the meniscus. Several standard criteria (size, location, signal intensity) can be applied and are usually well known. However, several pitfalls need to be avoided especially in the postoperative knee. In addition, there are portions of the meniscus, which are usually missed during reporting such as the roots or the ligamentous attachments of the meniscus to the capsule. This talk will revise some technical issues regarding imaging protocols to provide proper meniscus images, the standard anatomy of the menisci including the roots and their ligamentous attachments, and will use clinical cases to illustrate the most common pitfalls in the pre- and postoperative knee to provide advice on how to avoid them.

Learning Objectives:

1. To understand how normal appearances can mimic meniscal tears.
2. To understand pitfalls in the diagnosis of meniscal tears.

A-262 16:28

B. The collateral ligaments and posterolateral corner: what are they, why do they matter and how do I assess them?

U. Aydingoz; *Ankara/TR (uaydingo@hacettepe.edu.tr)*

Collateral ligaments and the structures at the posterolateral corner are important in the stability of the knee. This lecture will cover their anatomy (including recently described structures) as it pertains to imaging, describe their injury patterns and corresponding imaging findings, and provide hints about wording the radiological findings. It is especially important to mention in an MRI report the posterolateral corner integrity in the setting of anterior cruciate ligament injury as it has direct impact on the management of the patient.

Learning Objectives:

1. To appreciate the significance of the collateral ligaments and posterolateral corner.
2. To understand pitfalls in the diagnosis of posterolateral corner injuries.

A-263 16:51

C. Imaging the reconstructed ACL in athletes: how to assess and what to report

A.P. Parkar; *Bergen/NO (apparkar@gmail.com)*

The ruptured anterior cruciate ligament (ACL) is regularly reconstructed. Preoperative radiographs provide valuable information about intercondylar slope and extension in the knee joint. In the past, reconstruction techniques focused on isometric grafts, though recently there is a clear turn towards "anatomic" reconstruction. This has led to a marked increase in early postoperative imaging to assess tunnel placements. Femoral tunnel placements are evaluated in a grid and tibial tunnel placements are evaluated in the lateral view. Graft impingement is evaluated in the lateral view with the knee in full extension. Early imaging also detects hardware failure and may serve as a baseline for later examinations. Radiographs and CT are usually used for early assessment. MRI is excellent for assessing soft tissue complications, such as localised arthrofibrosis (Cyclops lesion), re-rupture of the graft, concomitant meniscal or missed injuries to lateral stabilizing structures. The graft may have high signal intensity for as long as two years post-operatively. Anterior translation of the tibia is a useful indicator of partial rupture and consequent instability, rather than graft signal in this period. Further useful signs are uncovering of the posterior horn of the lateral meniscus and buckled posterior cruciate ligament, although MRI is not sufficiently accurate to differentiate between unstable and stable knee ligament injuries.

Learning Objectives:

1. To be able to distinguish normal from pathological postoperative imaging features in ACL reconstruction.
2. To understand the clinical relevance of postoperative ACL reconstruction imaging.

17:14

Panel discussion: How will the patient and clinician be most helped by our report, and is there a role for structured reporting?

16:00 - 17:30 **Room E2**

Multidisciplinary Session

MS 8

Pancreatic cancer: radiological diagnosis and treatment

A-264 16:00

Chairman's introduction

L. Grenacher; *Munich/DE (l.grenacher@diagnostik-muenchen.de)*

Pancreatic cancer is one of the most aggressive cancers with a median overall survival of 5-8 months. Recent advances and novel treatment options have improved especially for locally advanced cancers survival in recent years. Surgical resection is the only chance for potential curative treatment and, therefore, patients with resectable disease should be primarily resected even if an extended resection is necessary followed by adjuvant chemotherapy currently using gemcitabine. To identify a resectable tumour stage the

radiologic modality with the highest spatial resolution should be chosen to diagnose the tumour involvement in the visceral vessel segment. Multidetector CT is the method of first choice as staging modality and has the potential with newly developed functional imaging techniques to differentiate between inflammatory and cancer disease and for early detection of local recurrence. Radiotherapy plays a role in the neoadjuvant setting for borderline resectable pancreatic tumours. It can facilitate resection and increase the probability of negative resection margins. In stage IV PDAC the current standard of care is combination chemotherapy with FOLFIRINOX for patients with very good performance status, the combination of nab-paclitaxel+gemcitabine has also been approved for first-line treatment. Both regimens lead to median overall survival of significantly less than one year. Palliative radiotherapy regimens, however, still have an important role in patients with poor pain control. These palliative doses are usually administered in between chemotherapy cycles. The treatment of especially locally advanced pancreatic cancer is an interdisciplinary challenge that should be performed at specialised centers only.

Session Objectives:

1. To become familiar with state of the art imaging modalities for diagnosis, staging and therapy of pancreatic ductal carcinoma (PDAC).
2. To learn present decision algorithms for individual therapy strategies of PDAC in tumour boards.
3. To understand the value of new functional imaging modalities of PDAC.
4. To become familiar with new surgical, medical and radiation therapy protocols for PDAC and their potential survival benefit for the patients.

A-265 16:05

Surgical oncological management

J. Werner; *Munich/DE*

"no abstract submitted"

Learning Objectives:

1. To understand actual surgical therapeutic options of PDAC and the overall survival.
2. To become familiar with surgical options in case of local recurrence.
3. To understand the value of more aggressive surgical strategies.

A-266 16:20

Medical oncological management

D. Jäger; *Heidelberg/DE (dirk.jaeger@nct-heidelberg.de)*

The current standard of care for patients with resectable PDAC is surgery followed by adjuvant chemotherapy currently using gemcitabine. If combination treatments that have shown activity in metastatic disease PDAC lead to improved OS in the resectable situation needs to be shown. In stage IV PDAC the current standard of care is combination chemotherapy with FOLFIRINOX for patients with very good performance Status. The combination of nabPaclitaxel + gemcitabine has also been approved for first line treatment. Both regimens lead to median overall survival of signficantly less than one year. If novel treatment strategies like checkpoint inhibition will play a role in PDAC is still open, objective response rates with aPD1 or aPDL1 antibodies are very low. We will see novel combination strategies with checkpoint inhibitors combined with drugs that specifically modulate the tumour environment by either depleting macrophages or address other immunosuppressive features in the near future. The hope is that by overcoming the extremely immuno suppressive tumour environment checkpoint inhibitors might play a significant role in advanced PDAC.

Learning Objectives:

1. To learn about actual chemotherapeutic therapy of PDAC and potential benefit of combination with surgery.
2. To understand the survival benefit of oncological therapies.
3. To understand the development of chemotherapeutic strategies: from Gemcitabine mono to new immunological therapies.

A-267 16:35

Radiology oncological management

L. Grenacher; *Munich/DE (l.grenacher@diagnostik-muenchen.de)*

With regard to the German S3 guideline 2013 for exocrine pancreatic carcinomas endosonography as well as MDCT is the method of first choice for local staging of pancreatic adenocarcinomas. The highest spatial resolution is mandatory for exact determination of potential arterial or venous vessel infiltration for an exact T staging and the decision making of resectability. CT is, therefore, the method of first choice and superior to MRI for staging and for early detection of local recurrence. New functional imaging methods as DWI MRI and dual-energy CT techniques could give additional information to differentiate between inflammatory disease and other entities, for example autoimmune pancreatitis. To overcome today's limitations in differential diagnosis and exact determination of resectability vs. chemotherapy functional imaging methods should be added to daily routine protocols.

Learning Objectives:

1. To learn about diagnosis and staging of PDAC - which modality?
2. To understand the value of new functional imaging techniques.
3. To become familiar with the role of imaging in case of local recurrence.

A-268 16:50

Radiation oncological management

F. Sterzing; *Heidelberg/DE (florian.sterzing@med.uni-heidelberg.de)*

Radiotherapy plays a role in the neoadjuvant setting for borderline resectable pancreatic tumours. It can facilitate resection and increase the probability of negative resection margins. A combined modality approach with gemcitabine or 5 FU is used. Currently purely systemic approaches using FOLFIRINOX or gemcitabine/nab-paclitaxel are widely used and the importance of radiotherapy decreases for this indication. Adjuvant radiotherapy is no standard, chemotherapy is usually used. Palliative radiotherapy regimens, however, still have an important role in patients with poor pain control. These palliative doses are usually administered in between chemotherapy cycles. While 3D conformal radiotherapy is used in most trials, modern technologies as intensity-modulated radiotherapy enable an improved sparing of sensitive organs at risk. Proton or carbon ion radiotherapy are still experimental.

Learning Objectives:

1. To learn about indications for radiation therapy: state of the art.
2. To understand new radiation techniques and their benefit for patients with PDAC.

17:05

Multidisciplinary case presentation and discussion

1. To learn about decision making in individual cases of PDAC.
2. Multidisciplinary therapy strategies in patients with PDAC: time consuming or individual concept for significant increase of survival?

16:00 - 17:30 **Room F1**

Professional Challenges Session

PC 8b

An introduction to European Imaging Biomarker Alliance (EIBALL)

A-269 16:00

Chairman's introduction

P.M. Parizel; *Antwerp/BE (paul.parizel@uantwerpen.be)*

The mission of the European Imaging Biomarker Alliance (EIBALL) is to coordinate all ESR activities concerning imaging biomarkers, and to prepare an inventory of all activities and projects in the field of imaging biomarkers where the ESR is involved. EIBALL was created by merging the activities of the former ESR Subcommittee on Imaging Biomarkers, ESR Working Group on Personalised Medicine and ESR-EORTC Working Group. EIBALL aims to actively promote the development of imaging biomarkers (in different body regions, oncologic as well as non-oncologic), by providing a toolbox that contains information about current projects, centres involved in clinical trials and educational activities. The operational work of EIBALL will fall under the responsibility of EIBIR. Within EIBALL, the EIBIR representative will report and bring information about European projects and calls. EIBIR, based on a survey, should establish a network of European centres of excellence (core institutions) for the implementation and clinical validation of imaging biomarkers. EIBALL is to create an Imaging Biomarker Task Force to promote standardisation of image acquisition and analysis, and to implement quality assurance measures. EIBALL will operate in close collaboration with QIBA™ (technical validation synergies) to avoid duplication of development, and with EORTC (biological validation) to coordinate strategies, find complementarity, and benefit from synergies. ESMOFIR and ESMRMB will be responsible for developing scientific and educational activities.

Session Objectives:

1. To understand the mission and vision of EIBALL.
2. To learn how EIBALL promotes imaging biomarker development.
3. To become familiar with the main activities and collaborations of EIBALL.

A-270 16:03

EIBALL and its mission

S. Trattnig; *Vienna/AT (siegfried.trattnig@meduniwien.ac.at)*

The European Imaging Biomarker Alliance (EIBALL) was officially introduced at the ECR conference in 2015. Within the ESR Research Committee a restructuring was necessary, since there was a need for coordination of all activities in the field of imaging biomarkers, a need to restructure existing

resources and bodies and a need to increase collaboration with QIBA (Quantitative Imaging Biomarker Alliance) and EORTC (European Organisation for Research and Therapy of Cancer). The tasks of EIBALL were defined as follows: Prepare an inventory of all activities and projects in the field of Imaging Biomarkers where ESR is involved. The alliance should become a tool box that provides information about current projects, centres involved in clinical trials and educational activities. The operational work of the alliance should become the responsibility of EIBIR. Collaboration with EORTC is of high importance since EORTC has 150,000 patients in database with 50,000 in the follow-up and 18 disease oriented group (DOG). In collaboration with Imaging Group and the DOG imaging protocols can be implemented in EORTC trials which allows validation of imaging biomarkers in a large number of patients. A quality assessment/quality control system with a checklist for imaging biomarker in EORTC trials is implemented to get more acceptance of imaging by EORTC. Close collaboration with QIBA is planned to avoid duplication of development, to coordinate strategies, find complementarity and benefit from synergies. Subspeciality societies such as ESMOFIR and ESMRMB will be responsible for scientific and educational activities in EIBALL.
Learning Objectives:
1. To become familiar with the goals of EIBALL.
2. To learn about collaborations with QIBA.
3. To understand the different main strengths of EIBALL and QIBA.

A-271 16:20

The potential role of EIBALL for EORTC multicentre trials
Y. Liu; *Brussels/BE (yan.liu@eortc.be)*

The role of imaging biomarkers in clinical trials has evolved, thanks both to improvement in conventional imaging methods and to innovation in functional imaging techniques. Imaging biomarkers are involved throughout the drug development process, and serve many purposes such as outcome measures, inclusion criteria (patient selection and stratification), and safety monitoring tools (measure harm or lack of harm). Despite the obvious value of imaging biomarker, its integration into trials faces various challenges, such as the complexity of imaging techniques, the lack of standardization across multivendor platforms, and the paucity of optimised trial design and operational support. Those pitfalls become more noticeable, especially in centers with little experience in trials that involve imaging. The European Imaging Biomarker Alliance (EIBALL) is an initiative with an extended network of high-quality imaging centers, which provides valuable resources to conduct imaging biomarker-driven clinical trials. In this presentation, a road map for further collaborations between EIBALL and EORTC (European Organisation of Research and Treatment for Cancer) will emerge with the aim of qualifying and validating imaging biomarkers in multicenter clinical trials. The qualification path will be demonstrated with a concrete trial example (EORTC 1423, NCT02355353), which evaluates apparent diffusion coefficient (ADC) derived from diffusion-weighted MRI as an early readout of response to treatment in patients with liver metastases from colorectal cancer.
Learning Objectives:
1. To understand how EORTC benefits from EIBALL.
2. To learn about the role of imaging biomarker in clinical multicentre trials.
3. To become informed of EORTC multicentre trials jointly performed with EIBALL.

A-272 16:37

The organisational role of EIBIR in EIBALL
V. Vilgrain; *Clichy/FR (valerie.vilgrain@bjn.aphp.fr)*

The idea of creating a body that would improve European image-related research activities was born in 2000. It emerged within the former European Association of Radiology (EAR) which was later integrated into the European Society for Radiology (ESR). EIBIR was launched in 2006 as a non-profit limited liability company. Today, EIBIR proposes service packages for network members, industry partners and shareholder organisations to help or coordinate projects submitted to European programmes. Four EIBIR-supported proposals were awarded EU funding under Horizon 2020. The activities of the former ESR Subcommittee on Imaging Biomarkers, ESR Working Group on Personalised Medicine and ESR-EORTC Working Group were merged into EIBALL in 2015 to better coordinate the ESR activities concerning imaging biomarkers. Indeed, these two committees are deeply liaised and the operational work of the alliance concerning projects and calls will be the responsibility of EIBIR.
Learning Objectives:
1. To become familiar with the European network of EIBIR.
2. To learn about the role of EIBIR in the EIBALL structure.
3. To understand the organisational support activities of EIBIR for the alliance.

A-273 16:54

Imaging biomarker development for EIBALL by subspecialty societies
K. Nikolaou; *Tübingen/DE (Konstantin.Nikolaou@med.uni-tuebingen.de)*

The process of implementation, validation and standardization of imaging biomarkers poses a major challenge for the radiological community, for a number of reasons. For any newly developed (imaging) biomarker, the underlying pathophysiological mechanism has to be understood and the corresponding biomarker has to be a valid and reproducible surrogate for this pathophysiological process (proof of concept and proof of mechanism). Hence, the role of the radiological subspeciality societies (e.g. for cardiac, musculoskeletal or oncologic imaging) is significant, as only by expert knowledge on pathology, diseases and corresponding imaging techniques and applications, a sustainable development of imaging biomarkers can be propagated. In close cooperation with EIBALL, the subspeciality societies will have to solve all relevant issues in the process of developing reliable and reproducible imaging biomarkers, from standardization of image acquisition, standardization of image analysis, quality control and correct clinical use and implementation.
Learning Objectives:
1. To learn about the role of subspecialty societies in imaging biomarker development.
2. To understand the problems still to be solved with imaging biomarkers.
3. To become familiar with the transfer from technical to clinical validation of imaging biomarkers.
Author Disclosure:
K. Nikolaou: Speaker; Speaker Bureaus Siemens Healthcare, Bayer Healthcare, Bracco.

17:11
Panel discussion: What is the role of EIBALL now and in the future

16:00 - 17:30 **Room F2**

Special Focus Session

SF 8b
Assessing myocardium at-risk with MRI

A-274 16:00

Chairman's introduction
M. Gardarsdottir; *Reykjavik/IS (marianna@landspitali.is)*

Myocardial injury may occur with coronary artery occlusion and may be reversible or irreversible, depending on the duration of the occlusion. The distinction between irreversible necrosis and damaged but possibly viable myocardium is important to choose the appropriate course of action to save as much myocardium as possible in the acute setting, for re-vascularisation in the sub-acute setting or for recognition in the chronic setting. For the clinical importance it is important to understand how to assess the salvable myocardium and to provide for acceptable risk stratification in coronary artery disease therapy. Different disease conditions occur where the appropriate knowledge of the correct technique for application is important and the knowledge of different use of sequences and the understanding of contrast enhancement may impact the prevention of irreversible myocardial damage.
Session Objectives:
1. To understand technique of assessing at-risk myocardium.
2. To understand the different values of T2 imaging and delayed enhancement imaging.
3. To understand what is useful in the acute, sub-acute and chronic settings.
4. To learn how to perform studies with safety and accuracy for patients.

A-275 16:05

T2 imaging
M. Gutberlet; *Leipzig/DE (matthias.gutberlet@helios-kliniken.de)*

T2-weighted imaging has been used for cardiovascular imaging from the very beginning of cardiac MRI (CMR), especially for tissue characterisation in cardiac tumours. Furthermore, T2-weighted imaging was used in recent years more and more often to detect myocardial inflammation, oedema or other forms of reversible myocardial damage. Additionally, T2-w imaging has also been used to describe "myocardium at risk" and to quantify the success of revascularisation strategies in acute myocardial infarction by using the concept of "myocardial salvage index" calculations. However, T2-weighted imaging remains challenging whatever technique is used. Latest techniques of parametric imaging for absolute quantification and T2-map calculations may overcome some of the limitations of conventional T2-weighted imaging techniques.

Learning Objectives:
1. To understand the concept of tissue characterisation with T2 imaging.
2. To learn the meanings of inflammation, oedema and ischaemia.
2. To become acquainted with which sequences to use and what affects T2 imaging.

A-276 16:25

Late gadolinium enhancement

S. Kozerke; *Zurich/CH (kozerke@biomed.ee.ethz.ch)*

A wide range of ischaemic and non-ischaemic conditions are detected with late gadolinium enhancement (LGE) imaging and the method serves as gold standard for viability assessment of the myocardium today. The concept is based on T1-shortening due to the accumulation of a gadolinium (Gd) contrast agent within tissue after 10-30 min upon intravenous Gd injection. In infarcted myocardium the extracellular volume fraction is increased and hence a higher Gd concentration leads to reduced T1 and increased signal intensity in T1-weighted imaging. In this presentation, requirements pertaining to image contrast, spatial resolution and coverage will be reviewed. Imaging methods generating T1-weighted contrast versus quantitative T1 mapping will be introduced and compared. The importance of parameter adjustment for both T1-weighted imaging and quantitative T1 mapping is illustrated using image examples. Advanced sequence concepts using phase-sensitive inversion recovery, water-fat separation, motion correction and very fast whole heart approaches are briefly highlighted. Finally, data on the accuracy and precision of LGE and extracellular volume (ECV) mapping will be summarised and put into perspective regarding current and emerging applications.

Learning Objectives:
1. To understand the concepts of tissue characterisation with T1and T2 imaging and the concepts of delayed enhancement imaging.
2. To compare reproducibility of T1- and T2-weighted imaging vs quantitative T1 and T2 mapping.
3. To become acquainted with which sequences to use and what effects delayed enhancement imaging.

Author Disclosure:
S. Kozerke: Grant Recipient; Swiss National Science Foundation, European Research Programme.

A-277 16:45

Prognostic value of area-at-risk assessment by T2 and late enhancement imaging

A. de Roos; *Leiden/NL (A.de_Roos@lumc.nl)*

The area at risk after coronary artery occlusion is defined as the ischaemic bed distal to the occlusion. The area at risk may vary depending on the location of the occlusion in proximal (larger) or more distal (smaller) locations. Timely intervention may prevent progression of the wave front of myocardial necrosis starts at the subendocardial level, progressing throughout the area at risk in a transmural fashion. The salvageable myocardium is defined as the size difference between area at risk and area of necrosis. Various imaging techniques have been used to define both area at risk and area of necrosis. T2-weighted MR techniques (in a number of variations) have been advocated to estimate the area at risk. The assumption is that early oedema occurs in the area at risk and that T2-weighted MR techniques, therefore, allow visualisation of the area at risk as a bright region of myocardium. Late gadolinium enhancement (LGE) is mainly used to define the area of necrosis by demonstrating delayed accumulation of gadolinium in the increased interstitial space in the area of necrosis. LGE is well suited to assess the extent of the wave front of necrosis progressing through the area at risk. The endocardial surface length of LGE reflects the borders of the area at risk and has been used as another marker for the area at risk. Technical and clinical applications of T2weighted techniques and LGE will be discussed.

Learning Objectives:
1. To understand the concept of myocardial necrosis.
2. To understand different ways of estimating the extent of necrosis with delayed enhancement imaging.
3. To understand how the combined use of delayed enhancement and T2 imaging allows us to estimate salvageable myocardium after coronary occlusion and the clinical importance.

17:15

Panel discussion: How do we best assess at-risk myocardium and how do we best get the correct information across?

Discussion points:
1. What do we need to know in the acute and sub-acute setting?
2. What is the clinical use of the different methods?
3. How do we best assess at-risk myocardium and how do we best get the correct information across?

16:00 - 17:30 **Room D1**

Special Focus Session

SF 8c
Imaging in obesity

A-278 16:00

Chairman's introduction

S. Lee; *Manchester/UK (stephen.lee@cmft.nhs.uk)*

Obesity has become one of the major causes of morbidity and mortality in the developed world. The impact on health and health care resources has become an issue which can longer be ignored and needs to be addressed by the public and the appropriate authorities who deliver health care. As radiologists we must be aware of the issues surrounding the management of the obese patient which includes both diagnostic imaging, interventional radiology and recognition of the common surgical procedures performed in a Bariatric setting.

Session Objectives:
1. To outline the problems that patients with obesity present to the developed nations in the West.
2. To quantify and understand the role of intra-abdominal fat.
3. To evaluate the role of radiology in imaging patients after bariatric surgery
4. To determine the role of gastric embolisation in the treatment of obesity.

A-279 16:05

Epidemiology and current trends in obesity

N. Finer; *London/UK (n.finer@ucl.ac.uk)*

Worldwide the prevalence of obesity (BMI> 30 kg/m^2) doubled between 1980 and 2008, and it continues to increase such that in much of the world it is 'normal' to be overweight or obese. While the mechanisms of obesity relate to energy balance (i.e. energy consumed versus energy expended), the causes are more complex. Obesity is strongly heritable and mutations in genes involved in body weight regulatory pathways can result in severe childhood onset obesity (~5% of those presenting under the age of 5). Many more single nuclear polymorphisms in genes have been identified which drive and increased risk of developing obesity - of course in an environment that is permissive. In Europe, about 20-25% of the population is obese. Obesity is developing at ever earlier age increasing lifetime exposure to the risks. Few organ systems are exempt from the deleterious effects of excess adiposity, mediated by adipose tissue secretion of adipocytokines resulting in low-grade inflammation locally and systemically. Type 2 diabetes, non-alcoholic fatty liver disease, cardiovascular and cancer risk, obstructive sleep apnoea are all closely linked to obesity and the metabolic syndrome. Body mass index is not an accurate measure of total body fat, nor does it give information about fat distribution. This methodological shortcomings of epidemiological studies that have suggested modest overweight may be protective may account for this so-called 'obesity paradox': few people are fat and fit.

Learning Objectives:
1. To appreciate the scale of the prevalence of obesity worldwide.
2. To recognise the role of the environment and of genetic predisposition on the development of obesity.
3. To understand the impact of adiposity, and adiposity measures on health and disease.
4. To critically appraise the evidence for and against an 'obesity paradox'.

Author Disclosure:
N. Finer: Advisory Board; Novo Nordisk, Orexigen. Consultant; Novo Nordisk. Speaker; Novo Nordisk.

A-280 16:23

Fat quantification and advanced body composition assessment using MRI

O. Dahlqvist Leinhard; *Linkoping/SE (Olof.dahlqvist.leinhard@amraab.com)*

The development of Dixon MRI techniques and whole body MRI scanners enables high-quality water and fat-separated whole body imaging in rapid scan times. By measuring the proton density fat fraction (PDFF) or by relating the lipid signal to pure adipose tissue present in the image, the so-called fat referenced signal quantification, it is thus possible to achieve accurate and precise quantification of adipose tissue volumes, ectopic lipids, and lean tissue volumes within a region of interest. Modern image analysis methods allow for automated or semi-automated quantification of anatomical structures, such as subcutaneous fat, visceral fat, different muscle groups, liver fat, pancreatic fat, brown adipose tissue, etc. Currently, much effort is put into developing methods with improved accuracy and precision for fat and lean tissue quantification, into standardised definitions of anatomical compartments, and more rapid scanning protocols allowing widespread usage on most scanners. Today, applications of advanced MRI-based body composition are mainly

found within research regarding diseases related to metabolic syndrome, e.g. cardiovascular disease, chronic liver disease, obesity, and diabetes. Another application area is within large population studies, where body composition is an important phenotyping tool to improve understanding about complex relationships between genetic factors, diet, lifestyle, and the development of metabolic and neurodegenerative diseases. Ultimately, more specific and accurate phenotyping than biomarkers used clinically today, i.e. body mass index and waist circumference, will lead to improved prediction power for patient stratification in clinical trials, improved detection of health outcomes, and better tools for optimising clinical treatment.

Learning Objectives:

1. To describe techniques for acquisition of water- and fat-separated MRI and quantitative image analysis.
2. To describe methods for analysis of compartmental adipose tissue and lean muscle tissue quantification.
3. To discuss applications of whole-body-fat and water-separated MRI and their clinical translation.

Author Disclosure:

O. Dahlqvist Leinhard: Employee; Advanced MR Analytics AB. Founder; Advanced MR Analytics AB. Grant Recipient; Pfizer Inc. Patent Holder; Advanced MR Analytics AB. Shareholder; Advanced MR Analytics AB. Speaker; Philips Healthcare.

A-281 16:41

Imaging of modern surgical procedures and their complications

M. Rengo; *Latina/IT (marco.rengo@gmail.com)*

Obesity is a disease that has reached epidemic proportions around the world. During the past 20 years bariatric surgery has become an increasingly popular form of treatment for morbid obesity. The most common bariatric procedures performed include laparoscopic Roux-en-Y gastric bypass, laparoscopic adjustable gastric banding, and laparoscopic sleeve gastrectomy. Fluoroscopic upper gastrointestinal examinations and abdominal computed tomography (CT) are the major imaging tests used to evaluate patients after these various forms of bariatric surgery. We will illustrate the common bariatric surgical procedures, the imaging procedures accordingly to become familiar with the normal post-operative anatomy and to appreciate the role of imaging in the assessment of suspected immediate and long-term postoperative complications.

Learning Objectives:

1. To understand the common bariatric surgical procedures.
2. To understand the imaging procedures accordingly.
3. To become familiar with the normal post-operative anatomy.
4. To appreciate the role of imaging in the assessment of suspected immediate and long-term postoperative complications.

A-282 16:59

Is there a role for bariatric embolisation in the treatment of the obese patient?

C. Weiss; *Baltimore, MD/US (cweiss@jhmi.edu)*

Bariatric arterial embolisation (BAE) is a catheter-directed technique for the treatment of obesity. It involves embolisation of the arterial supply to the fundus of the stomach with the goal of reducing production of ghrelin. Ghrelin is a potent orexigenic (appetite stimulating) hormone which is released from the fundus of the stomach. In animal models BAE has been shown to reduce the release of ghrelin and lead to reductions in weight/reductions in weight gain. This procedure is now being performed in human clinical trials which have shown feasibility and safety of BAE in human subjects. A review of the literature will be performed to identify animal and human studies relating to bariatric embolisation. Content will be organised as follows: A. BAE background, rationale and hormonal physiology. B. Review of bariatric arterial anatomy in swine and human subjects. C. Critical review of the current preclinical studies: safety, feasibility and efficacy D. Critical review of previous and current early clinical studies: safety, feasibility and efficacy. E. Insight into future directions and upcoming studies pertaining to BAE. Bariatric embolisation effectively modulates ghrelin levels in animal studies and produces to reductions in weight/reductions in weight gain. BAE is being actively tested in human subjects, and it has been found to be feasible and safe. Continuing clinical studies will help establish the durable efficacy of BAE in humans.

Learning Objectives:

1. To understand the physiologic underpinnings of bariatric interventions.
2. To understand the pre-clinical and early clinical data behind bariatric embolisation.
3. To understand techniques and patient selection for bariatric embolisation.
4. To understand the potential role of bariatric embolisation in the treatment of the obese patient.

Author Disclosure:

C. Weiss: Equipment Support Recipient; Merit/Surefire. Research/Grant Support; Siemens/Merit/NIH, NIBIB. Speaker; Siemens/Merit.

17:17

Panel discussion: How best to manage obesity and its implications on the radiology department

16:00 - 17:30 **Room D2**

Special Focus Session

SF 8d

CT radiation dose optimisation: are we doing enough?

A-283/A-284 16:00

Chairmen's introduction

I.M. Björkman-Burtscher; *Lund/SE (isabella.bjorkman-burtscher@med.lu.se)*

C. Malamateniou; *London/UK (christina.malamateniou@kcl.ac.uk)*

With the advent of faster CT scanners, with more detectors and more advanced software, it is becoming imperative to be able to use this technology not only to improve the quality of diagnostic information but most importantly to ensure we continue to provide a safe environment for all of our patients, irrespective of their age and size. Customisation and optimisation of the technique used is required to achieve truly patient-centred care. Two different dose optimisation campaigns have been recently launched in collaboration with ESR to ensure this initiative is realised in both adults and children: "Image wisely" and "Image gently". The following talks will recap on the discrepancies of dose estimation and minimisation in different examination, discuss the need for standardisation, review past and current practices to optimise CT radiation dose in adults and children, highlight the gaps and challenges in current practices and the need for improvements and outline future initiatives required and promising technologies available to carry this initiative forward. These presentations will explain the examinations that need to be prioritised in response to dose optimisation, the importance of working together in multi-disciplinary teams to achieve co-ordination of this effort between radiologists, medical physicists and radiographers and the role of diagnostic reference levels as an importance metric to monitor progress.

Session Objectives:

1. To introduce the concept of radiation dose levels and dose optimisation techniques used in CT.
2. To outline the main aim of the talks of the session and how they connect to each other.
3. To refer to the main radiation protection initiatives in Europe led by the ESR.

A-285 16:05

CT radiation dose optimisation: what has been achieved so far?

J. Santos; *Coimbra/PT (joanasantos@estescoimbra.pt)*

The population exposure due to computed tomography (CT) examinations dramatically increased in the last decades. Concern is particularly justified considering the risks of ionising radiation exposure. CT technology and its clinical use has advanced in a relatively short period of time. Despite these significant technological advances, which have contributed to the improvement of image quality and faster examinations CT, if not used correctly the technology can increase the average radiation dose administered per examination. Radiographers must understand the impact of exposure parameter selection on dose values and image quality and also be familiar with recent advances in dose optimisation using different CT scanner design features. Optimisation international campaigns, created to increase awareness within the heath professionals and general public, such as Image Wisely, Eurosafe Campaign and Image Gently, were projected to stimulate best practices that contribute to dose reduction maintaining the diagnostic image quality, these recommendations must be used in current practice to promote patient safety.

Learning Objectives:

1. To consolidate knowledge regarding current radiation dose levels used in CT.
2. To become familiar with recent advances in dose optimisation using scanner design features and their impact on patient dose.
3. To understand how radiographers can optimise CT radiation doses on an individual basis.
4. To enhance understanding of international optimisation campaigns such as Image Wisely.

A-286 16:30

Dose reduction techniques in paediatric CT: from A to Z

E. Sorantin; *Graz/AT (erich.sorantin@medunigraz.at)*

According the PiDRL survey, most frequent computed tomography (CT) examinations in children are, in descending order, head/neck, chest and abdomen thus counting for about 75% of all paediatric CTs. Therefore, it makes sense to optimise these examinations first. IAEA surveys in 40 countries have shown, there is considerable lack of organisation, e.g. in about 50% of facilities protocols for children were missing, indication-based protocols available only in 57%, CTDI values for head and chest two to five times of those for adults. All of these simple facts indicate we are not doing enough for radiation protection in paediatric CT. During lecture dose relevant factors according to the "Imaging Chain" will be discussed as well as adjusting kV to paediatric needs. The influence on image quality and dose will be shown. By exploiting the fact, that if all CT parameters are kept constant but the slice thickness is just half there must be an increase in noise - in particular two times more. Therefore, if a standard examination is reconstructed at half slice thickness and image quality is still appropriate, the amount of waste radiation is in the range of 100%. Therefore, if the next examination will be reduced with, e.g. 20% mAs setting less will be for sure in appropriate quality and the process can be started again. Thus, the "half slice thickness" approach is easy to do, does not need special equipment or human resources and will help to find the appropriate dose.

Learning Objectives:

1. To consolidate knowledge of trends in paediatric CT use and the importance of optimisation in this cohort.
2. To understand how paediatric CT protocols should be 'child sized' to ensure dose optimisation in line with the Image Gently initiative.
3. To become familiar with the availability and use of paediatric referral guidelines and diagnostic reference levels and their impact on CT use and justification.
4. To consider the role of superficial shielding during CT scanning.

Author Disclosure:

E. Sorantin: Board Member; Austrian Society for Radiology and Nuclear Medicine. Consultant; Ulrich Medical Coop. Investigator; Multicenter Study for Optimisation of Intravenous Contrast Medium Injection in Pediatric CT - academic study, Study in Pharmacokinetics, safety and efficacy of Dotarem in children up to 2 years of age - GUERBET. Speaker; ECR, ESR, DRG, ESR, IAEA.

A-287 16:55

Challenges and opportunities in CT dose optimisation: what can we do in the future?

S.J. Foley; *Dublin/IE (shane.foley@ucd.ie)*

This presentation discusses present challenges related to CT radiation dose optimisation. It outlines difficulties in dose estimation in CT using current metrics of CTDI and DLP, namely that these are not measures of patient dose per se and are intended more for comparative purposes than for individual dose assessment. It will also discuss the potential role for newer metrics such as size-specific dose estimate (SSDE) to allow more accurate assessment of individual dose, while also considering the potential for future improved dose metrics. The issue of standardisation of CT practice will also be examined with attention paid to differences in CT use locally, nationally and internationally by reviewing radiation dose differences between scanners, centres and manufacturers, using information from studies into diagnostic reference levels. In particular, the issue of subjective preferences will also be examined which impact on patient dose and image quality and with a current dearth of guidelines on minimum acceptable standards. The impact of the new European Directive on Basic Safety Standards will also be considered in light of dose optimisation. Finally, future developments in scanner design will be contemplated with special consideration of dose optimisation features that could significantly reduce CT radiation doses while maintaining or improving image quality.

Learning Objectives:

1. To understand difficulties in dose estimation in CT using current metrics of CTDI and DLP and the potential role for newer metrics such as size-specific dose estimate (SSDE).
2. To become familiar with the lack of standardisation between scanners and protocols across centres and the role of diagnostic reference levels.
3. To gain an understanding of future developments in scanner design that will aid radiation dose optimisation.

17:20

Panel discussion: What are the suggested priorities and actions for CT dose optimisation?

16:00 - 17:30 **Room K**

American College of Radiology (ACR) Session

ACR

Delivering higher value care in radiology: how to make it work in clinical practice - perspectives from the American College of Radiology

Moderators:
B. Allen, Jr.; Birmingham, AL/US
H.-U. Kauczor; Heidelberg/DE

A-288 16:00

Awareness to accountability: coping with the mandates for documenting higher-value care

B. Allen, Jr.; *Birmingham, AL/US (bibb@mac.com)*

US Health and Human Services Secretary, Sylvia Burwell, recently stated that 85% of US Medicare fee-for-service payments will be tied to quality or value by 2016, but the imperative for radiologists to document the delivery patient-centric higher value care is not limited to the United States. Organized radiology not only has the ability but the responsibility to empower radiologists to transition from volume-based to value-based care and position their practices for future success. At the ACR, we believe development meaningful metrics specific to radiology for quality reporting and promoting these to policy makers is critical. We are partnering with radiologists to develop tools to capture quality information as part of our daily workflow either though PACS, dictation software or EHR. If metrics are standardised, we have an opportunity for national or even international registry reporting, which offers not only opportunity for internal process improvement but also benchmarking. In the US, these registries can be designated as Qualified Clinical Data Registries by our government agencies to be used for quality reporting in the Physician Quality Reporting System and also by American Board Radiology for meeting Practice Quality Improvement requirements for Maintenance of Certification. Our goal is for radiologists to seamlessly participate in these programs automatically by reporting their metrics to the registries and monitoring their dashboards for areas that need improvement. Additionally, registry reporting allows data mining that will support future socioeconomic research in radiology and plays a significant role in supporting radiologist participation in population health management.

Learning Objectives:

1. To review radiology's efforts to raise awareness and promote culture change among radiologists to adapt to health system and consumer initiatives for value-driven care.
2. To review organised radiology's efforts to raise awareness and promote culture change among radiologists to adapt to the mandates of health reform.
3. To discuss radiology societies' role in empowering radiologists to document the delivery of higher value care through metrics development, policy maker engagement, and data collection/registry development for reporting quality data to policy makers and certification bodies.

A-289 16:25

Radiologists' role in delivering higher-value care through population health management

W.T. Thorwarth; *Reston, VA/US (wthorwarth@acr.org)*

There is a worldwide demand for increasing value in healthcare delivery. Radiologists must embrace this movement and explore all avenues available to demonstrate the value we bring and implement improvements to advance this effort. This is not limited to episodic interpretation of imaging studies or minimally invasive procedures. Donald Berwick, past USA Medicare administrator, described the "Triple Aim" of: 1) improving the individual experience of care, 2) improving the health of populations, and 3) reducing the per capita costs of care for populations. This session will focus on how radiology as a profession, radiology specialty societies, radiology practices and radiologists as individuals can advance the second and third of these objectives.

Learning Objectives:

1. To examine current trends and mandates for physician involvement in population health management.
2. To discuss the value radiologists can bring to population health management and how this role will become an important resource for their health systems.
3. To identify the tools radiologists can use in their practices to be effective in population health management by reducing variation in radiological care.

A-290 16:50

Involving patients in their radiological care: radiologist visibility, personalised care and improving outcomes

D.C. Kushner; *Virginia Beach, VA/US (dckushner@yahoo.com)*

The concept of "Patient- and Family-Centered Care" is a current focus of the American College of Radiology. The specialty of radiology, with long-term leadership from the ACR, has made decades of significant improvements in imaging care through research, technological development, advances in IT, safety and quality. While these efforts have benefited patients worldwide, the world population itself has continued to change. Patients and families have been empowered by new developments in telecommunications, social media, instant access to information and globalization of services. These changes have produced new patient and societal expectations for all health care providers, physicians and institutions. In this light, the ACR has developed a new commission on Patient- and Family-Centered Care that will focus more broadly on harnessing both established and new methods to engage the patient and family in imaging care. Such engagement will produce more recognition of radiology as a specialty and the radiologist as a physician. Furthermore, this new trend will vastly improve communications of results to patients and families as well as improving their understanding of their individual health challenges. Finally, improved involvement of patients and families will permit more effective re-design of imaging processes and procedures so that satisfaction with and confidence in imaging will improve for the patients, families and referring physicians.

Learning Objectives:

1. To discuss the ways radiologists can enhance patients' experiences throughout the continuum of radiological care.
2. To identify ways to improve patient outcomes through effective communication.
3. To leverage the value of patient-centred radiological care as a resource for health systems.

17:15

Questions and answers

16:00 - 17:30 **Room G**

E³ - ECR Academies: Neuroradiology: from Morphology to Function

E³ 819

Cerebral blood flow quantification

A-291 16:00

Chairman's introduction

A. Jackson[1], T. van der Zijden[2]; *[1]Manchester/UK, [2]Edegem/BE (thijsvanderzijden@hotmail.com)*

Accurate non-invasive measurement of cerebral blood flow is one of the most valuable research and clinical tools in the neurosciences. Unfortunately, although a number of methodologies have been described and are in common use there are still major variations in the implementation of different techniques and, more importantly, in the components of blood flow that they measure. Different methodologies aim to quantify arterial/arterial inflow, capillary perfusion or large vessel blood flow. It is essential to understand the underlying biological structures and function of regional vasculature, the interaction of water systemic and local autoregulatory mechanisms affecting flow and, in the case of pathology, the changes that occur in both structure and physiological response. In this session we will outline, in particular, the use of arterial spin-labelling techniques, identifying variations in technique and the effect of those variations on blood flow measurements and presenting current consensus opinions. We will also explore in detail the underlying physiological processes that control blood flow in health and disease and see examples of both research and clinical applications of these methodologies.

A-292 16:03

A. Functional imaging of cerebral perfusion

A. Krainik; *Grenoble/FR (akrainik@chu-grenoble.fr)*

The lecture presents the functional properties of the cerebral vasculature, including neurovascular coupling, autoregulation, and vasoreactivity to circulating gases. We see how to conduct functional imaging of perfusion, especially using MRI under hypercapnic challenge. We show that this method allows to estimate the impact of functional changes of perfusion on activation fMRI in aging and brain-lesioned patients referred for stroke and tumour. It also provides critical information on the vascular reserve in patients referred for steno-occlusive disease, neurodegenerative diseases, tumour, seizure, etc.

Learning Objectives:

1. To understand that functional imaging of perfusion enables the study of properties such as vasoreactivity to circulating gases, autoregulation and neurovascular coupling.
2. To show that functional imaging of perfusion can influence therapeutic strategy through estimation of the vascular reserve and the risk of ischaemia.
3. To learn that functional MRI of vasoreactivity is of value in understanding functional MRI activation.

A-293 16:32

B. Cerebral blood flow measurements with arterial spin-labelling

X. Golay; *London/UK (x.golay@ucl.ac.uk)*

Arterial spin labelling (ASL) is an MRI perfusion imaging method capable of providing quantitative estimates of cerebral blood flow (CBF). Unlike Gd-based methods, ASL cannot generally provide measurements for cerebral blood volume (CBV). The measurement of perfusion is obtained in ASL by non-invasive labelling of arterial blood water proximal to the tissue of interest. These labelled spins are then imaged at a later time point after exchange with the tissue magnetization. As such, it can be repeated over a time period of a few seconds or minutes, and has a wide range of applications in the brain, from basic neuroscience to applied clinical neurology, as well as for the assessment of organ homeostasis anywhere in the body. By varying the time between labelling and imaging, one can assess the bolus arrival time (BAT), which can be a very useful parameter in neurovascular diseases. There are numerous ways of labelling arterial water spins, which lead the whole field to develop into many different pulse sequences, with varying readout techniques and acquisition schemes. A recent 'White paper' has been published by the major players in the field, stating what is thought to be the best way to perform ASL measurements today, including quantification of perfusion. This presentation will summarise the main aspects of perfusion quantification, and the latest developments in the field to provide adequate quantitative imaging in patient populations.

Learning Objectives:

1. To reveal how arterial spin labelling (ASL) can accurately measure cerebral blood flow (CBF).
2. To present an overview of the advantages and limitations of using ASL in adult and paediatric subjects.
3. To show that the use of subject-specific model parameters (for example particularly blood and tissue T1) can improve the accuracy of CBF estimates.

Author Disclosure:

X. Golay: Board Member; Imgenious Ltd. CEO; Gold Standard Phantoms Ltd. Consultant; Olea Medical. Research/Grant Support; Olea Medical, Chiesi Pharmaceutical.

A-294 17:01

C. Cerebrovascular reserve imaging and the consequences of neurovascular uncoupling

D. Mikulis; *Toronto, ON/CA (mikulis@uhnres.utoronto.ca)*

The purpose of this presentation is to discuss the implementation of MRI-based cerebrovascular reactivity measurement in a clinical setting. This topic will be addressed in 5 sections: 1) Mechanisms of brain blood flow control, 2) Physiological functional hyperemia, 3) Application of CO_2 stimuli for the measurement of CVR, 4) Neurovascular uncoupling, and 5) Clinical utility of CVR. Points of emphasis will include: 1) Benefits of stimulus quantification, 2) Consequences of severely reduced CVR in terms of future risk of stroke as well as cortical thinning that can occur in the absence of acute ischemic events, 3) Challenges facing clinical implementation, and 4) Informed patient selection for revascularisation.

Learning Objectives:

1. To understand the importance of predicting haemorrhagic transformation in patients with acute ischaemic stroke.
2. To review imaging techniques to predict haemorrhagic transformation and show clinical examples.
3. To investigate if texture analysis of postcontrast T1-weighted MR images is a better predictor of haemorrhagic stroke transformation than visual evidence of contrast-enhancement.

Author Disclosure:

D. Mikulis: Grant Recipient; David Mikulis. Patent Holder; David Mikulis. Research/Grant Support; CIHR, GE Healthcare. Shareholder; Thornhill Research, Inc.

16:00 - 17:30 **Room M 1**

Vascular

RC 815

Carotid artery disease: so what's new?

Moderator:
T. Jargiello; Lublin/PL

A-295 16:00

A. The diagnostic assessment of carotid arteries
R. Iezzi; *Rome/IT (roberto.iezzi.md@gmail.com)*

Stroke is the third leading cause of death in industrialised nations, behind heart disease and cancer, and a leading cause of long-term disability. The current indication for intervention in patients with carotid artery stenosis is based primarily on the degree of stenosis and symptoms. Carotid ultrasonography, CTA, and MRA can provide the information needed to guide the choice of medical, endovascular, or surgical treatment. As each imaging modality has strengths and weaknesses, choosing among the available vascular imaging modalities, deciding when to combine multiple modalities, and judicious application of angiography are challenging aspects of evaluation in patients with carotid artery disease. These features will be discussed and highlighted in the presentation to obtain a suggested diagnostic algorithm for diagnosis and follow-up of patients with carotid artery disease. The final section of the presentation will be dedicated on the discussion about plaque instability that in recent studies seems to be crucial in the aetiology of acute cerebral ischaemic events in patients with carotid disease. Some authors advocate the possibility that patients may soon be selected for intervention based more on plaque vulnerability than on the degree of stenosis or symptoms. The challenge could be to identify patients at high risk who have lesions that are vulnerable to thrombosis, so-called "vulnerable-plaques", before the event occurs. Moreover, to tailor and improve treatment strategies, appropriate diagnostic methods must be chosen that are able to determine the patient-specific risk of experiencing a cardiovascular event, the so-called "vulnerable-patient".
Learning Objectives:
1. To understand the role of US, CT, MR and DSA in diagnostic assessment.
2. To learn the optimal imaging algorithm for diagnosis and follow-up.
3. To appreciate the role of plaque characterisation in routine practice.

A-296 16:30

B. Carotid stenting vs endarterectomy: is the jury back yet?
S. MacDonald; *Newcastle upon Tyne/UK*

"no abstract submitted"
Learning Objectives:
1. To understand the evidence supporting surgery and endovascular therapy.
2. To understand why the trials have been slow to bring clarity to optimal therapy.
3. To learn how best to triage patients for surgery or endovascular therapy.

A-297 17:00

C. Carotid interventions in the setting of acute CVA
S. Sencer; *Istanbul/TR (serrasencer@gmail.com)*

Carotid stenting is a well-established method of revascularisation in patients with carotid stenosis. Indications for carotid stenting are based upon the symptomatic status of the patient, degree of stenosis and possibly other factors (patient features such as co-morbidities, life expectancy, age, sex, etc). In pre-treatment evaluation, Doppler USG, CTA and MRA can be used to investigate the degree of stenosis and plaque character. Catheter angiography is usually reserved for cases where there is a discrepancy between noninvasive vascular imaging techniques. Cerebral MRI with diffusion-weighted imaging is used for assessing ischaemic lesions (symptomatic and silent) in the territory of intended treatment as well as other findings. In patients with acute CVA, non-contrast head CT and advanced imaging techniques such as CT perfusion and perfusion MR studies can also be utilised for selecting the suitable treatment strategy. In the setting of acute stroke treatment, carotid angioplasty and/or stenting can be performed as an adjunct to thrombectomy/thrombolysis or as the primary choice of therapy depending on the angiographical findings. Dissection of the carotid artery may also present as an acute clinical picture and is also treated with carotid stenting. The technique and equipment for carotid stenting is chosen according to the type of carotid stenosis and DSA findings based on the vascular disease.
Learning Objectives:
1. To understand the indications and contraindications to carotid stenting.
2. To appreciate how CT/MR can aid patient selection for carotid stenting.
3. To learn about carotid stenting in the setting of acute thrombosis/dissection.

16:00 - 17:30 **Room M 2**

Cardiac

RC 803

Imaging of heart failure

A-298 16:00

Chairman's introduction
C. Loewe; *Vienna/AT (christian.loewe@meduniwien.ac.at)*

The numbers of patients diagnosed with systolic or diastolic heart failure are increasing during last years. Thanks to improved possibilities to assess and diagnose ventricular function and dysfunction, new terminology and classification have been introduced. Since early diagnosis and treatment are important factors for outcome, knowledge about new classification and appropriate use of modern imaging techniques are required. Furthermore imaging biomarkers have been introduced recently to assess prognosis and to guide the treatment. In this refresher course, three outstanding experts will approach the possibilities, challenges and problems in imaging heart failure from different directions. After presentation of the currently accepted guidelines about the appropriate use of available imaging techniques in heart failure patients, the second presentation will be especially focused on the role and position of MRI as a gold standard for diagnosis and management of heart failure patients. A special focus will be on recently introduced modern techniques for advanced tissue characterisation by means of MR mapping techniques. The importance and value of nuclear medicine in heart failure management will be the topic of the last presentation including even modern hybrid scanners. Especially in such a complex field as represented by heart failure integrated approach and hence knowledge about all available imaging tools is mandatory to provide best medical care to the patients. The session will be closed by a panel discussion with the aim to define diagnostic algorithms in heart failure and to define in which situation what kind of imaging test should preferably be used.
Author Disclosure:
C. Loewe: Speaker; Speaker Honorarium from: Siemens, Bracco, Guerbet, GE Healthcare, Medtronic.

A-299 16:05

A. Current ESC and AHA guidelines: how to choose imaging techniques in heart failure patients?
J.T. Ortiz-Pérez; *Barcelona/ES (jtortiz@clinic.ub.es)*

Due to its complexity and the unspecific nature of symptoms, early recognition of heart failure (HF) is often difficult. Physicians should be familiar with the underlying physiopathology, and according to the patient's profile, judge the probability of the disease. HF may arise from malfunction of the myocardium, valves and pericardium as well as from rhythm or conduction abnormalities. In this regard, cardiac imaging remains critical. Referring physicians should be aware of appropriateness criteria, what to expect, limitations and contraindications of the imaging techniques. The electrocardiogram, chest x-ray and serum natriuretic peptides constitute the first-line tools to complement the workup of HF. However, based on its wide availability, portability, and comprehensive information provided, echocardiography remains mandatory in suspected HF. Tissue Doppler imaging by echo may recognise myocardial dysfunction at early stages, but clinical implementation is still pending on multicentre validation. Other techniques, such as single-photon emission computed tomography and positron emission tomography have a well-known background in ischaemic heart disease and will become more useful in the next future along with recent developments in molecular nuclear medicine. Finally, late gadolinium-enhanced cardiac magnetic resonance is well accepted by clinicians for the recognition of the underlying pathology in myocardial diseases, varying from ischaemic heart disease to infiltrative or deposition or genetically conditioned processes. The advent of T1-mapping techniques holds promise for the early detection of myocardial fibrosis deposition in many entities. The information derived from these novel techniques may change the way treatment is delivered to the patients in the next future.
Learning Objectives:
1. To become familiar with the diagnostic algorithm of heart failure according to current guidelines.
2. To learn the strengths and weaknesses of the different imaging techniques in heart failure patients.
3. To discuss the role of imaging techniques to guide clinicians in diagnosis, treatment and follow-up.

A-300 16:28

B. Differentiating the causes for heart failure: is MRI the indisputable gold standard?

T. Leiner; *Utrecht/NL*

"no abstract submitted"

Learning Objectives:

1. To learn about MRI techniques to evaluate heart failure and its potential causes.
2. To learn a practical approach for differentiating the causes of heart failure using MRI.
3. To become familiar with the role of MRI in the clinical management and prognosis.

A-301 16:51

C. SPECT as an alternative imaging technique

F. Caobelli; *Hannover/DE (federico.caobelli@gmail.com)*

The longstanding history, profound evidence-based and steadily increasing versatility of cardiac SPECT provide great benefit to the patient with heart failure (HF). Nuclear cardiology techniques guide clinical decision making by ruling in or ruling out ischaemic cardiomyopathy, by determining myocardial viability, by detecting global impairments of flow reserve, by identifying impaired global and regional sympathetic innervation, and by identifying (molecular) cardiac involvement in systemic diseases. Incremental prognostic value provides guidance of interventional, medical and device therapy. Besides these important advantages in clinical practice, the availability of promising radiopharmaceuticals tracing many other pathological pathways prospectively represents an important tool to predict the onset of HF and its complications. As such, cardiac SPECT may be the optimal key towards personalised therapy in heart failure.

Learning Objectives:

1. To learn about nuclear imaging techniques in the detection of heart failure.
2. To appreciate imaging findings in the diagnosis of heart failure and its causes.
3. To become familiar with the role of nuclear imaging for diagnosis and prognosis in heart failure.

17:14

Panel discussion: What is the preferred comprehensive imaging test in heart failure?

16:00 - 17:30 **Room M 3**

Interventional Radiology

RC 809

Current trends in transarterial chemoembolisation (TACE) and radioembolisation for HCC

A-302 16:00

Chairman's introduction

A. Denys; *Lausanne/CH (Alban.Denys@chuv.ch)*

Hepatocellualr carcinoma treatment is driven by offcial recommandations from the BCLC endorsed in the US and European society or by the Hong-Kong classification. In both classifications patients with multiple lesions, child A cirrhosis, and a good performance stautus are candidates for TACE. More advanced tumours with portal vein invasion as well as large single lesions are in a grey zone where different treatment options can be discussed ranging from sorafenib, TACE, or radio-embolisation. The choice is driven by local habits but also by scientific results from non randomised trial. Survival in HCC patients is also driven by the severity of cirrhosis. This means that the loco regional treament impact on liver function is crucial.

Session Objectives:

1. To learn how to select HCC patients for TACE-TAE or radioembolisation.
2. To understand optimal DEB technique for TACE.
3. To understand the role of the radiologist in radioembolisation of HCC.

Author Disclosure:

A. Denys: Advisory Board; BTG, Terumo, Covidien. Consultant; BTG. Grant Recipient; Covidien, Cook.

A-303 16:05

A. Imaging in therapy planning and follow-up

L. Crocetti; *Pisa/IT (laura.crocetti@med.unipi.it)*

Imaging in interventional oncology plays a key role in the entire process starting from patient selection, leading to patient treatment and continuing with patient follow-up. Pre-procedural imaging evaluation is aimed to determine the indication for interventional therapies according to the size, number and location of lesions, to the presence of major vascular invasion, nodal disease and distant metastases, and to choose the most suitable approach according to tumour histology. Planning a treatment in a cirrhotic patient with hepatocellular carcinoma (HCC) represents a good example to show the burden of information an interventional radiologist needs to know before a treatment. When pre-procedural imaging and clinical evaluation classify the patient as an intermediate stage, with multinodular HCC, intra-arterial therapies are advised. In this case, a careful evaluation of liver vasculature is strongly demanded to plan a safe and successful treatment. Extrahepatic vessels - such as inferior phrenic arteries - potentially feeding the tumours should be demonstrated in advance and then selectively catheterized during the procedure. Similarly multiple feeding arteries arising from different branches of hepatic artery should be evaluated during pre-treatment modality to guarantee a satisfying drug and embolizing material administration during the procedure.The main objectives of imaging surveillance after transarterial treatment of liver tumours are to define expected normal changes at the treatment site, identify abnormal changes such as residual disease or tumour recurrence, and depict treatment-related complications to allow prompt intervention and guide further management. Modified RECIST is currently used to evaluate treatment response in HCC.

Learning Objectives:

1. To learn how imaging influences the selection of the embolisation strategy in HCC.
2. To learn about standard and advanced imaging techniques in the follow-up after treatment.
3. To learn how imaging may guide the decision about re-treatment.

A-304 16:28

B. TACE and TAE for HCC: new agents, new schedules, new combinations

K. Malagari; *Athens/GR*

"no abstract submitted"

Learning Objectives:

1. To learn about the results of new treatment schedules and treatment combinations.
2. To learn about the rationale of recent and ongoing trials.
3. To learn about clinical results and possible further developments.

A-305 16:51

C. Radioembolisation: critical appraisal of techniques and guidelines for treatment

J.I. Bilbao; *Pamplona/ES (jibilbao@unav.es)*

Radioembolisation (RE) consists in the selective and accurate implantation of microparticles that deliver therapeutic radiation within a liver tumour. To achieve this purpose the angiographic technique must be optimised and adapted attending to any anatomical situation and to any haemodynamic circumstance that the tumoural vascularisation may show. Dosimetry must follow the accepted general rules but, similarly, must be personalised attending to tumour burden, liver functional reserve, and amount/presence of shunting towards healthy tissues. The activity should be administered to the whole tumour but, if possible, trying to preserve some liver parenchyma from radiation. There are several well-documented articles, including hundreds of patients, that endorse the efficacy of RE in HCC. The group defined as "intermediate" (BCLC B stage) includes an heterogeneous group of patients for which the actual guidelines recommend only chemoembolisation (TACE). According to publications, RE has demonstrated efficacy not only in patients in whom TACE has failed but also in multinodular HCC and in cases with big uninodular tumours. RE is specially indicated in BCLC C stage in whom there is segmental/lobar portal invasion. Several prospective randomised multicentre trials are now in process (i.e. SARAH) for answering some of the preceding questions. In the case of localised HCC non-suitable for resection, RE offers two unique features. First, the tumour can be ablated by administering a high dose localised to the tumoural area (radiation segmentectomy). Second, RE is the only intra-arterial tumouricidal treatment that also provokes contralateral hypertrophy (as portal embolisation does) rendering patients to a possible surgical rescue.

Learning Objectives:

1. To learn about critical aspects of techniques and dosimetry.
2. To become familiar with ongoing trials and guidelines for treatment.
3. To understand the relative role of TACE/TAE and radioembolisation in HCC.

Author Disclosure:
J.I. Bilbao: Advisory Board; Boston Scientific. Consultant; Cook. Speaker; Sirtex Medical.

17:14
Panel discussion: The intermediate HCC patient: how can we stratify patients and allocate them to different therapies?

16:00 - 17:30 **Room M 4**

Joint Course of ESR and RSNA (Radiological Society of North America): Emergency Radiology

MC 828

General principles: paediatric and ENT emergencies

Moderators:
A. Palkó; Szeged/HU
R.J. Zagoria; San Francisco, CA/US

A-306 16:00

A. Imaging of polytrauma patients
U. Linsenmaier; *Munich/DE (Ulrich.Linsenmaier@helios-kliniken.de)*

Diagnostic imaging of complex multiple trauma/polytrauma remains a challenge for any department providing modern emergency radiology (ER) service. An early and comprehensive approach for ER imaging is crucial for a priority-oriented and timely therapy concept with the aim of identifying potentially life-threatening injuries early and initiating appropriate treatment.The basic diagnostic approach still consists of focused ultrasound using focused assessment with sonography for trauma (FAST) and conventional radiography (CR), usually limited to a single supine chest x-ray for triaging patients undergoing immediate operations. Multidetector computed tomography (MDCT) has become established as early whole body CT (WBCT) as the indisputable diagnostic method. The detection rate of injuries by WBCT is outstanding and it improves the probability of survival by 20-25% compared with all other previous methods. At the same time, the spatial and temporal resolution of MDCT was improved resulting in considerably shortened examination times but WBCT is still associated with a significant radiation exposure, even in the acute single-use setting. Using modern scanner and dose reduction technology, including iterative reconstruction, a dose reduction of up to 40% could be achieved. The substantial number of images in WBCT is another challenge; images must be processed priority-oriented, read and transferred to the picture archiving and communications system (PACS). For rapid diagnosis, volume image reading (VIR) offers additional options to keep the diagnostic process on time. Modern WBCT after multiple trauma is performed early, comprehensively and personalised so that WBCT improves the probability of survival by 20-25%.
Learning Objectives:
1. To learn about general principles of diagnostic imaging in emergency radiology in traumatic and non-traumatic emergencies.
2. To understand the aetiology, background and management of common radiological emergencies.
3. To appreciate the role, indications and protocols for US, CR, MDCT in modern emergency radiology.

A-307 16:30

B. Challenges of imaging paediatric abdominal emergencies
C.J. Sivit; *Cleveland, OH/US (Carlos.Sivit@UHhospitals.org)*

This presentation will review the imaging approach and associated imaging findings observed in conditions associated with vomiting and acute abdominal pain in the paediatric age group. Common and uncommon clinical conditions, particularly those that require operative intervention, will be stressed. The current imaging approach to these conditions, important imaging findings and diagnostic pitfalls will be discussed.
Learning Objectives:
1. To understand the variations of pathology that cause abdominal pain and vomiting in infants and children.
2. To learn how to plan safe and effective imaging protocols using US, CT, and MRI.
3. To recognise pitfalls in the diagnosis of paediatric abdominal emergencies with imaging.

A-308 17:00

C. Imaging in ENT emergencies
D. Nunez; *New Haven, CT/US (diego.nunez@yale.edu)*

Non-traumatic emergent conditions involving the ear, nose and throat comprise a variety of disease entities, some of which may become life-threatening if not readily recognised and treated. They typically present as bleeding, or as difficulty to breathe or swallow. Occasionally, imaging studies may aid in the appropriate localisation of airway obstructing foreign bodies or in the diagnosis and treatment of epistaxis by guided interventional procedures. It is, however, in the assessment of head and neck infections and their complications where cross-sectional imaging plays a fundamental role. Facial and cervical infections are common clinical problems and although a presumptive diagnosis can be made clinically, imaging studies are often requested to confirm the diagnosis, to localize the infectious process and importantly to exclude the possibility of abscess formation or other complications. The contribution of imaging becomes more relevant in patients with clinical suspicion of deep neck infection where access to appropriate clinical evaluation may be limited. This presentation will analyse the imaging findings of head and neck infections using a systematic spatial approach, as well as the indications for emergent CT and MR when necessary. A variety of complications will be discussed including intracranial extension of disease, airway compromise, vascular lesions and osseous involvement.
Learning Objectives:
1. To understand imaging findings in patients presenting with acute head and neck conditions using a systematic spatial approach.
2. To get an understanding of the role and indications of CT and MR in acute non-traumatic ENT case management.
3. To learn how to identify the extent of disease and recognise specific complications of cervicofacial infections.

16:00 - 17:30 **Room M 5**

E³ - ECR Academies: Diagnostic Urogenital Radiology

E³ 822

Upper and lower urinary tract

Moderator:
V. Logager; Copenhagen/DK

A-309 16:00

A. CTU and MRU of the upper urinary tract
N.C. Cowan; *Portsmouth/UK (nccowan.uro@gmail.com)*

1) What is the definition of CT and MR urography? What are normal findings? CT urography is contrast-enhanced CT examination of the kidneys, ureters and bladder. MR urography is an evolving group of techniques for examination of the urinary tract without use of ionising radiation. Normal findings are illustrated. 2) What are the indications and contraindications? The principal indication is haematuria. Contraindications to CT urography centre around whether iodinated contrast media or radiation should be avoided. 3) What is the optimum CT urography technique for investigating haematuria? Manoeuvres include oral or intravenous hydration, administration of diuretics, rolling and exercising the patient for mixing of contrast with urine. Promoting isotropic resolution by paying attention to acquisition techniques. 4) How do you measure the quality of the CT and MR urogram? The diagnostic accuracy of CT urography for stones, upper tract urothelial cancer, renal cell cancer and bladder cancer is the best measure of the quality of a CT or MR urogram. The diagnostic accuracy of MR urography has not been systematically studied. 5) What is the recommended protocol for CT and MR urography? A single-bolus high-resolution protocol is recommended for CT urography. T2 and T1 techniques are discussed for MR urography. 6) What are the optimum diagnostic strategies using CT and MR urography? The concept of front line high-tech imaging for haematuria and patient-centred diagnosis is explored. 7) What are the problems with using CT and MR urography and how may they be solved? Pragmatic solutions provided.
Learning Objectives:
1. To learn about the technical requirements of CTU and MRU.
2. To learn about indications, diagnostic accuracy, diagnostic strategies, advantages and limitations of CTU and MRU.
3. To understand the normal imaging findings.

A-310 16:30

B. Imaging of kidney and ureter

M.A. Cova; *Trieste/IT (cova@gnbts.univ.trieste.it)*

Urothelial carcinomas of the renal pelvis constitute approximately 10%-15% of all renal tumours. These carcinomas are 50 times less common than bladder urothelial carcinomas but 2-3 times more common than those of ureter. At ultrasonography (US), urothelial carcinoma of the renal pelvis typically appears as a central soft tissue mass, with or without hydronephrosis. On CT urography (CTU) and on MR urography (MRU) urothelial carcinoma of the renal pelvis usually appears as single or multiple sessile filling defects that compress the renal sinus fat, with pelvicalyceal irregularities, focal or diffuse mural thickening, calyceal amputation, and tumour-filled distended calyces. Urothelial cancer of the renal pelvicalyceal system is sometimes characterised by unusual imaging features simulating renal cell carcinoma, chronic inflammatory renal disease, or hydronephrotic kidney. In most of these cases the involvement of the urothelial surface is the key imaging finding for the correct diagnosis. Primary urothelial carcinoma of the ureter constitutes 1% of upper urinary tract neoplasms. 2% of patients with bladder urothelial carcinoma present synchronous ureteral lesions, while 6% of them will develop metachronous ureteral lesions. On CTU and MRU, the features of urothelial neoplasms of the ureter may vary from mild circumferential focal wall thickening to large masses that may protrude into the ureteral lumen causing urinary tract obstruction. Rarely, infiltrative ureteral cancers can have similar appearance than ureteritis and differential diagnosis may be difficult. Other differential diagnoses include ureteritis cystica, fibroepithelial polyp, tuberculosis, amyloidosis and metastases to the ureter.

Learning Objectives:

1. To learn about the typical signs of urothelial carcinoma in the kidney and ureter, including rare manifestations.
2. To learn about the most frequent differential diagnoses.
3. To understand the potential pitfalls.

A-311 17:00

C. Imaging of bladder and urethra

J. Lopes Dias; *Lisbon/PT (Joaolopesdias85@gmail.com)*

Bladder cancer is the ninth most commonly diagnosed cancer worldwide. The most common subtype is urothelial carcinoma. At the initial diagnosis, 70% of cases are non-muscle-invasive bladder cancer and 30% are muscle-invasive. This distinction is crucial since muscle-invasive cancer has a poorer prognosis and is more likely to be metastatic. For detection purposes, cystoscopy is the modality of choice in most centres, but CT urography and US are also commonly requested. Typically, these tumours appear as focal or multifocal wall thickening; however, some tumours present with diffuse wall thickening and may mimic inflammatory and infectious conditions. Cystoscopy and pathologic staging remain the standards of reference, and are used for stages confined to the bladder. While CT accurately identifies stages T3b or higher, MRI allows clear differentiation between bladder wall layers and appears to distinguish muscle invasive from non-muscle invasive disease. Retrograde urethrography and voiding cystourethrography remain the modalities of choice for imaging the urethra, while US, MRI and CT are particularly useful for evaluating periurethral structures. However, advances in MRI and 3D US have allowed more accurate static and dynamic imaging of the urethra, particularly in females. This talk will initially focus on the imaging features of bladder cancer. The staging system, normal post-surgical appearance and signs of recurrence will be reviewed, and some particular issues like urachal and diverticular tumours will be highlighted. Finally, traumatic, inflammatory and infectious bladder conditions will be reviewed, followed by a brief discussion on malignant and nonmalignant urethral diseases.

Learning Objectives:

1. To become familiar with various diseases of the bladder and urethra.
2. To learn about the typical imaging findings of malignant and non-malignant disease.
3. To learn about the most frequent differential diagnoses.

Friday, March 4

08:30 - 10:00 **Room A**

E³ - ECR Academies: Interactive Teaching Sessions

E³ 921
Diagnostic evaluation of bone tumours

A-312 08:30
A. Bone tumours: benign or malignant?
H.-J. van der Woude; *Amsterdam/NL (h.j.vanderwoude@olvg.nl)*

Discrimination between benign and malignant bone tumours based on imaging features is challenging. Radiologists have to be aware that that aggressive appearing benign lesions may mimic malignant lesions and certain malignant lesions may appear benign. As such, many lesions will show radiographic features that can be assessed as uncertain, and additional imaging with or without invasive procedure have to be performed accordingly. Various non-neoplastic reactive processes, secondary to trauma, infection or stress, may also mimic bone or soft tissue tumours, even malignant ones. Other potential diagnostic pitfalls may occur when certain lesions present at unusual locations or in an unusual manner. Systematic analysis of good-quality plain radiographs is pivotal to assess the nature of bone tumours and tumour-like lesions, and to narrow the differential diagnosis. Non-radiographic features contributing to this diagnostic process include age of the patient and location of the lesion (within the body). Radiographic characteristics that should be taken into account include: location of lesion within bone, central, eccentric, parosteal or soft tissue origin, the pattern of growth including cortical bone involvement and margins, type of periosteal reaction, and presence or absence of matrix formation. Combining these features assist in direction of the subsequent strategy: for benign lesions, additional imaging (CT, MRI) may be performed on indication for further characterisation. For uncertain or certain malignant lesions, additional imaging (MRI, CT, and/or nuclear imaging) is always performed for characterisation and locoregional staging. Invasive procedures for histology or culture should only be performed after completing the imaging process.

Learning Objectives:
1. To review the features on conventional radiographs which distinguish benign and malignant bone tumours.
2. To extend this knowledge to analyse features on MRI and CT which can help to distinguish benign and malignant bone tumours.

A-313 09:15
B. Pseudotumours: mimic bone tumours
F.M.H.M. Vanhoenacker[1], G. Vanderschueren[2]; [1]*Antwerp/BE*, [2]*Leuven/BE (filip.vanhoenacker@telenet.be)*

Pseudotumours of bone are lesions mimicking primary (or secondary) bone tumours. Pseudotumours may be a challenge for the radiologist, as misinterpretation may result in unnecessary and potential harmful diagnostic procedures and treatment. The aetiology is variable and includes normal variants, post-traumatic disorders (stress fractures, apophyseal avulsion fractures), inflammatory (e.g. tophaceous gout), infectious diseases (e.g. osteomyelitis) and metabolic diseases (e.g. Paget's disease, calcium hydroxyapatite disease, brown tumours, haemophilic pseudotumour). Another group of tumour-like conditions are non-neoplastic in nature, including dense bone islands, fibrous dysplasia, non-ossifying fibroma, intraosseous ganglion cyst, Langerhans cell histiocytosis, (post-traumatic) bone cyst, etc. Considering a pseudotumoural lesion in the differential diagnosis is the first step in correct identification. Furthermore, like in true bone tumours, analysis of clinical features (age, location, concomitant diseases) is a prerequisite for correct diagnosis. Imaging may assist in the differential diagnosis with true tumoural lesions. The absence of aggressive imaging features on plain radiographs is a major key. Some pseudotumoural diseases have pathognomonic imaging signs, such as ground glass appearance in fibrous dysplasia, coarse trabeculae and bone enlargement in Paget's disease. CT may be helpful to demonstrate sequestra in chronic osteomyelitis or subtle soft tissue calcification in calcium hydroxyapatite disease. In some specific scenarios, MRI may provide additional information by analysing signal intensity, contrast enhancement pattern and degree of soft tissue extent. Bone cysts are typical of high signal intensity on T2-WI and show only peripheral enhancement. In Paget's disease, there is relative preservation of fat within the bone marrow.

Learning Objectives:
1. To review the range of lesions which mimic tumours of the bone.
2. To extend this knowledge to analyse features that identify pseudotumours of the bone.

08:30 - 10:00 **Room B**

Abdominal Viscera

RC 901
Hepatocellular tumours

A-314 08:30
Chairman's introduction
C. Bartolozzi; *Pisa/IT (carlo.bartolozzi@med.unipi.it)*

Despite the tremendous improvements in cross-sectional imaging modalities, characterisation of benign and malignant hepatocellular focal lesions still represents a challenge for radiologists. While morphological and vascular criteria are essential in guiding through the process of differential diagnosis in specific clinical settings, new functional non-invasive criteria are being investigated and seem to play a crucial role in improving diagnostic confidence. According to and beyond available guidelines, functional imaging is entering daily clinical practice, representing an essential adjunctive tool not only for lesion characterisation but also for patients' management.

Session Objective:
1. To briefly introduce the diagnostic challenge of benign and malignant hepatocellular focal lesions.

A-315 08:35
A. The revised adenoma classification
C.J. Zech; *Basle/CH (christoph.zech@usb.ch)*

Hepatic adenomas are rare benign primary liver lesions. They are usually diagnosed incidentally in younger adults with a predominance in women. Among the predisposing factors, hormonal stimulation and oral contraceptives are discussed. Also in patients with a metabolic syndrome, adenoma can be found more frequently. In the last years, the concept of adenoma being a uniform group of lesions has been changed dramatically. Histopathology and molecular biology identified several distinct subgroups with potential clinical implications for therapy indications and clinical management of those lesions. This lecture session aims to introduce the recent classification of adenoma and their imaging appearance.

Learning Objectives:
1. To describe the underlying histopathologic characteristics of hepatocellular adenoma.
2. To define and compare the features of different imaging techniques for the correct diagnosis.
3. To differentiate hepatic adenoma from other hepatocellular focal lesions, i.e. focal nodular hyperplasia.

Author Disclosure:
C.J. Zech: Advisory Board; Liver Advisory Board Bayer Healthcare until 2013. Speaker; Speaker Honoraria from Bayer Healthcare.

A-316 08:58
B. HCC staging: what is new in imaging and can predict prognosis
C. Ayuso; *Barcelona/ES (cayuso@clinic.ub.es)*

Staging is a relevant topic in the management of patients with HCC because it determines the therapeutic approach. Tumour burden defined on CT and MRI, liver function (Child-Pugh, portal hypertension) and general health status (presence or not of cancer-related symptoms) are key points to define the HCC stage of the disease (0-D in the BCLC classification), and to recommend the optimal therapeutic option to achieve the best outcome in every case. Microvascular invasion, satellites, additional nodules and poor differentiation degree are predictors of high risk of recurrence following potentially curative treatments. CT and extracellular contrast agents MRI are unable to recognise these predictors of bad prognosis, and non-invasive diagnostic criteria for HCC nodules below 1 cm have not been validated. The contribution of functional imaging techniques such as diffusion-WI and combined contrast agents RMI for the demonstration of microvascular invasion and satellite lesions will be discussed, as well as the potential role of PET/CT-choline in the assessment of tumour extension in HCC patients.

Learning Objectives:
1. To define HCC staging criteria and their impact on therapeutic management.
2. To describe HCC imaging prognostic factors, including functional and metabolic imaging.
3. To appraise the added clinical value of imaging prognostic factors in the therapeutic management.

A-317 09:21

C. Equivocal nodules in cirrhotic patient: how to solve the puzzle

Y. Menu; *Paris/FR (yves.menu@sat.aphp.fr)*

Management of cirrhotic nodules is still challenging in spite of imaging advances and wide acceptance of international guidelines. Briefly, US is important for the detection of liver nodules; however, its contribution to characterisation is low. CT has merit showing nodule enhancement. However, Se and Sp are lower than those of MRI. Nowadays, CT is more commonly considered as a whole body staging method in case of liver tumour, or as a alternative when MRI is inconclusive. PET-CT using choline might be an added method in very selected cases. MRI is the standard method for characterisation. Any nodule with hyperintensity and/or enhancement at the arterial phase should be considered as potential HCC. Liver-specific contrast may confirm the suspicion when showing hypointensity at the hepatobiliary phase. However, this should not be considered as a binary sign, as there are false positives and false negatives. International guidelines recommend treating "typical" nodules larger than 1 cm, and to follow-up nodules smaller than 1 cm. Mid-sized nodules (1-3 cm) without typical enhancement are more problematic. However, imaging should not be considered as a stand-alone tool. Given a similar nodule, the clinical decision could be very different according to clinical **Background:** in patients with mild liver disease, good performance status, the diagnostic algorithm will be more aggressive, for instance including biopsy, compared to patients with end-stage liver disease. Therefore, the algorithm is a combination of imaging signs, mainly gathered with MRI, definition of treatment possibilities in every single patient, and should be finalised within multidisciplinary teams.

Learning Objectives:

1. To describe modern imaging techniques to identify and characterise nodules in cirrhotic patients.
2. To define the added value of hepato-specific contrast agents and multiparametric approach for the differential diagnosis.
3. To appraise an algorithm for the management of equivocal nodules.

09:44

Panel discussion: Impact of imaging on classification and differentiation of hepatocellular lesions

08:30 - 10:00 **Room O**

Paediatric

RC 912

Hepatobiliary imaging in children

Moderator:
M. Raissaki; Iraklion/GR

A-318 08:30

A. Imaging of liver masses

H. Woodley; *Leeds/UK (h.woodley@nhs.net)*

There is a wide differential of focal liver lesions in children including inflammatory lesions, cystic lesions and benign and malignant neoplasms. This lecture will provide a practical approach to imaging children with focal liver masses discussing the role of different imaging modalities and protocols in assessing the extent of disease, narrowing the differential diagnosis and specific imaging features of common benign and malignant neoplasms. Paramount in the initial assessment of focal liver masses is knowledge of the clinical presentation of the child including clinical signs and symptoms, laboratory tests and underlying syndromes or diseases. Ultrasound is the first imaging modality of choice in assessment of the child with a liver mass. Examination includes a full abdominal survey with confirmation of intrahepatic location, presence of solitary or multiple lesions, extra hepatic disease and any signs of pre-existing liver disease. Initial characterisation includes assessment of the solid or cystic nature, calcification, vascularity, involvement of hepatic vessels and any biliary dilatation. Further cross sectional imaging is often required although the use of Contrast Enhanced Ultrasound may be diagnostic in some instances. Magnetic Resonance Imaging (MRI) or Computed Tomography (CT) will fully document the extent of disease and enable Pretext Staging to be accurately assessed in malignant disease. However MRI is the preferred imaging modality of choice for further assessment of focal liver lesions due to the non -ionising radiation technique and the superior tissue characterisation including the use of liver specific contrast agents which may enable an exact diagnosis to be made and avoid biopsy.

Learning Objectives:

1. To learn about imaging protocols.
2. To learn about common benign and malignant lesions and differential diagnosis.
3. To become familiar with the role of new imaging techniques and hepatocytes-specific contrast agents.

A-319 09:00

B. Imaging of biliary disorders

S.G.F. Robben; *Maastricht/NL (s.robben@mumc.nl)*

Diseases of the gallbladder and bile ducts in children are relatively rare and occur at any age, even in infants. Many pathophysiological mechanisms are involved: inflammatory (cholangitis), trauma (bilioma), autoimmune (sclerosing cholangitis), iatrogenic (inspissated bile caused by TPN) and congenital diseases (biliary atresie, choledochus cyst). Also a variety of hereditary diseases and syndromes can affect the biliary system in many ways: cystic fibrosis, spherocytosis, Alagille syndrome and sickle cell anaemia. The imaging characteristics, imaging techniques and pathophysiology will be discussed.

Learning Objectives:

1. To become familiar with the roles of US, CT and MRI.
2. To learn about manifestations of common diseases.
3. To discuss the role of hepatobiliary contrast agents.

A-320 09:30

C. Intervention in the hepatobiliary system

S. Franchi-Abella; *Le Kremlin-Bicêtre/FR (stephanie.franchi@bct.aphp.fr)*

Liver biopsy even if rare is the most common interventional radiology technique performed in children. Image guidance is always recommended in order to minimise the risk of complication. Percutaneous core needle biopsy is usually performed using 18G needles in infants and 16G in children. Coaxial biopsy technique is useful when more than one core is required. When a target biopsy is performed, the biopsy needle should always reach the target through a non-tumoural liver parenchyma. When the risk of bleeding is high, the biopsy track can be occluded using gelfoam plugs. Transjugular liver biopsy can be performed even in newborns when using US guidance. Biliary interventions mainly concern the treatment of biliary complications after liver transplantation (drainage of bile leaks and dilatation of biliary strictures). In native livers, percutaneous cholangiography or cholecystography can be diagnostic (neonatal cholestasis) or therapeutic (bile plug syndrome in infants, drainage for obstruction). Concerning vascular interventions, arterial or venous thrombosis or stenosis after liver transplantation can be treated percutaneously. In native liver, selective embolisation of the hepatic artery is sometimes required in infants with liver haemangioma with high output cardiac failure resistive to medical therapy or in acute tumoural or post-traumatic bleeding. Venous interventions mainly concern the management of portal hypertension: evaluation of portal branches patency in portal vein obstruction, revision of surgical porto-systemic shunts, creation of transjugular intrahepatic portosystemic shunts. Congenital porto-systemic shunts can be closed percutaneously sometimes. Close collaboration with clinicians, surgeons and anaesthesiologists is mandatory to optimise the management of these patients.

Learning Objectives:

1. To become familiar with liver biopsy in focal and diffuse hepatic disorders.
2. To highlight the role of interventional radiology in biliary disorders.
3. To learn about the role of interventional radiology in hepatic vascular disorder.

08:30 - 10:00 **Room N**

E³ - ECR Academies: Modern Cardiac Imaging

E³ 920

How to quantify the haemodynamic significance of coronary stenosis

Moderator:
C. Loewe; Vienna/AT

A-321 08:30

A. CT-angiography: new tools (TAFE, TAG, CT-FFR)

G. Pontone; *Milan/IT (gianluca.pontone@ccfm.it)*

Coronary artery disease (CAD) is a major cause of mortality and morbidity, and its management consumes a large proportion of health care budgets. Non-invasive functional tests are commonly used to assess risk of CAD and to identify patients for invasive coronary angiography (ICA). Despite the routine use of these tests, only one-third of patients with suspected CAD referred for elective ICA have obstructive CAD. The low diagnostic yield of elective ICA

may be due to the limited accuracy of non-invasive functional stress tests. Coronary computed tomography angiography (cCTA) is a highly sensitive method to detect anatomic CAD and to rule out the presence of CAD with high accuracy and low radiation exposure. Despite the high negative predictive value of cCTA, its positive predictive value is limited by several factors, including coronary calcium, and spatial resolution and could be responsible for over-estimation of CAD. Consequently, anatomic CAD documented by cCTA may not be haemodynamically significant. An optimal non-invasive test would characterise both the anatomy and functional significance of coronary lesions, thereby reducing the need for subsequent testing, additional ionising radiation exposure, higher costs, and delayed diagnosis and treatment. Recently, several methods have been developed in the field of cCTA (CT-FFR, TAG, TAFE) and validated against invasive FFR or outcome. The current lecture will evaluate the technical aspects and clinical experience of all these discussing the strength and weakness of each approach with a final focus on the potential impact on the routine diagnostic workup.

Learning Objectives:
1. To understand how the haemodynamic significance of coronary stenosis affects the choice of treatment and the patient's prognosis.
2. To learn about new approaches to grading of coronary stenosis with the help of CTA (TAFE, TAG, CT-FFR).
3. To become familiar with the diagnostic value of these tools in comparison with traditional methods.

Author Disclosure:
G. Pontone: Investigator; Heartflow. Speaker; GE Healthcare, Bracco, Medtronic.

A-322 09:00

B. Myocardial perfusion: what can be done with MR and CT

R. Vliegenthart; *Groningen/NL (r.vliegenthart@umcg.nl)*

Non-invasive assessment of myocardial perfusion is important in the diagnosis and risk stratification of coronary artery disease (CAD). Especially in intermediate-high pre-test probability of (suspected) CAD, and in recurrent or new symptoms in known CAD, myocardial perfusion imaging is recommended. Many coronary stenoses do not significantly reduce perfusion in the myocardium supplied by the coronary artery, and thus, do not cause myocardial ischaemia. Evaluation of coronary flow, downstream of the stenosis, is only a proxy for the more important resulting myocardial perfusion. A number of studies has shown the superior diagnostic accuracy of adenosine-perfusion MRI compared to the commonly used SPECT, with the additional advantage of MRI of lack of radiation. Dynamic perfusion CT, an imaging technique still in research phase, is gaining interest as CT may allow evaluation of anatomical and functional CAD in one noninvasive imaging test. Quantification of myocardial perfusion is of importance to detect early signs of reduced myocardial perfusion, and to diagnose three-vessel disease. The relationship between gadolinium concentration and MRI myocardial signal intensity is non-linear, allowing semi-quantitative measurements. Iodine-based contrast concentration shows a linear relationship with myocardial CT density, which enables absolute quantification of myocardial blood flow based on dynamic perfusion CT. In this presentation, the technique of MRI/CT for myocardial perfusion evaluation will be discussed, as well as the evidence base and indications for adenosine-perfusion MRI/CT.

Learning Objectives:
1. To appreciate the clinical need for assessment of myocardial perfusion and viability.
2. To understand how perfusion MR and CT are performed in clinical settings.
3. To learn about diagnostic performance of perfusion MR and CT and clinical indications for them.

A-323 09:30

C. New players on the field: SPECT/CT, PET/CT, MR/PET

S.G. Nekolla; *Munich/DE*

Doubtless, this is primarily a mono-modal imaging world. In the same way as our knowledge of disease in general and cardiac pathology in particular is ever increasing, imaging technology advances. Still, for the assessment of parameters, which are known to be relevant today, cardiac imaging from every modality has their inherently unique strengths and weaknesses. This leads to two distinct scenarios: in the first one, a particular modality tries to emulate the strengths of a "competitor" to derive a valuable parameter - this might come, however, at the price of extended scan time or complex acquisition and processing steps. Or, in an alternative approach, mainly complementary modalities are integrated in hybrid imaging systems which almost by definition increase the costs of investments. Still, in the last decade, SPECT/CT, PET/CT and recently, PET/MR devices were introduced to the cardiac imaging community. This review presentation will discuss the advantages and disadvantages of these integrated solutions with respect to effectiveness of workflows, diagnostic accuracies and the synergistic effects. This combined assessment of not only perfusion but also morpho-functional parameters, information on not only metabolic and inflammatory processes but also myocardial innervation will improve our understanding of the complex inter-play of the highly regulated cardiac system. These integrated devices are an important step towards improved disease understanding and thus implementation of a truly patient-centric approach, which facilitates an even tighter integration of the imaging process into the clinical workflow.

Learning Objectives:
1. To understand the advantages and limitations of hybrid perfusion imaging.
2. To learn about the diagnostic value of hybrid imaging for studies of myocardial perfusion.
3. To become aware of clinical indications for hybrid myocardial perfusion studies.

08:30 - 10:00 **Studio 2016**

Professional Challenges Session

PC 9a

Biobanks meet imaging

Moderators:
E. Neri; Pisa/IT
M. Pasterk; Graz/AT

A-324 08:30

How does Biobanking and BioMolecular resources Research Infrastructure - European Research Infrastructure Consortium (BBMRI-ERIC) work?

J.-E. Litton; *Graz/AT (jan-eric.litton@bbmri-eric.eu)*

In 2008, BBMRI was one of the first projects entering the preparatory phase of the European Strategy Forum on Research Infrastructures (ESFRI) Roadmap for Research Infrastructures. Within three years, BBMRI grew into a 54-member consortium. These efforts culminated in the Member States' decision to apply for the European Research Infrastructure Consortium (ERIC) legal framework. BBMRI-ERIC was founded on 3 December 2013, three days after the Statutes were published in the Official Journal of the European Union. BBMRI-ERIC shall establish, operate and develop a pan-European-distributed Research Infrastructure of biobanks and biomolecular resources to facilitate the access to resources as well as facilities and to support high-quality biomolecular and medical research. As the existing biobanks have a strong national character and background, a distributed hub-and-spoke structure is implemented for BBMRI-ERIC. BBMRI-ERIC is not just any infrastructure; it is a unique and truly Pan-European Research Infrastructure for health. Unique, because BBMRI-ERIC is set up to become a key source for users in both academic and scientific institutions as well as in the pharmaceutical and life science industries, thereby contributing directly to the Innovation Union concept. Pan-European because BBMRI-ERIC already shows an excellent geographic and regional coverage all over Europe involving countries from South, East, West, North and Central Europe. Moreover, it has developed a funding model that allows both large Member States such as Germany or France as well as very small Member States like Malta or Estonia to participate as equal partners.

Learning Objectives:
1. To understand the diversity of human disease, biological samples and corresponding data.
2. To appreciate the benefits provided by biobanks for personalised medicine.
3. To learn about how the biobanking network of BBMRI has established quality assurance in biobanks.

A-325 08:45

Patient rights: data overprotection?

M.T. Mayrhofer; *Graz/AT (michaela.th.mayrhofer@bbmri-eric.eu)*

Data protection requires striking a balance between the rights of individuals to privacy and the ability of organisations to use such data. This is equally true when patient and research data are concerned. Responsible handling of data, however, does not end with its legal requirements but includes a set of ethical conducts: while making the best use of any entrusted data (given typically for altruistic reasons), data have to be protected from careless handling, misuse and illegal disclosure. Hence, the ultimate responsibility is to use data appropriately, so that neither the expectations nor the efforts of the data providers and users go to waste.

Learning Objectives:
1. To understand the rationale for patient rights.
2. To consolidate knowledge about the implementation of anonymization and pseudonymization.
3. To learn about the upcoming General Data Protection Regulation.

A-326 09:00

What is the difference between a PACS and a clinical bank of radiological images?

A. van der Lugt; *Rotterdam/NL (a.vanderlugt@erasmusmc.nl)*

A PACS is a medical imaging technology which provides economical digital storage and convenient access to images from multiple imaging modalities (source machine types). A PACS is designed for patient care in which image data of a specific patient are retrieved, analysis and compared. The final evaluation is reported to clinicians. In contrast, an imaging biobank can be defined as an organised database of medical images and associated imaging biomarkers (radiology and beyond) shared among multiple researchers, and linked to other biorepositories. An imaging biobank is designed for scientific use. Image data are systematically analysed (visually, manually, or (semi)-automated) with the main aim to extract imaging biomarkers than can be related to patient characteristics like medical history, genomic data, biomaterials and outcome. The data storage is structured in a way that the data can be queried and retrieved. To exploit the available information interactions with other databases are a perquisite. General requirements with respect to the data collection are, therefore, a database facilitating storage of image data and metadata, storage of derived image-based measurements, and storage of associated non-imaging data, taking into account the need to deal with longitudinal data, and to cope with multiple file formats.

Learning Objectives:

1. To appreciate the need for structured and searchable image data and reports.
2. To understand the requirements for a clinical imaging bank.
3. To learn about the intraoperability of clinical image bank and other data repositories.

A-327 09:15

Population-based cohort biobanks: accessing large European prospective cohorts through the biobanking infrastructure BBMRI - large prospective cohorts (LPC)

O. Törnwall; *Graz/AT (outi.tornwall@bbmri-eric.eu)*

Most of the present knowledge on diagnostics, diseases and drugs was obtained by investigation of human biospecimens and related medical data. Central for such investigations are biobanks that collect and store biological samples with information of study individuals before and up to the onset of disease and beyond. A critical factor for success is facilitation of structured access to biobanked materials in an ethically and privacy-compliant manner. In 2013, an EU-funded multinational BBMRI-LPC-project (Biobanking and Biomolecular Resources Research Infrastructure - Large Prospective Cohorts) was established in mission to facilitate 'free-of-charge' access to samples and health data across country borders through open scientific calls. BBMRI-LPC unites prospective study sets from 17 countries with 22 different cohorts involving over 1 million study participants. Initiated by BBMRI-LPC, three pan-European scientific calls have been launched to date to support concrete research projects involving multiple LPCs. Through the successful research projects, the access procedures of various cohorts are mapped and recorded to recognise the roadblocks, and to provide potential suggestions for more streamlined access procedures in the future.

Learning Objectives:

1. To learn about BBMRI - large prospective cohorts (LPC).
2. To understand how to obtain easy access to samples and data.
3. To learn how to transfer expertise from established to new emerging biobanks.

A-328 09:30

Population-based cohort: image banks

F. Bamberg; *Tübingen/DE (fabian.bamberg@med.uni-muenchen.de)*

Advanced imaging techniques are currently increasingly implemented into cohort studies due to their valuable insights into the morphological and functional non-invasive characterisation of human tissue. Recent advances in technology have enabled complex procedures, such as whole-body MRI to be accommodated within reasonable scanning times and relatively comfortable scanning conditions. Also, technical developments in CT scanning have allowed for effective imaging at very low radiation doses. In general, these tools are used to assess the degree of subclinical disease burden but also to allow for comprehensive assessment of risk constellation that are associated with adverse outcomes. In this context, understanding variations of normal anatomy as well as deviation that predispose to earlier disease occurrence represent a major objective. While the potential benefit of utilizing these imaging techniques is substantial, there are a number of challenges to be addressed: first, given the fact that imaging represents a mean to assess the human body without technical variations, significant effort needs to be spent on constant image acquisition parameters and homogeneous scanner configurations. Second, the generation of enormous imaging data requires dedicated post-processing pipelines and a high level of quality assurance to establish imaging biobanks. Also, new concepts with respect to data analysis will need to be developed and implemented. Finally, the presence of potential incidental findings on these high-resolution images demands the implementation of dedicated algorithms on the management of incidental findings balancing between participants' interests and study aims.

Learning Objectives:

1. To appreciate the added value provided by imaging in population-based cohorts.
2. To understand the difference between observation, incidental finding and result.
3. To learn about the intraoperability of biobanks and image banks.

A-329 09:45

What are ontologies?

B. Gibaud; *Rennes/FR (bernard.gibaud@univ-rennes1.fr)*

Imaging biobanks are being developed to facilitate the broad sharing of collections of medical images over the web. Federating such data sharing systems is very important to facilitate search and access by the researchers. This task remains challenging because these systems were developed independently and consequently image-related information (i.e. information about imaged subjects, imaging protocols, image processing, studies in the context of which the images were acquired and processed, etc). may be organized according to various information models and schemas. Semantic web technologies provide interesting solutions to address this problem. Especially, ontologies facilitate the alignment of such heterogeneous data onto a common semantic reference. The presentation will introduce the basics of ontologies, and explain how ontologies can help sharing medical images and related imaging biomarkers in imaging biobanks and federations of imaging biobanks. Emphasis will also be put on interoperation with (specimen) biobanks' data repositories, which is of critical importance with regards to correlating imaging observations and biomarkers with biological data obtained from specimen (histopathology, genomic and other omic data). The MIABIS/OMIABIS model (Minimum Information About Biobank data Sharing) already in use in biobanking will be introduced and a mapping to information models of the medical imaging domain will be discussed.

Learning Objectives:

1. To understand the requirements for a structured and interoperable "language".
2. To learn about different ontologies and taxonomies.
3. To consolidate knowledge about "Minimum Information About Biobanking Sharing" (MIABIS) 2.0.

08:30 - 10:00 **Room E1**

Professional Challenges Session

PC 9b

Radiology ten years from now: where will it be?

A-330 08:30

Chairman's introduction

C.D. Becker; *Geneva/CH*

Digital technology has fundamentally changed the role of the radiologist as a provider and interpreter of images. Images may be seen as a "commodity" that is available anywhere and can be reinterpreted anytime. The radiologist's expertise for ensuring quality, efficacy and safety of an imaging study or to define the right imaging protocol is often invisible. The radiologist's clinical relevance in the modern multidisciplinary environment lies in his or her involvement in the process of choosing the right imaging modality for a specific patient and for a specific clinical problem and in the participation as a subspecialist in the clinical and scientific activities of organ-related groups or "centres". With digitilisation of pathology images, pathologists could face similar developments as radiologists in the future. One solution to face these challenges consists in organising 'diagnostic platforms' for close interaction of all specialties related to medical imaging in order to generate a common personalised report to be discussed at regular multidisciplinary meetings in subspecialised teams to ultimately end in a personalised (tailored) patient management strategy. At the same time however, it appears necessary to define the requirements and organisation of general radiologic training for the future. Radiologic practice in most primary care hospitals requires well- trained radiologists with interpretation and interventional skills covering all radiologic modalities and related to many organ- related fields rather than "super-specialists" in a specific subspecialty. Our discussion will focus on the above challenges.

Session Objectives:
1. To define the role of the radiologist in the multidisciplinary environment.
2. To evaluate potential synergies between radiology and pathology in a common management structure.
3. To discuss the leadership challenges in radiology for the next decade.

A-331 08:40

Expanding radiology with new multidisciplinary competencies

J.A. Reekers; *Amsterdam/NL (j.a.reekers@amc.uva.nl)*

In the next decade, the profession of radiologist will undergo a huge change. The transformation from imager to image consultant is inevitable and already things are changing. The central position of diagnostic imaging will only grow; however, we have to be prepared to defend our position against clinicians reading images. Becoming the indisputable image specialist, consultant and quality guard is, therefore, mandatory. The new radiology curriculum is already dedicated to sub-specialization after 2-year common trunk. Also the demands from the patients, insurance companies and government regarding safety, transparency, efficacy and cost reduction will only grow. Here the role of physician assistants will expand very rapidly. Because the new radiologists will be super-specialised and busy with their new task as imaging consultant, they will no longer have the time and knowledge to take care of the bulk of routine imaging, including plain films and ultrasound. Here we will see emerging of a new profession to fill that gap. This is also seen already in many countries where ultrasound and also plain films are more and more taken care of by non-radiologist/technicians, working in the radiology department. To protect the intellectual property of radiology, radiologists will have a dominant role in clinical advisory boards and multidisciplinary meetings. The product to sell in the future is no longer images but specialised imaging knowledge and service. When that is realised the imaging machines will no longer be part of the radiology department but a service unit by itself.

Learning Objectives:
1. To explain the need for subspecialisation and clinical involvement for future radiologists.
2. To review the role of the subspecialised radiologist in the modern hospital environment.
3. To discuss strategies to increase visibility of the radiologist in the medical community.

A-332 09:00

Potential synergies between radiology and pathology

R.H. Oyen; *Leuven/BE (Raymond.Oyen@uzleuven.be)*

Pathology is considered as the ultimate reference for final diagnosis of many diseases. Unlike radiology, the pathology result/report is not often contested by clinicians. Radiologists will admit that pathology correlation allows quality control and peer review, and that correlation improves radiology training and expertise. Communication between interventional radiologists and pathologists is essential for appropriate handling of biopsy specimens to obtain 'more' information from 'less' material. Profound and accessible correlation with pathology and communication with the pathologist is also largely beneficial for surgeons to improve surgical techniques and ultimately patient outcome. With digitization of pathology, images of gross pathology and microscopic specimens will become available hospital wide and, as for radiology, images will be separated from the report. Many clinicians now subspecialists in interpretation of radiological imaging studies, will gain experience and expertise in pathology interpretation too. To face future challenges, it is seemingly inevitable to organize 'diagnostic platforms' involving radiology, clinicians involved in imaging, nuclear medicine, pathology, and genetics. Intense collaboration and interdisciplinary platform discussions should generate a single, common and personalised report. This single report of diagnostic findings from the platform is communicated and discussed with the referring clinicians at regular multidisciplinary meetings in subspecialised teams, to ultimately end in a personalised (tailored) patient management strategy. This flow would avoid therapeutic management based upon clinician's adherences
to a (single) technique or modality. The role of imaging platforms should, therefore, be that of consultancy in several stages of personalised patient care.

Learning Objectives:
1. To describe the advantages of integrating radiology and pathology in the same organisational structure.
2. To discuss workflow and potential synergies.
3. To review local experience with regard to integration.

A-333 09:20

The beauty of general radiology

G.H. Mostbeck; *Vienna/AT (gerhard.mostbeck@wienkav.at)*

The beauty of being a general radiologist may be defined by: not having to call the chest specialist when there is a pulmonary nodule on an abdominal CT, not having to call the vascular radiologist when there is a suspicion of DVT and a need for compression ultrasound and not having to call the paediatric radiologist do identify the thymus as the aetiology of mediastinal widening. However, general radiology "as such" might be considered an "endangered non-subspecialisation" in radiology. Looking at the new edition of the "European Training Curriculum" level I and II, knowledge, skills, competences and attitudes have been well defined for these two training levels, with special emphasis that two subspeciality areas should be chosen in training years 4 and 5, one of these subspeciality areas may remain general radiology. Accordingly, there should be at least one subspecialisation for every radiologist. The role of these general radiologists in the modern hospital environment depends on the size and specialization (secondary to tertiary care centre) of these hospitals. The larger, the more subspecialisation necessary based on general radiology support. The smaller, the more general radiology requirements and the need for 24/7 radiology subspecialisation and expert opinion consultation (teleconsultation). In this regard, the general radiologist may be defined as the gate keeper for more complex diagnostic and interventional procedures performed and interpreted by radiologic subspecialists.

Learning Objectives:
1. To define the training requirements and related challenges for complete, transverse core competences in general radiology.
2. To define the practical challenges involved with increasing subspecialisation in radiology.
3. To define the role of the general radiologist in the modern hospital environment.

09:40
Panel discussion: What are the leadership challenges for the next decade?

08:30 - 10:00 **Room E2**

Special Focus Session

SF 9c

Brain hypersignals after repeated gadolinium administrations

A-334 08:30

Chairman's introduction

V. Runge; *Berne/CH*

As stated in: Runge VM. Commentary on T1-Weighted Hypersignal in the Deep Cerebellar Nuclei After Repeated Administrations of Gadolinium-Based Contrast Agents in Healthy Rats: Difference Between Linear and Macrocyclic Agents. Invest Radiol. 2015;50 (8):481-2. "The gadolinium chelates (the GBCAs) are critical to disease diagnosis by MR, indeed to clinical medicine worldwide, and have proven to be overall a very safe class of contrast media. However, the article of reference in this issue of Investigative Radiology {Robert P, Lehericy S, Sylvie G, et al. T1-weighted hypersignal in the deep cerebellar nuclei following repeated administrations of gadolinium-based contrast agents in healthy rats: difference between linear and macrocyclic agents. Invest Radiol. 2015;50:473-480.} should serve as a call for further research as well as re-evaluation by the pharmaceutical regulatory agencies worldwide. All of the currently approved GBCAs should be evaluated by the methods used in the article by Robert et al, or by a similar approach. This could lead, and if so appropriately, to the reassessment of the approval status of the least stable agents. As physicians, let us remember, above all, to do no harm."

Session Objectives:
1. To review old and recent data on gadolinium (Gd) chelates kinetics and toxicity.
2. To learn about the recent abundant literature concerning brain hypersignals.
3. To understand the undertakings and positions of the health agencies.

Author Disclosure:
V. Runge: Advisory Board; Guerbet. Research/Grant Support; Guerbet, Bracco. Speaker; Bayer.

A-335 08:35

Chemistry of Gd chelates and fundamentals in toxicity

S. Aime; *Turin/IT (silvio.aime@unito.it)*

Numerous studies indicate that gadolinium (Gd3+) chelates, used as contrast agents (CA) in MRI, are not fully eliminated from the body in the presence of problems in renal excretion. More recently it has been reported that some residual Gd3+ was found in the brain of patients with normal renal function treated with Gd3+-based contrast agents. It is important to get more insight into the characterisation of the chemical form of the Gd-containing species. The in vivo preservation of the metal complex integrity relies on their thermodynamic

and kinetic stabilities. It is known, however, that complexation equilibria are not reached in body fluids because of the slow dissociation and the relatively rapid elimination of CAs. Hence, the extent of in vivo dissociation of CAs depends on the stability constants and also on the rates of dissociation and elimination of Gd3+ chelates. The speciation of the released Gd3+ ions relies on the binding affinity these ions have with the components of the biological fluids. Calculations using solutions mimicking biological fluids will be presented to predict the amount of in vivo released Gd3+. These data will be compared with the results obtained in vivo from animal models.

Learning Objectives:

1. To understand the determinants of the in vivo stability of Gd complexes.
2. To understand the physicochemical aspects affecting the biodistribution of Gd.

Author Disclosure:

S. Aime: Consultant; Bracco Imaging.

A-336 08:52

Recent literature review

A. Radbruch; *Heidelberg/DE (a.radbruch@dkfz.de)*

Several recent studies have shown that the serial application of gadolinium based contrast agents (GBCAs) can result in a signal intensity increase on unenhanced T1 weighted images in different regions of the brain; first and foremost in the dentate nucleus. Furthermore, autopsy studies found gadolinium in brain tissue of patients exposed to multiple GBCA administrations while no gadolinium was found in patients without exposition to GBCAs. Further studies reported a signal intensity increase exclusively in patients exposed to serial injections of linear GBCAs while no signal intensity increase was reported for serial injections of macrocyclic GBCAs. The talk will review the evidence provided so far from the published literature.

Learning Objectives:

1. To review published data on hyperintensities and gadolinium deposition in the brain after repeated gadolinium administrations.
2. To review published data on the differences of hyperintensities and gadolinium deposition in the brain after repeated administrations of macrocyclic and linear gadolinium based contrast agents.

Author Disclosure:

A. Radbruch: Advisory Board; Bracco, Guerbet, Abbvie. Consultant; Bayer, Guerbet. Research/Grant Support; Guerbet. Speaker; Bayer, Guerbet, Prime-Oncology, Siemens.

A-337 09:09

Hypersignals in the brain: which clinical impact

T.A. Yousry; *London/UK (t.yousry@ucl.ac.uk)*

Over the last few years, there has been an increasing number of publications reporting T1 shortening in the dentate nucleus and globus pallidus of patients exposed to repeated injections of gadolinium-based contrast material. The T1 shortening suggests dechelation and has mainly been observed with linear rather than macrocyclic gadolinium chelate administration. The clinical relevance of this observation is not clear. Nevertheless, the FDA felt it important enough to make an announcement on its investigation of this observation. We will, therefore, review the clinically most important aspects of the function of the dentate nucleus and globus pallidus. We will then review how mineralisation can affect their function and consider the potential clinical impact.

Learning Objectives:

1. To understand the clinically most important aspects of the function of the dentate nucleus and basal ganglia nuclei.
2. To learn about signal variants and concerned pathologies.
3. To speculate about the potential implications of gadolinium depositions.

A-338 09:26

Recent FDA and EMA undertakings in the matter

O. Clément; *Paris/FR (olivier.clement@egp.aphp.fr)*

Brain hypersignals in the dentate nucleus and globus pallidum after repeated administrations of Gd chelates have been a major issue for radiologists with many publications in the past year. The European Medicines Agency (EMA) and the American Food and Drug Agency (FDA) have been very active in the information of patients and in the gathering of pertinent information by drug manufacturers. The aim of this talk will be to review the most recent official views and positions on the subject which could translate into a modification of the injection protocols in contrast-enhanced MRI.

Learning Objectives:

1. To learn about the pharmacovigilance actions of the European Medicines agency and the American FDA.
2. To understand the risk minimisation measures.

Author Disclosure:

O. Clément: Speaker; lectures on allergic reactions for Bracco and Guerbet.

09:43

Panel discussion: Gadolinium injections: should we change our practice?

08:30 - 10:00 **Room F1**

Oncologic Imaging

RC 916

Diffusion-weighted imaging (DWI) in oncology: how I do it

A-339 08:30

Chairman's introduction

D.-M. Koh; *Sutton/UK (dowmu.koh@icr.ac.uk)*

Diffusion-weighted MRI is widely employed in oncology to improve disease detection, support disease characterisation and for assessing tumour response to treatment. The technique can now be applied at both 1.5 T and 3.0 T and the principles for technical optimisation are similar. DWI is being used in the abdomen for disease assessment, including in the liver, kidneys and pancreas, as well as for evaluation of peritoneal disease. Whole body DWI is an imaging technique that is being widely evaluated, particularly for the evaluation of bone marrow disease. Whole body DWI images may be assessed qualitatively and quantitatively, and use of standardised reporting may help to widen the adoption and dissemination of the technique.

A-340 08:35

A. DWI: how to optimise protocols

N. Papanikolaou; *Stockholm/SE (npapan@npapan.com)*

Diffusion-weighted imaging (DWI) is a modality that can be used to study microscopic motion of water molecules, and therefore the presence of macroscopic physiologic motion like respiration or peristalsis, affecting abdominal organs, poses certain challenges. Several methods have been proposed including breath holding, respiratory triggering or free breathing to overcome respiratory-related image degradation. Additionally, ultrafast pulse sequences like single-shot echo planar imaging are preferable for diffusion applications due to their capability to freeze macroscopic motion; however, they are sensitive to susceptibility artefacts. Efficient fat suppression is a prerequisite for adequate image quality and different approaches including spectral fat sat pulses or inversion recovery methods (DWIBS) have been proposed. Geometrical distortions represent another potential problem since it may hamper diagnostic efficacy of DWI images. To minimise the latter effects, strong gradients need to be recruited to achieve short echo times and furthermore make the right selection of the phase encoding direction. In the context of a reliable and accurate analysis of the DWI data, the choice of a sufficient number of b-values and an optimal distribution is mandatory and still under discussion. Literally, signal attenuation due to capillary blood flow (perfusion) is most apparent at low b-values with their range varying depending on the tissue of interest. On the other hand, diffusivity is highlighted in higher b-values. Therefore, choosing the optimum number and group of b-values can substantially minimise the overall measurement error of the diffusion metrics that lead to better quantitative and qualitative results.

Learning Objectives:

1. To learn about examination protocols and techniques.
2. To understand the different models describing diffusion in various organs and diseases.
3. To become familiar with basic and advanced post-processing aspects.

Author Disclosure:

N. Papanikolaou: Owner; N. Papanikolaou & Associates LP.

A-341 08:58

B. DWI in abdominal oncology: ready for clinical practice?

D.M. Lambregts; *Amsterdam/NL*

The role of diffusion-weighted imaging has emerged in recent years and DWI is now part of various clinical oncological MR imaging protocols. This lecture aims to discuss the various ways DWI can be used for oncologic imaging evaluation (visual assessment, volumetry, quantification/ADC) and address the strengths and weaknesses of these approaches. We will highlight some important pitfalls that radiologists need to be aware of when looking at diffusion-weighted images. Finally, we will discuss the most important current and future applications of DWI for oncologic imaging in the abdomen.

Learning Objectives:
1. To learn about the different ways diffusion imaging protocols can be used for qualitative and quantitative evaluation of malignant tumours in the abdomen.
2. To understand the pitfalls of using DWI in abdominal oncology.
3. To become familiar with the current clinical applications for DWI in abdominal oncology.

A-342 09:21

C. DWI: whole body imaging

V. Vandecaveye; *Leuven/BE (vincent.vandecaveye@uzleuven.be)*

Diffusion-weighted imaging (DWI) uses differential tissue microstructural properties for tumour detection, staging and response assessment. Technical developments have enabled clinically efficient whole body DWI (WB-DWI) and is warranted in oncology due to the increasing need for assessment of multifocal disease. WB-DWI brings a number of challenges in terms of correct selection of indications, optimisation of sequences and qualitative and quantitative interpretation protocol. WB-DWI is best applied in indications where metabolic imaging has lower diagnostic yield due to inflammatory background such as in the post-treatment setting, in case of expected small volume disease such as in peritoneal carcinomatosis in ovarian or colorectal cancer or in case of cancer with low metabolical profile like lobular breast cancer or gastric cancer. The DWI sequence is the core of the imaging protocol but requires anatomical sequences for correlation and exact interpretation. The types of applied anatomical sequences vary depending on the indication but with contrast-enhanced sequences being indispensable in abdominal cancer and non-enhanced T1 sequences being mandatory for assessing skeletal metastases. WB-DWI benefits most from the application of the short tau inversion recovery (STIR) prepulse as it is robust to inhomogeneity-induced fat suppression and susceptibility artefacts and facilitates the detection of small tumoural lesions. Image interpretation should be qualitative as much as possible for clinical efficiency and to enhance communication with referring clinicians. Quantitative image evaluation in case of response assessment of nodal staging requires development of computer-aided imaging interpretation tools. This presentation outlines indications, optimised imaging and interpretation protocols for WB-DWI.

Learning Objectives:
1. To learn about the most common indications of whole body diffusion imaging in cancer staging and treatment planning.
2. To become familiar with normal anatomy and physiological signal at whole body diffusion imaging.
3. To understand how to integrate qualitative and quantitative interpretation criteria into a structured report to optimise communication with the referring clinician.

09:44
Panel discussion: How to optimise DWI for clinical practice?

08:30 - 10:00 **Room F2**

Special Focus Session

SF 9a
Breast density: how not to be confused?

A-343 08:30

Chairman's introduction

E. Azavedo; *Stockholm/SE (edward.azavedo@ki.se)*

Breast density is an important factor that makes breast imaging a challenging task. Sensitivity of mammography to detect malignancies in dense breasts is affected in an unfavourable way while ultrasound provides better chances to detect abnormalities in dense tissues. MRI has shown to have a high sensitivity that is independent of breast density. These are known facts but even then there has been development in these technologies. During this session we will have three speakers giving us the highlights of these three technologies to help us to assess dense breasts.

Session Objectives:
1. To learn why breast density is a diagnostic problem and to understand if it is a prognostic factor.
2. To be able to identify and grade breast density.
3. To understand why dense breast could be a masking process and to learn how to avoid false negatives.

A-344 08:35

The mammographic dense breast

F.J. Gilbert; *Cambridge/UK (fjg28@cam.ac.uk)*

The understanding of breast density is important as there is increased recognition of the likelihood of masking of breast cancer when there is increased fibroglandular tissue and the increased risk of breast cancer in those with high breast density. In those women with high breast density, mammographic sensitivity is reduced below 50%. Breast density is usually expressed as the percentage of fibroglandular tissue in relation to the whole breast size. However, there is mounting interest in the absolute fibroglandular volume as a more robust measure of risk. The problem of assessing density from a 2D image is challenging but there are several software tools which are robust and reproducible and comparable to human observer measurements. There are a number of observer scales which are frequently used such as the UK score - fatty, mixed and dense; Cumulus, Boyd classification and the American College of Radiologists BIRADS which was revised in 2014. This is a descriptive semi-quantitative scale which uses four categories: A - almost entirely fatty (< 25% glandular), B - scattered areas of fibroglandular density (25-50% glandular), C - heterogeneously dense which may obscure small masses (51-75% glandular) and D - extremely dense which lowers the sensitivity of mammography (> 75% glandular). BIRADS is reasonably reproducible amongst observers. Breast density is an inherited phenotype with recognised SNPs. However, density is also affected by age, menopausal status, hormonal supplements, anti-oestrogen therapy, weight and radiotherapy.

Learning Objectives:
1. To learn the definition of dense breast and the consequences on mammography interpretation.
2. To understand the different methods to measure breast density on mammography.
3. To analyse details that can be associated with abnormalities in dense tissues.

A-345 09:00

The ultrasound dense breast

L.J. Pina Insausti; *Pamplona/ES (ljpina@unav.es)*

US can be used in a targeted mode to assess a lesion that has been previously detected on other modalities (such as mammography, MRI, PET-CT, etc). with excellent results. Moreover, it is well known that US can detect additional breast cancers in dense breasts after negative mammography, increasing the detection rate of breast cancer up to 37%. The automated breast US can play an important role to increase the detection of additional cancers in the screening of dense breasts. The ACR BI-RADS™ describes three patterns for US breast composition: homogeneous echotexture-fat, homogeneous echotexture-fibroglandular and heterogeneous echotexture. These patterns have similarities with mammographic density patterns (dense mammographic patterns can be seen as homogenous echotexture-fibroglandular and heterogeneous echotexture patterns). Due to the fact that most benign and malignant lesions are usually seen as hypoechoic masses, these lesions are better detected on homogeneous echotexture-fibroglandular than on the other patterns. However, there are other not well-studied factors that can influence the detection of lesions with US: volume of the breast (attenuation of US in large-sized breasts), localisation of the lesion (worse visualisation in deeply to superficially located lesions or lesions located behind the nipple or scars) and atypical appearance of some breast cancers (hyper or isoechoic cancers, subtle distortions, etc).

Learning Objectives:
1. To learn the different categories of breast density on ultrasound according to the new BI-RADS lexicon.
2. To learn the impact of breast density on ultrasound analysis and the interest of automatic breast ultrasound in breast cancer screening.
3. To learn how to handle a transducer in dense breasts.

A-346 09:25

The MRI dense breast

P.A.T. Baltzer; *Vienna/AT*

Breast density in MRI is considered an ambiguous term: it mainly refers to the amount of fibroglandular tissue that should be assessed and categorised according to the BI-RADS lexicon. As known from mammography studies, the amount of fibroglandular tissue is an independent risk factor for development of breast cancer. MRI may assess this risk factor in a volumetric, three-dimensional manner. This is why some authors consider MRI assessment of breast density superior to mammographic assessment. After contrast agent administration, breast parenchyma can show various levels of enhancement, referred to as background parenchymal enhancement. This enhancement is referred to as "MRI breast density" by some authors, a connection based on the assumption that a marked background parenchymal enhancement may decrease the diagnostic performance of breast MRI in analogy to the amount of fibroglandular breast tissue in mammography. This talk will deal with both aspects of breast density and provides the delegates with evidence-based clinical knowledge.

Learning Objectives:

1. To learn the differences of breast density and (breast enhancement patterns) background parenchymal enhancement (BPE), on MRI.
2. To understand if breast density or (breast enhancement) BPE have an influence on breast cancer risk.
3. To understand enhancement in diffusely growing malignancies in a dense background.

09:50

Panel discussion: How to overcome the dense breast in screening?

08:30 - 10:00 **Room D1**

Chest

RC 904

Low dose and no-dose chest imaging: opportunities and limitations

Moderator:

A.P. Parkar; Bergen/NO

A-347 08:30

A. Low-dose CT

O. Buckley; *Dublin/IE (orlabucko@gmail.com)*

COPD is a multifactorial disease that is best evaluated with a combination of clinical and radiologic parameters. CT is used in the diagnosis and management of COPD. CT in COPD can be used to differentiate airway predominant disease, parenchymal disease or a mixture. Ultralow-dose (ULD) CT has been shown to have good correlation with standard-dose CT of the thorax in the evaluation of COPD. Protocol for ultralow-dose CT thorax is discussed with overview of options for dose reduction including using fixed low mA, reducing kilovoltage, reconstruction algorithms, and adjusting noise thresholds. Achievable dose levels are discussed. Image quality at these levels is illustrated with discussion of impact of increased noise on mild, moderate and severe disease. The clinical application of the ULD protocols in imaging of COPD is discussed with strengths and weaknesses identified. Specifically the impact of body mass index on densitometry measurements is reviewed. Other CT features of clinical significance in COPD patients that are identifiable at ULD CT are discussed such as coronary artery calcification and pulmonary artery dimensions.

Learning Objectives:

1. To learn about techniques for decreasing the radiation dose on CT.
2. To know in which clinical situations low dose CT should be performed.

Author Disclosure:

O. Buckley: Grant Recipient; 25,000euro from Charitable Meath Foundation, invested in Toshiba Medical Systems Densitometry software. Speaker; invited speaker to Toshiba Medical systems lunch time symposium ESTI Amsterdam 2014.

A-348 09:00

B. MRI

J. Dinkel; *Munich/DE*

The purpose of this presentation is to review the currently available MR techniques useful in thoracic imaging and to provide an overview of present and emerging clinical applications of thoracic MRI. Although many studies have advocated a valuable role for thoracic MRI, it has currently limited clinical utilisation with the exception of cardiovascular imaging. However, new technical developments and MRI sequences have continuously improved the quality and broadened the clinical indications for thoracic MRI. Furthermore, due to its high soft tissue contrast and the lack of radiation exposure, MRI allows for repeated measurements of the lung structures and, therefore, appears to be appropriate for functional investigation of lung.

Learning Objectives:

1. To learn about the current lung MR protocols.
2. To know in which clinical situations lung MRI is a helpful adjunct to diagnosis.

A-349 09:30

C. US

F. Gleeson; *Oxford/UK (fgleeson@mac.com)*

Ultrasound is increasingly used in the Intensive Care Unit. It may be used to confirm the presence of a pleural effusion and help to determine if it suitable for or requires drainage. US plays a key role in guiding chest drain insertion and identifying post insertion complications. More recently it has been shown to be useful in diagnosing a pneumothorax, particularly in the context of a recent line insertion. It may also be of value in diagnosing heart failure, infection and has been reported to be of value in diagnosing pulmonary embolic disease.

Learning Objectives:

1. To learn when and how to perform a US study in the intensive care patient.
2. To become familiar with the strengths and limitations of the technique.

08:30 - 10:00 **Room D2**

Radiographers

RC 914

State-of-the-art breast imaging

A-350 08:30

Chairmen's introduction (part 1)

V. Syrgiamiotis; *Athens/GR (syrgiamiotisvasilis@gmail.com)*

Developments in digital mammography provides the new components of mammography equipment hardware, the new components of mammography potential of tomosynthesis in breast imaging and the new developments focusing in general recommendations, technical requirements, patient handling. The session will be focused on the current limitations of digital mammography in breast imaging and will highlight the role of the radiographer in breast MRI in view of the recent developments in MR imaging technology. It will be also a challenge to learn about possible future developments in clinical applications.

A-351 08:33

Chairmen's introduction (part 2)

S. Zackrisson; *Malmö/SE (sophia.zackrisson@med.lu.se)*

Breast imaging has faced a major evolution during the last decades with the introduction of digital mammography, digital breast tomosynthesis and moreover, an important role for breast magnetic resonance imaging (MRI). This implies that the radiographer's role has become more diverse and challenging. This refresher course will provide an overview of breast imaging including the current status and development of digital mammography, digital breast tomosynthesis and breast MRI. It will focus on strengths and weaknesses of the modalities, the radiographer's role and patient handling.

Session Objectives:

1. To review current methods of screen-film mammography.
2. To present recent developments in digital mammography.
3. To explain the future of breast MRI techniques.

Author Disclosure:

S. Zackrisson: Speaker; Speaker's fees and travel support from Siemens Healthcare AG.

A-352 08:35

A. Current status of digital mammography

C.E. Mercer; *Manchester/UK (c.e.mercer@salford.ac.uk)*

With an ever increasing reliance on full field digital mammography for the detection of small lesions, there is a strong expectation of the mammography practitioners to provide high-quality mammography images on first attempt. However, blurred images have been anecdotally acknowledged as a 'new phenomenon' within digital mammography. Practitioners are being placed under increasing pressure to identify any 'blurring' of the image and repeat immediately if required, rather than cause a technical recall which places additional anxiety on the client. Accurate breast compression techniques can assist in the reduction of 'blurring' and are an essential skill for practitioners to

acquire. In addition to these technical abilities, practitioners are required to manage the complexity of patient rapport and have effective time management skills. Utilising a newly designed breast compression paddle, which produces a readout of pressure rather than force, the client experience, over time, could be standardised. With the utilisation of new breast positioning skills for the oblique and the cranio-caudal views, which demonstrate a reduction in pressure for the client, the overall experience of the procedure may be improved. Utilising these new techniques, practitioners have the ability to detect small breast lesions in areas of the breast that may not have been visualised by analogue film mammography.

Learning Objectives:

1. To appreciate the strengths and weaknesses of digital mammography in breast imaging.
2. To become familiar with the importance of optimising breast compression for improving image quality.
3. To appreciate the clinical role of digital mammography in highlighting breast pathologies.

A-353 08:58

B. Developments in digital mammography

C. Reis; *Lisbon/PT (claudia.reis@estesl.ipl.pt)*

In the past two decades, technology developments in breast imaging technology took place. A milestone was the introduction of digital mammography (DM) in the 1990s. The main goal pursued by manufacturers has been to develop practical, inexpensive, harmless, patient-friendly equipment, effective in identifying, localising and characterising abnormal tissues and signs of pathology within the breast. The subtle x-ray attenuation properties between normal and abnormal breast tissues and the risks associated to ionising radiation demand imaging techniques that minimise dose and optimise image quality. This promotes the refinement of dedicated x-ray equipment for mammography (specialised x-ray tubes, adequate x-ray spectra, compression devices, anti-scatter grids, phototimers and digital detector systems). The development of DM has opened up new opportunities to solve some problems related to tissue overlapping such as tomosynthesis and contrast enhancement digital mammography (CEDM). Tomosynthesis is a novel technique that aims to increase the sensitivity for breast cancer detection. Studies reported improved conspicuity of breast structures by removing the visual clutter associated with overlying anatomy. If the detector exposure is kept constant, conspicuity/detail improves with reduced compression, possibly as a result of the greater tissue separation between tomosynthesis sections. However, tomosynthesis is a relatively recent technology and there are a number of technical parameters that must be optimised. Studies are ongoing to optimise the angular range for the projections, the number of projections, the x-ray beam energy and dose, and the primary mammographic view craniocaudal and/or mediolateral oblique.

Learning Objectives:

1. To understand the current developments in digital mammography.
2. To become aware of the potential of tomosynthesis in breast imaging.
3. To become familiar with the current limitations of digital mammography in breast imaging.

A-354 09:21

C. Breast MRI and the future

G. Podobnik; *Ljubljana/SI (gpodobnik@onko-i.si)*

This presentation will include the developments of breast MRI from its early days until today with special focus to its current status in breast diagnostics (general recommendations, technical requirements, patient handling and sequences). Furthermore, it will discuss the radiographers' views and the role in today's daily performance and recommendations for breast MRI. Some challenges will also be addressed, e.g. how to overcome motion artefacts. In addition, the presentation will provide a brief overview of the future development in breast MRI in terms of possible improvements in the near future, such as advance imaging techniques (diffusion-weighted imaging, spectroscopy and perfusion imaging), furthermore improvements in hardware and in advance image postprocessing.

Learning Objectives:

1. To appreciate the strengths and weaknesses of MRI in breast imaging.
2. To understand the role of the radiographer in breast MRI in view of the recent developments in MRI technology.
3. To become aware of possible future developments in and clinical applications of breast MRI.

09:44

Panel discussion: The role of multimodality imaging in breast imaging

08:30 - 10:00 **Room K**

EFOMP Workshop: Radiation Protection for the female patient and female medical staff

EF 1

Breast imaging modalities and radiation dose

Moderators:
T. Beyer; Vienna/AT
J. Damilakis; Iraklion/GR

A-355 08:30

Chairman's introduction

J. Damilakis; *Iraklion/GR (damilaki@med.uoc.gr)*

Several imaging techniques have been developed for breast cancer diagnosis. X-ray mammography is the most widely used modality for early detection and follow-up of lesions. Ultrasound examination, magnetic resonance imaging, magnetic resonance spectroscopy and positron emission tomography can provide additional information for the early diagnosis and characterisation of breast tumours. Dedicated CT systems have been developed for the three-dimensional high-resolution imaging of the breast. However, x-ray mammography has been considered as a 'gold standard' for screening of asymptomatic women. Screening mammograms are associated with low radiation dose and are capable of reducing breast cancer mortality considerably. Mammography screening usually involves two views of each breast. It is well known that the glandular tissue in the breast is very sensitive to radiation. The mean glandular dose associated with the two view examination is 2.5-5 mGy. Although mammography is a low-dose technique, optimisation of protection, i.e. reduction of radiation dose without loss of diagnostic information is of paramount importance. Glandular dose increases with decreasing tube potential and increasing breast thickness. Scattered photons degrade image quality considerably. The use of an anti-scatter grid reduces scatter; however, patient dose is increased. The use of automatic exposure control and proper breast compression are also important measures to reduce dose and improve image quality.

Session Objectives:

1. To become familiar with the advanced breast imaging modalities.
2. To learn about breast doses from these modalities.
3. To appreciate their advantages and limitations.

A-356 08:35

Breast CT: technology and patient dose

I. Sechopoulos; *Nijmegen/NL (ioannis.sechopoulos@radboudumc.nl)*

The two-dimensional nature of mammography limits its sensitivity and specificity, especially when imaging dense breasts. To overcome this limitation, various tomographic and pseudo-tomographic imaging methods, including stereoscopic mammography, digital breast tomosynthesis and dedicated breast CT, are being developed and their clinical performance investigated. Given their different characteristics, some of these methods appear to be complementary, each with its own strengths and weakness in the clinical realm. Dedicated breast CT consists of an optimised CT system for imaging of the breast, involving a cone beam CT system that irradiates only the imaged breast, at lower x-ray energies and with higher spatial resolution than conventional CT systems. Due to its unique acquisition geometry and x-ray spectra, the dosimetric characteristics of this technology differ substantially from both mammography and conventional CT. Current breast CT system design and characteristics, the clinical trials performed with this technology, and the dosimetric aspects of breast CT will be reviewed. Finally, potential future developments in dedicated breast CT technology will be discussed.

Learning Objectives:

1. To understand the technical aspects of breast CT.
2. To become familiar with breast dose levels from breast CT.
3. To give an overview of future improvements and developments of breast CT.

Author Disclosure:
I. Sechopoulos: Consultant; FUJIFILM Holdings Corporation. Patent Holder; Hologic, Inc, Barco nv.

A-357 09:05

Digital mammography for screening and diagnosis of breast cancer: breast doses and radiogenic risks

O. Morrish; *Cambridge/UK (oliver.morrish@addenbrookes.nhs.uk)*

The justification for the use of ionising radiation for medical imaging requires an assessment to be made that balances the benefit from that imaging against the potential detriment caused by the radiation dose. This judgement is of

particular importance when medical exposures are carried out on asymptomatic individuals such as those used in breast cancer screening programmes. As full field digital mammography equipment has been replacing older film screen-based analogue equipment, the doses associated with mammographic exposures have reduced. This talk will outline the methodology used to assess radiation dose from mammography, or mean glandular dose, and will indicate the typical doses delivered by modern equipment. The factors influencing these doses will be explored, from x-ray system design and technology to radiographic technique. The relationship between radiation dose and the risk of breast cancer induction from mammography will be reviewed with a look at the latest research findings that reinforce the view that the radiogenic risk from a properly managed breast screening programme are minimal.

Learning Objectives:

1. To learn about breast doses and radiogenic risks from a two-view digital mammography.
2. To become familiar with breast doses and risks of radiation-induced breast cancer associated with mammographic screening.
3. To understand that the risk of radiation-induced breast cancer due to a properly performed mammographic screening programme is minimal.

A-358 09:30

Digital breast tomosynthesis: physical principles and radiation dose levels

G. Gennaro; *Padua/IT (gisella.gennaro@ioveneto.it)*

Digital breast tomosynthesis (DBT) is a quasi-3D imaging technique, which reconstructs tomographic images of the breast from a series of low-dose projection images acquired by a digital detector while the x-ray tube rotates within a limited arc. This can be relatively easily obtained from a standard digital mammography platform where the gantry is allowed to move around an axis located above the breast support, while the digital detector remains stationary during the acquisition of the low-dose projection. At present, different solutions are available for DBT systems, each of them with pros and cons, but the physical differences across systems are such that the comparison is not easy. More recently, synthetic 2D mammograms have been proposed, obtainable from DBT acquisition, and expected to replace standard 2D mammography while reducing radiation dose. A full overview will be provided of all technical aspects of digital breast tomosynthesis, and differences among DBT systems will be presented and analysed. Dose levels of DBT will be compared with those coming from standard 2D mammography. Furthermore, it will be shown how the major factor affecting dose levels in tomosynthesis is the clinical protocol, and how the synthetic 2D images might have a role in population dose reduction. Finally, future improvements and developments of digital breast tomosynthesis will be explored.

Learning Objectives:

1. To understand the technical aspects of digital breast tomosynthesis.
2. To become familiar with breast dose levels from digital breast tomosynthesis.
3. To give an overview of future improvements and developments of digital breast tomosynthesis.

08:30 - 10:00 **Room G**

E³ - ECR Academies: Neuroradiology: from Morphology to Function

E³ 919

Functional imaging of the spine

A-359 08:30

Chairman's introduction

M. Muto; *Naples/IT (mutomar2@gmail.com)*

This session will give an update on the most advanced spine technique from morphology to dynamic evaluation of CSF and tractography. The recent progress has as usual an important clinical therapeutic application leading to a better treatment decision. All the speakers are going to discuss the most advance progress in their field.

A-360 08:33

A. Measuring CSF flow: technique and clinical usefulness

B. Ertl-Wagner; *Munich/DE (Birgit.Ertl-Wagner@med.uni-muenchen.de)*

The cardiac cycle is the motor of cerebrospinal fluid (CSF) flow. During systole, there is an inflow of volume into the cranial vault. As the skull is nearly rigid, a compensatory downward flow of CSF ensues. During diastole, there is an upward flow of CSF from the spinal canal into the cranial vault with a nearly simultaneous venous outflow. Using MR phase contrast sequences, it is possible to quantify and assess the direction of CSF flow and the arterial inflow and venous outflow. When measuring flow, it is important to acquire the imaging planes perpendicular to the main axis of flow. Branching vessels or vascular loops should be avoided. Moreover, the velocity encoding (VENC) needs to be carefully chosen to ascertain a reliable quantification of flow and to avoid aliasing. To measure aquaeductal flow, the measurement plane should be positioned perpendicular to the aquaeduct. This also enables the quantification of the aquaeductal net flow and an estimation of the CSF production rate. To quantify the cerebrospinal CSF volume shift, the imaging plane should be positioned at the level of C2 above the most cranial pair of exiting nerve roots. When combining the measurements of arterial inflow and venous outflow to and from the cranial vault as well as the craniospinal volume shift, the intracranial pressure can be estimated. Chiari malformations can lead to an impaired craniospinal CSF flow. The assessment of CSF flow parameters can be combined with the evaluation of morphological parameters to enhance diagnostic decision making.

Learning Objectives:

1. To review the physiology of CSF flow during the cardiac cycle.
2. To evaluate the reliability of the quantification of CSF flow rates by use of phase contrast MRI.
3. To show examples where alterations of CSF flow in the craniocervical junction can influence clinical management (e.g. in patients with Chiari Malformation Type I).

A-361 09:02

B. Diffusion tensor imaging of the spinal cord in the assessment of intramedullary changes

M. Sasiadek; *Wroclaw/PL (marek.sasiadek@umed.wroc.pl)*

Conventional MRI sequences provide limited information of the internal spinal cord pathology. Diffusion tensor imaging (DTI) of the spinal cord might improve qualitative and quantitative assessment of the intramedullary changes. DTI is based on anisotropic diffusion, which theoretically is ideally suited to imaging of spinal cord tracts. However, due to the small size of the spinal cord and artefacts, obtaining good quality DTI of the spinal cord is a challenge. Fortunately technical developments (e.g. parallel imaging, cardiac and respiratory gating, decrease of the FOV, reconstructive matrix and slice thickness, increased number of diffusion directions, use of 3 T MR) improve quality of DTI images. DTI of the spinal cord can be used in many intramedullary changes, e.g. degenerative myelopathy, spine trauma, spinal canal intramedullary and extramedullary tumours, inflammatory diseases of the spinal cord. Currently the most promising applications of DTI seem to be degenerative myelopathy, spine trauma and intraspinal tumours. In degenerative disease of the spine DTI can detect, on the base of fractional anisotropy (FA), mean diffusivity (MD) or average diffusion coefficient (ADC) measurements, myelopathic changes which are not visible on plain MRI. Similarly in traumatic spinal cord injury DTI can evidence changes in the spinal cord at and away the site of trauma. In intraspinal tumours DTI may be helpful in differentiation compression from infiltration of the adjacent spinal cord tissue. The advantages of spinal cord DTI, described above, should result in increasing role of this technique in diagnosis, prognosis and follow-up of spinal cord diseases.

Learning Objectives:

1. To review the technique of diffusion tensor imaging (DTI) in the assessment of the spinal cord.
2. To document the usefulness of DTI in the detection of cervical spinal cord integrity alterations in different stages of degenerative spine disease.
3. To discuss the value of DTI in other diseases of the spinal cord.

A-362 09:31

C. Functional and quantitative MRI of symptomatic stenoses of the lumbar spine

K. Eberhardt; *Werneck/DE (info@mrt-kompetenzzentrum.de)*

The possibility to study the functional range of motion of the lumbar spine in a conventional whole body MR scanner is demonstrated. This approach guarantees detectability in preoperative diagnosis lumbar motion function, which was even superior to the results from conventional myelography and pmCT. Function-dependent measurements were described in numerous publications using open MRI systems with mostly low field strength or only under axial load. However, in all in vivo studies published so far only 2D

analyses were carried out. The values given in the literature for the range of motion show a relatively large range but are in good accordance with our findings. Studies were carried out with open MR scanners using vertically aligned magnetic fields of low field strength which allowed for some degree of movement. However, the spatial resolution of the data, which can be achieved with these MR scanners, is far too insufficient to perform detailed analysis or 3D examinations. Furthermore, studies in sitting or in the lateral position without position fixing devices allow only poorly controlled and not standardised examinations. Furthermore, it is showed that the change in CSF volume on MR-myelography (MRM) as a result of lumbar decompressive surgery strongly correlates with postoperative clinical findings. In conclusion, clinically reliable assignment of functionally related symptoms (e.g. of instabilities) to main stenosis height and length is often challenging because of the diversity of symptoms. Necessary diagnostic criteria can be fulfilled by this advanced MRM approach, which allows for sufficient visualisation of neural structures under motion function.

Learning Objectives:

1. To review the technique for performing MR myelography of the lumbar spine in flexion and extension.
2. To document the advantages of dynamic MR myelography for quantification of stenoses, motion-related changes, and spondylolistheses of the lumbar spine.
3. To show that dynamic MR myelography may be useful for early detection of spinal and for aminal stenosis, and show illustrative clinical examples.

08:30 - 10:00 **Room M 1**

Molecular Imaging

RC 906

Preclinical imaging as a driver for translational research: how I do it

A-363 08:30

Chairman's introduction

J. Hodler; *Zurich/CH*

The time lag between "bench and bedside" may be considerable, meaning that new knowledge is withheld from patients who might need it. The seamless transition between basic research and clinical work is, therefore, very important. Radiology can play an important role, for instance by adding technical knowledge and organisational abilities to animal imaging and by translating imaging protocols from animals to humans. To do so there is a need of structured training of clinical scientists and MD/PhDs and to provide attractive career tracks for them. There is also a need of interprofessional work, including physicists, engineers, biologists, technicians, lab workers and many others. This workshop provides knowledge about preclinical imaging and its translation into clinical radiology by experts in their fields.

Session Objectives:

1. To learn the translational potential of preclinical research.
2. To understand the needs of preclinical research.
3. To know the physiological differences between small animals and humans.

Author Disclosure:

J. Hodler: Equipment Support Recipient; Siemens. Grant Recipient; Siemens, Guerbet, Bayer. Research/Grant Support; Siemens, Guerbet, Bayer, Swiss National Research Foundation.

A-364 08:35

A. Preclinical MR/PET imaging of cancer

C. Kuntner-Hannes; *Seibersdorf/AT (claudia.kuntner@ait.ac.at)*

Small animal molecular imaging has become an important technique for the development of new drugs, radiotracers and therapies. Positron emission tomography (PET) together with magnetic resonance imaging (MRI) provides unique in vivo information about specific molecular pathways in cancer. It involves many choices, starting with the selection of radiotracer, animal model, hardware and software settings to data analysis and animal handling considerations. How to decide what settings or conditions to use is not straightforward, as the experimental design is dependent on the particular science being investigated. There is no single answer, yet there are factors that are common to all experiments that are the subject of this talk. From physics to physiology, there are many factors to consider, each of which can have a significant impact upon measurements of metabolism in vivo. This talk examines the most common factors related to all types of quantitative PET imaging of cancer.

Learning Objectives:

1. To learn the different targets for molecular imaging of cancer.
2. To understand the needs of standardisation in preclinical imaging.
3. To understand the challenges in quantitative preclinical PET imaging.

Author Disclosure:

C. Kuntner-Hannes: Research/Grant Support; Lower Austria Corporation for Research and Education (NFB) (Grant LS11-002 and LS12-006).

A-365 08:53

B. What about nano-technology?

F.M.A. Kiessling; *Aachen/DE (fkiessling@ukaachen.de)*

Nanotechnology is discussed highly controversially within society. Some consider it a major enabler in modern medicine. Others have strong concerns about its toxicity and its potential to cause ecological damage. In this talk, common classes of nanomaterials used in medicine are introduced. Materials are discussed in context with biocompatibility and degradability. Basic properties of nanoparticles that depend on their size, shape and charge are introduced, which define their pharmacokinetic properties. Based on these properties their suitability for diagnostic and theranostic purposes are discussed and illustrated with preclinical and clinical examples. In this context, the following aspects will be covered: imaging the blood pool, characterising and using the EPR (enhanced permeability and retention) effect in tumours with diagnostic and therapeutic nanoparticles, opening of biological barriers with microparticulate systems, labelling the MPS (mononuclear phagocyte system), and labelling cells and tissue engineered constructs. After this talk, the audience will have a better understanding of indications for the use of nanotechnology in diagnostic, therapeutic and theranostic concepts and should be able to recognise major pitfalls that exclude any future clinical translation.

Learning Objectives:

1. To understand nano-technology as it is used in imaging.
2. To learn the potential utility and toxicity of nano probes.
3. To understand the elimination route of nano probes.

A-366 09:11

C. View of the young researcher

D. Berritto; *Acerra/IT (berritto.daniela@gmail.com)*

In biomedical research, many experimental study designs require the application of small animal models for complex human diseases, where the underlying mechanisms can be explored in vivo by collecting non-invasively and, when possible, simultaneously anatomical, functional, and metabolic information. To meet the growing need of this information, in the last years new technologies for small-animal imaging have been developed including micro-radiography (μ-XR), micro-computed tomography (μ-CT), micro-magnetic resonance imaging (μ-MRI), micro-positron emission tomography (μ-PET), micro-ultrasonography (μ-US) and hybrid technologies, such as CT-PET and CT-SPECT. These tools constitute a key factor in the success and timeliness of research thanks to the possibility of conducting longitudinal research studies repeatedly examining the same animal model before, during and after the experimental procedures. Moreover, should not be regarded as a marginal issue the fact that non-invasive imaging helps to render animal experiments more ethically acceptable as it is compliant with the principles of the 3Rs (replacement, reduction, refinement). In relation to this new direction, some limitations must be overcome: available animal models are often inadequate; they do not reproduce in a satisfying manner several diseases. Moreover, we have no basis to determine how accurate a particular study on animals is, because a positive result on animals is not always replicable on humans. Clinical and translational research encompasses the acquisition of new knowledge about health and disease prevention, pre-emption and treatment and the methodological research necessary to develop or improve research tools, requiring more dedicated learning time and an intellectual environment conducive to such endeavours.

Learning Objectives:

1. To learn the benefits of preclinical imaging for clinical activities.
2. To learn how to translate the knowledge from pre-clinical to clinical applications.
3. To understand the limitations of translation.

A-367 09:29

D. View of the radiographer

R. Harris; *London/UK (rachelh@sor.org)*

Changes in societal and scientific understanding demand the most appropriate evidence-based care is provided for patients. In recent years, there has been an emphasis on the need for clinical frontline staff to be able to deliver high-quality evidence-based care and to realise the potential of non-medical staff taking on higher levels of responsibility. The Society and College of Radiographers has recently published its new research strategy. This is an ambitious document, which sets out expectations for the appreciation and use of research involvement at all levels of practice. The overarching Society and College of Radiographers' vision for research is to improve patient care and outcomes by continuing to develop, grow and implement a high-quality evidence base. The strategy has three key aims: embed research at all levels of radiography practice and education; raise the impact and profile of

radiography through high-quality research focussed on improving patient care and/or service delivery; expand radiography research capacity through development of skilled and motivated research-active members of the profession. This presentation will discuss factors that support or hamper research activity by radiographers. The main focus will be imaging research in general, but challenges and opportunities for radiographer involvement in preclinical imaging research and veterinary practice as foundations to assist in the building of skill sets and knowledge bases will also be discussed. In conclusion, research must become a fundamental component of radiographic practice as it will verify standards of care and sustain the future of the profession.

Learning Objectives:

1. To understand the role of the radiographer as partner.
2. To consolidate knowledge about prerequisites for imaging phantoms and animals.
3. To appreciate the benefits for translational and clinical research.

09:47

Panel discussion: How to set-up an attractive programme

08:30 - 10:00 **Room M 2**

Vascular

RC 915

Fixing a leaky EVAR

Moderator:
R. Morgan; London/UK

A-368 08:30

A. The role of US: Doppler, 3D US, CEUS
P. Ricci; *Rome/IT*

Endovascular aneurysm repair (EVAR) is an effective alternative treatment to open repair of abdominal aortic aneurysm and the number of EVAR procedures carried out worldwide is continuously growing. Incomplete exclusion of the aneurysm sac from the circulation, defined as endoleak, is the most frequent complication after EVAR occurring in 10% to 45% of cases, and it can be associated with aneurysm enlargement and possibly rupture. Despite its notable advantages, ultrasonography has not yet achieved reference standard status in the EVAR follow-up because of low diagnostic specificity and sensitivity. Recent studies on ultrasound examinations performed without echo-contrast agents reported sensitivity rates ranging from 43% to 97%, such wide differences suggesting that it does not guarantee the necessary reliability (4.5). Therefore, to date computed tomography angiography (CTA) is the preferred imaging modality to follow-up patients after EVAR. However, CTA surveillance carries the risks associated with radiation and contrast media exposure. Magnetic resonance angiography (MRA) and contrastenhanced ultrasonography (CEUS) have been shown in some studies a better accuracy than CTA (6, 7-13). However, there is no consensus with regard of optimal work-up with diagnostic imaging modalities in surveillance after EVAR. The accuracy of current imaging modalities in the detection and characterisation of endoleaks in aortic endografts, focusing especially on the accuracy of CEUS with the use of second generation contrast agent have been presented. The advantages, the limitations of CEUS in comparison with CTA and MRA, will be discussed.

Learning Objectives:

1. To understand the techniques of modern US assessment and follow-up with case illustration.
2. To appreciate the indications and limits of US in the modern imaging pathway.
3. To learn the latest evidence base for US assessment of endoleaks.

A-369 09:00

B. 2D and 3D CTA: current concepts
A. Bücker; *Homburg a.d. Saar/DE (arno.buecker@uks.eu)*

To detect and characterise an endoleak, contrast-enhanced ultrasound, CT or MRI can be used. While ultrasound offers real-time imaging, CT and MRI have to rely on optimally timed acquisition schemes to successfully localize the source of an endoleak. New CT scanners offer sufficient speed to acquire multiple 3D data sets allowing to visualise the filling of an endoleak albeit at the cost of higher radiation exposure. But ever more complex aortic prosthesis like fenestrated and branched systems require advanced imaging protocols, because the probability of combined types of endoleaks is increased. This justifies the use of higher radiation exposure. The lack of ionising radiation makes MRI an attractive alternative to CT. Using special k-space strategies MRI is also fast enough to acquire multiple 3D data sets but without the limitation radiation exposure might cause. But the type of aortic prosthesis has to be considered, because susceptibility artefacts due to the metal used can still be a problem. This will exclude some prosthesis from follow-up by MRA. Once an endoleak is successfully characterised either by MRA or CTA, transarterial oder percutaneous therapy planning can be made. Knowledge of the flow characteristics and the size of the remaining aortic aneurysm perfusion will aid in choosing the ideal endoleak therapy.

Learning Objectives:

1. To learn the optimal acquisition protocols for CT and MR assessment of endoleaks.
2. To appreciate the imaging characteristics of new grafts and their leaks.
3. To understand the role of CT/MRA in endoleak therapy planning.

A-370 09:30

C. Endovascular management
R. Uberoi; *Oxford/UK (raman.uberoi@orh.nhs.uk)*

After aortic aneurysm repair a major complication is the presence of endoleaks, which is persistent perigraft flow within the aortic aneurysm sac. Endoleaks are the most common complication following EVAR with an incidence of 10-50%. Depending on the type and persistency of endoleaks, further enlargement and rupture of the aneurysm sac can occur. It is important to carefully assess the follow-up imaging for endoleaks, with correct classification so that the most appropriate management is carried out. The majority of endoleaks treatment is predominantly managed by endovascular techniques. Type 1 endoleaks are often associated with unfavorable morphology and require urgent treatment. whereas type II endoleaks which are the most frequent, accounting for up to 40% of endoleaks, can be observed in the many cases. 50% of Type II ELs resolve spontaneously, 10-15% are persistent on long-term follow-up with new type II endoleaks developing in 5-10%. As in type I endoleaks, type III endoleaks are under high pressure, with significant risk of rupture and require urgent treatment. Type III endoleaks are infrequent with an estimated incidence of 4% beyond 1 year. Type IV endoleaks are defined as a porous endograft, which is usually seen < 30 days after graft placement, due to fabric porosity and usually do not require treatment. Type V endoleaks are said to be persistent pressurisation of the sac where there is no identifiable type 1-IV endoleak. A variety of hypothesis have been postulated and these patients have been treated with relining of the whole stent graft.

Learning Objectives:

1. To learn the natural history of endoleaks.
2. To understand the interventional therapy options.
3. To learn the outcome data on interventional therapies for endoleaks.

08:30 - 10:00 **Room M 3**

Special Focus Session

SF 9b

Imaging in the presence of orthopaedic hardware

A-371 08:30

Chairman's introduction
M. Zanetti; *Zurich/CH (marco.zanetti@hirslanden.ch)*

This special focus session will address how the CT and MR imaging protocols can be optimised in the presence of orthopaedic hardware. The management of prosthetic joint infection using imaging as well as laboratory findings will be addressed specifically. The role of other imaging methods such as ultrasound and hybrid imaging (PET-CT, SPECT-CT) will be discussed at the end of the panel discussion.

Session Objectives:

1. To learn how CT can be optimised in the presence of orthopaedic hardware.
2. To learn how MRI can be optimised in the presence of orthopaedic hardware.
3. To learn about the role of imaging in prosthetic joint infection.

A-372 08:35

Optimising CT for imaging metalwork

M.-A. Weber; *Heidelberg/DE (MarcAndre.Weber@med.uni-heidelberg.de)*

Orthopaedic hardware should not be considered a contraindication to computed tomography (CT) imaging, although hardening artefacts along metallic non-radiopaque materials may impair image quality in CT. The hardware alloy, the geometry of the hardware and its orientation all affect the magnitude of image artefacts. Stainless steel or cobalt chrome hardware produces most artefacts, while titanium hardware produces the least. Hardware with a rectangular cross-sectional shape such as a fixation plate will cause more artefacts than a radially symmetrical device such as an intramedullary nail. CT image artefacts are in general most severe adjacent to the hardware and are related to incomplete x-ray projection data resulting in streaks. These artefacts at multi-detector CT may be mitigated by several factors, such as decreasing the detector collimation and pitch, increasing the kilovolt peak and tube charge, and using a smoother reconstruction filter. Iterative reconstruction techniques have the advantage of minimising calcium blooming and metal artefacts. With this technique, the first, uncorrected image is reconstructed and regularized, before then being compared with the gathered raw data. As long as these fail to match, other reconstructions are generated. Image quality increases with the number of reconstructions. Even modern CT scan technology can now considerably reduce artefacts through dual-energy methods, allowing the same body region to be examined at two different energy levels. Virtual monochromatic images synthesized from dual-energy CT data have the potential to correct for beam hardening or metal artefacts.

Learning Objectives:

1. To understand that orthopaedic hardware should not be considered a contraindication to computed tomography.
2. To become familiar with the factors affecting the magnitude of image artefacts.
3. To learn about new techniques to minimise metal artefacts.

A-373 09:00

What problems do metalwork cause for MRI and how can we solve them?

J.V. Dehem; *Ypres/BE (johan.dehem@yperman.net)*

Orthopaedic hardware is a challenge in imaging, especially in MRI. Implanted hardware accelerates local dephasing thus resulting in significant signal loss. Induced variations in local magnetic field interact with both slice encoding and in plane encoding leading to in-plane and through-plane signal displacement (pile-up or loss). Simple tips and tricks to cope with these problems are reviewed and can be readily deployed in standard FSE imaging as illustrated in clinical cases. In the last decade, advanced imaging techniques have been developed. They are known under the generic acronym MARS (metal artefact reduction sequence). VAT (view angle tilting) and SEMAC (slice encoding for metal artefact correction) will be discussed and the imaging results are illustrated using clinical cases. Ageing population and the use of orthopaedic hardware such as total hip or total knee prosthesis in younger patients both lead to an increased use of arthroplasty. Since eventually all arthroplasty can/will fail, orthopaedic surgeons need tools to evaluate symptomatic patients with arthroplasty. In the orthopaedic community there is growing awareness of the information MRI can provide. Recent concerns about metal on metal hip arthroplasty with entities like ALTR (adverse local tissue reaction) and ALVAL (aseptic lymphocytic dominant vasculitis-associated lesion) further fuel the clinical need for high-quality MRI. In orthopaedic and radiologic papers evidence of the value of MRI examination in arthroplasty patients has been published with emphasis on soft tissue contrast, synovial expansion and periprosthetic bone evaluation. We need to be ready.

Learning Objectives:

1. To understand the challenges metalwork causes for MR imaging of the joints.
2. To become familiar with new MRI metal artefact reduction techniques.
3. To appreciate the growing clinical need for MR imaging of patients with orthopaedic hardware.

A-374 09:25

Imaging prosthetic joint infection: traditionally problematic, but do we have the answers now?

F. Kainberger; *Vienna/AT (franz.kainberger@meduniwien.ac.at)*

Periprosthetic joint infection is a serious complication occurring in approximately 1-3 % of all cases of total joint replacement. Indication: Projection radiographs are routinely performed in case of clinically suspected early or delayed loosening with infection being one of the major causes. PET-CT and other cross-sectional imaging techniques are additional modalities. Investigation: With artefact reduction, better insight of the bone-metal interface, i.e. the place of interaction between biofilm and implant, can be gained. Radionuclide imaging reflects functional rather than anatomical changes and is therefore of high importance in this case with complementary accuracy of the different methods. Leucocyte and bacteria imaging refer to molecular imaging techniques with the potential to detect occult infections. Interpretation: Soft tissue swelling and signs of effusion are typical for any form of inflammation. The main role of imaging is in the differential diagnosis of infection versus ALTR (adverse local tissue reactions) and other causes of joint pain. Diagnosis: Laboratory parameters are still of major importance in the diagnosis of periprosthetic infections. Newer imaging techniques, however, are catching up in the diagnostic pathway.

Learning Objectives:

1. To define situations in which imaging may significantly help to improve the diagnosis of infection.
2. To apply modern concepts to the forms of inflammation following endoprosthetic and other orthopaedic procedures.
3. To differentiate infection from other types of hardware loosening.

09:50

Panel discussion: What is the imaging modality of choice after plain films in the presence of orthopaedic hardware?

08:30 - 10:00 **Room M 4**

Emergency Radiology

RC 917

Acute pain: your friend and enemy in emergency radiology

A-375 08:30

Chairman's introduction: patients with acute pain - management and therapeutic pathways

J. Walecki; *Warsaw/PL (jerzywalecki@o2.pl)*

The character, intensity and onset characteristics of pain are very important clinical features. These can be especially helpfull to a radiologist who doesn't usually have access to a complete medical history of the patient. Pain can be a roadsign for physicians, and depending on its: features, onset characteristics, and associations can point us in the right direction and help us reach the right diagnosis. Pain in each particular region can mean different things, for instance: in case of a ruptured cerebral aneurysm a sudden thunderclap type headache usually occurs, often described as "the worst headache of my life" by patients. In the setting of such a description of pain by the patient, a non-contrast head CT is mandantory. Even if no blood is detected on a native CT, we must analyse the CSF for Xanthochromia, and perform a CT angiogram. In 2007 Kreist / Lancet wrote about 1600 admissions to the ER with headache of which 7% were subarachnoid haemorrhages - this is an alarming statistic. Whenever we have a patient complaining of acute, severe pain in the abdomen, chest or pelvis we find ourselves in a medical dilema trying to discern what it could possibly be. Experience also tells us that we shouldn't disregard such complaints of pain, as trivial pain has been known to represent medical emergencies, and severe pain has also been known to be caused by trivial things - for instance bloating. In chest pain for example the primary goal of non-invasive imaging is to exclude acute coronary syndromes and other serious conditions such as pulmonary emboli, or aortic pathology. Pain, if appropriately recognised can be a diagnostic friend of the clinically inclined radiologist - usually leading to the correct diagnosis.

A-376 08:35

A. Head

P.C. Maly Sundgren; *Lund/SE*

It is not unusual that patients present to the ER with acute headache. To decide if imaging is needed the clinical history and description of the headache, acute, severe, dull, after previous trauma, etc., is crucial. In the acute setting most patients will undergo a plain CT first and as second-line investigation an MRI. Plain films have no role in acute headache. Common causes for acute headache such as trauma, SAH, and infections and less common but important conditions such as brain tumour especially in children will be discussed. Suggested imaging protocol and which clinical information is needed for proper imaging will be discussed.

Learning Objectives:

1. To become familiar with common clinical conditions resulting in acute headache.
2. To understand the choice of the best-suited imaging modality.
3. To learn about typical imaging findings in the most common clinical scenarios.

A-377 08:59

B. Chest

C.N. De Cecco; *Charleston, SC/US (dececco@musc.edu)*

"Chest pain" is the chief complaint in about 1-2% of primary care patient visits, and while the cause is often non-cardiac, it is also important not to miss serious conditions such as an acute coronary syndrome, pulmonary embolism, or pneumonia. Diagnostic imaging plays an important role in determining whether a patient's chest pain is due to a life-threatening condition requiring timely treatment or it is a minor nuisance. Contrast-enhanced multidetector-row computed tomography (CT) has replaced previous invasive diagnostic procedures and currently represents the imaging modality of choice when the clinical suspicion of pulmonary embolism or acute aortic syndrome is raised. In addition, triple-rule-out (TRO) computed tomographic angiography can provide a cost-effective evaluation of the coronary arteries, aorta, pulmonary arteries, and adjacent intrathoracic structures for the patient with acute chest pain. Thus, the aims of this lecture are: 1. to illustrate the major causes of acute chest pain; 2. to describe the role of imaging in the diagnosis and management of chest pain; 3. to describe TRO technique and actual/future applications; 4. to critically appraise TRO role in acute chest pain management and to describe effective strategies to integrate TRO in the emergency department workflow.

Learning Objectives:

1. To become familiar with clinical conditions resulting in acute pain.
2. To understand which additional data will influence the choice of the correct imaging modality.
3. To learn about typical imaging findings in patients with acute chest pain.

Author Disclosure:

C.N. De Cecco: Research/Grant Support; Siemens, Bayer.

A-378 09:23

C. Abdomen

R. Basilico; *Chieti/IT (rbasilic@unich.it)*

Acute abdominal pain is a common main complaint in patients examined in the emergency department and can be related to a wide range of diseases. On the basis of the results of the initial diagnostic steps for these patients, represented by clinical evaluation and laboratory investigations, the clinicians will consider imaging examinations to help establish the correct diagnosis. The diagnostic approach for acute abdominal pain is not only one of the most difficult for the clinician but it is also a great challenge for the radiologist because differential diagnoses include a myriad of disorders, ranging from life-threatening to benign self-limiting conditions. The diagnostic workup of patients admitted with acute abdominal pain is based on various imaging modalities such as abdominal plain film, ultrasound, CT and MRI: the topographic classification of acute abdominal pain (pain in one of the four abdominal quadrants, diffuse abdominal pain, flank or epigastric pain) with reference to the age and gender of patients, facilitates the choice of the imaging technique and allows to narrow the range of possible diagnoses. The most practical approach to acute abdominal pain is to confirm or to exclude the most common disease and to look for general signs of pathology such as inflamed fat, bowel wall thickening, ileus, free fluid, free air, etc. Moreover, knowledge of atypical imaging findings is of great importance to improve the diagnostic orientation. In any case, results have to be confronted with clinical findings to obtain the correct diagnosis.

Learning Objectives:

1. To become familiar with common clinical conditions resulting in acute abdominal pain.
2. To understand what clinical information influences the choice of the best-suited imaging modality.
3. To learn typical and less typical imaging findings in patients with acute abdominal pain.

09:47

Panel discussion: Where does radiology fit in the pathway?

08:30 - 10:00 **Room M 5**

E³ - ECR Academies: Diagnostic Urogenital Radiology

E³ 922

Gynaecology

Moderator:
T. Cunha; Lisbon/PT

A-379 08:30

A. MR imaging techniques and normal anatomy of the female pelvis

C.S. Balleyguier; *Villejuif/FR (Corinne.BALLEYGUIER@gustaveroussy.fr)*

MRI is a key examination to explore the female pelvis. Indications include uterine and ovarian cancer staging, characterisation of an indeterminate adnexal mass, deep endometriosis staging and evaluation of pelvic floor dysfunction. Another indication is fibroid evaluation after embolisation. T2-weighted sequences without fat suppression are required in at least two planes. T1-weighted images±fat suppression are required to assess the bloody or fatty content of an ovarian mass. In adnexal masses and pelvic tumours, diffusion-weighted sequences and perfusion imaging must be added to further evaluate the lesion. High b values around 1000 must be chosen. To standardise the report, categories including morphological images, DWI and perfusion may help to determine a score, GI-RADS score. This score includes categories from 1 to 5, according the risk of malignancy. To avoid mistakes, anatomical variants and common pitfalls such as functional lesions must be known. Another common pitfall is a Tarlov cyst, a perineural cyst, which may mimic an ovarian mass. Biopsy must be avoided in such lesions.

Learning Objectives:

1. To learn about the different MR protocols according to the clinical question.
2. To become familiar with normal imaging findings of the female pelvis.
3. To become familiar with potential pitfalls.

Author Disclosure:

C.S. Balleyguier: Speaker; Siemens, Samsung.

A-380 09:00

B. Staging of cervical cancer

R. Forstner; *Salzburg/AT (r.forstner@salk.at)*

Cancer of the uterine cervix is most commonly staged clinically according to the FIGO classification system. However, this does not integrate the prognostically important finding of lymph node metastases. Tumour size, tumour stage and presence of lymph node metastases correlate not only with the prognosis but are also the most important determinators for treatment decision to perform radical surgery or primary radio-chemotherapy. MRI has been accepted as gold standard of imaging cervical cancer, with staging accuracies ranging between 75% and 96%. Excellent correlations have been shown between the tumour diameter and volume and pathologic gross specimen. MRI performs significantly better than CT in tumour visualisation and in detection of parametrial invasion. High NPV (94%) for exclusion of parametrial invasion is pivotal before radical surgery. Furthermore, bladder and rectum invasion can be reliably excluded, thus saving the patient invasive diagnostic procedures. Most guidelines recommend MRI for staging of cervical tumour with a clinical stage 1b2 or higher for the assessment of locoregional tumour spread. If fertility preservation is an issue, MRI plays a crucial role for the prediction of feasibility of radical trachelectomy. The key sequences in staging cervical cancer are sagittal and transaxial oblique T2WI in a plane perpendicular to the endocervical canal. More advanced MRI techniques have been suggested as prognostic biomarkers. For the assessment of retroperitoneal lymph node metastases PET/CT seems superior to CT and MRI.

Learning Objectives:

1. To learn about the MR appearance of cervical cancer, including mimics.
2. To become familiar with the spread of disease.
3. To understand the impact of imaging on therapeutic decision making.

A-381 09:30

C. Differential diagnoses of adnexal masses

S. Swift; *Leeds/UK*

"no abstract submitted"

Learning Objectives:

1. To understand how to identify the origin of the suspicious adnexal mass.
2. To learn about how to differentiate benign from malignant adnexal masses, also applying functional techniques.
3. To understand how to differentiate between benign surgical and non-surgical lesions.

10:30 - 12:00 **Room A**

E³ - ECR Academies: Interactive Teaching Sessions

E³ 1021

Emergency radiology I

A-382 10:30

A. Abdominal vascular emergencies

A. Palkó; *Szeged/HU (palkoand@gmail.com)*

Acute abdomen is a condition characterised by sudden onset of severe abdominal pain which may be associated with various other signs. Vascular emergencies (thrombo-embolism, dissection, rupture, non-obstructive mesenteric ischaemia, etc). are rarely responsible for the acute abdominal symptoms, nevertheless we must be aware of their potential role since these conditions are characterised by high mortality rate which may be reduced only if the reliable and accurate diagnosis is provided shortly after the onset of the disease. The diagnosis may be made theoretically by ultrasound, computed tomography, magnetic resonance imaging and catheter angiography alike, however, because of the state of the patient and the urgency of diagnosis the single best modality of choice for the detection and characterisation of these conditions is CT angiography. The lecture introduces the most important clinical features, imaging signs and differential diagnostic considerations of acute abdominal vascular emergencies.

Learning Objectives:

1. To understand the different types of abdominal vascular emergencies.
2. To learn about imaging findings and treatment options.

Author Disclosure:

A. Palkó: Advisory Board; Affidea.

A-383 11:15

B. Chest trauma

J.D. Dodd; *Dublin/IE (J.Dodd@st-vincents.ie)*

Chest trauma is a common reason for referral of patients to the emergency department. Several aspects of chest trauma can be life threatening or cause major morbidity, and it is important that radiologists are aware of the appropriate imaging tests to acquire to detect chest trauma complications. It is also important for radiologist to be able to recognise the various imaging signs that can be evident in chest trauma patients. Chest trauma patients may have injuries to multiple organ systems within the thorax. Skeletal structures that may be injured include the ribs, sternum, scapula and spine. Several parenchymal lung injuries may occur including lacerations, contusions, haemorrhage and cavitation. Air leaks may manifest as pneumothorax or pneumomediastinum. Vascular injury may affect both arterial structures such as the aorta and venous structures such as the superior vena cava. Injury to the central airways, including the trachea are also important to recognise. Multiple modalities are at the disposal of the radiologist in chest trauma, but the mainstays of assessment remain the chest radiograph and chest CT.

Learning Objectives:

1. To understand the imaging technique.
2. To become familiar with the differential diagnosis.

10:30 - 12:00 **Room B**

ESR meets the Nordic Countries

EM 1

Mammography in Nordic countries: screening and new developments

Welcome the ESR President:
L. Donoso; Barcelona/ES
Presiding:
K. Riklund; Umeå/SE
M. Garðarsdóttir; Reykjavik/IS
G. Hagen; Oslo/NO
K.R. Nielsen; Copenhagen/DK
H. Ståhlbrandt; Eksjö/SE
R.L. Vanninen; Kuopio/FI

A-384 10:30

Introduction

H. Ståhlbrandt; *Eksjö/SE (henriettae@gmail.com)*

The Nordic countries have been predecessors in national population-based mammography screening programs, which started in the Nordic countries in the end of the 1980s and beginning of the 90s. Overall, participation in mammography screening programs have shown a reduction in deaths from breast cancer. In this session, Nordic researchers are invited to talk about a different part of the radiology in breast cancer in the Nordic countries. The journey will start in Denmark, to get an overview of mammography screening, and to learn about its advantage and disadvantage. New Danish data are presented. The journey will then continue across the North Sea to Iceland, where we will learn about using MRI pre-operatively as a screening to find additional ipsi- or contralateral lesions. Is this a feasible construct? Moving on to Sweden, we will hear about the difficulties of mammographing dense breasts. Are other methods than regular mammography better to find cancers in dense breasts? We will also learn about how to calculate risks of breast cancers. Crossing the border to Norway, we learn about another drawback of mammography screening - interval cancers and missed cancers. How do we classify those, and can this help us in measuring the quality of our screening programs? Finally, we walk up to the north of Norway and take the step over to Finland, where we will hear about the more advanced methods of breast radiology MRI.

Session Objectives:

1. To become familiar with radiology in breast cancer in Nordic countries.
2. To learn about screening, individualisation, risk stratification and new methods.

A-385 10:35

Mammography screening in Denmark: implementation and results

I. Vejborg; *Copenhagen/DK (ilse.vejborg@rh.regionh.dk)*

Mammography screening aims at detecting breast cancer in its early stages and thereby to reduce breast cancer mortality. To achieve a substantial reduction in disease-specific morbidity and mortality with as few negative side effects as possible it is necessary to build up and maintain a high standard on a professional and organisational level, not only in the screening programme as such but even concerning the ensuing diagnostic workup and treatment. In a population-based screening programme every member of the target population must be known to the programme. A high participation rate and a high detection rate are necessary. Unnecessary workup should be minimised. Multidisciplinary team working, high-volume readers, training and audits are essential. A continuous monitoring of the quality using target and performance indicators on various aspects of the screening programme as well as its derived interventions is essential to obtain and maintain a high standard. The main benefit of screening is reduction in breast cancer mortality. The main harm is overdiagnosis. As screening started in Copenhagen in 1991 and in Funen in 1993, and the national roll-out took place only from 2007 to 2010, Denmark offers one of the best opportunities for evaluating the outcome of screening. Results concerning false-positive rates, overdiagnosis and impact on breast cancer mortality in the long-standing Copenhagen mammography screening programme will be presented as well as the quality assurance and results from the nationwide programme.

Learning Objectives:

1. To learn about the challenges in implementation of a service cancer screening programme.
2. To learn about the balance between positive and negative effects of a population-based screening programme.
3. To discuss quality assurance of a nationwide mammography screening programme and to present its results.

A-386 10:55

Performing MRI preoperatively in all breast cancer patients in Iceland: is it worthwhile?

M. Garðarsdóttir; *Reykjavik/IS (marianna@landspitali.is)*

Iceland is a country of 330,000 inhabitants. Breast cancer operations are performed in the National University hospital in Reykjavík, with only a few exceptions. Since 1 January 2007, all patients diagnosed with breast cancer planned for an operation at the hospital have been offered a preoperative magnetic resonance imaging (MRI) examination. Preoperative examinations are useful for detecting additional lesions, either ipsilaterally or contralaterally, benign or malignant that are not found on mammography and may, therefore, change the choice of operation for about half of patients. A study in 2011 showed that 15.1% more lesions were found with MRI, 8.1% ipsilaterally and 6.0% contralaterally. In total, 7.0% had a different procedure planned, a larger operation in 3.2% and 3.9% of patients had a bilateral operation instead of unilateral. It is a unique opportunity to be able to offer this kind of an examination to a whole nation, making MRI as a research tool a valuable asset and also as a clinical tool for our patients. The lack of proven clinical benefit in the effect on recurrence and on survival is an aspect that needs to be addressed as well as the effect of overestimation and possible overtreatment.

Learning Objective:

1. To understand the value of preoperative assessment of disease extent as a tool in appropriate surgical planning.

A-387 11:05

Breast density, risk for breast cancer and how to personalise screening: what are the future breast imaging modalities?

S. Zackrisson; *Malmö/SE (sophia.zackrisson@med.lu.se)*

Mammography is the established method in breast cancer screening. However, the sensitivity of digital mammography (DM) for the detection of breast cancer is less than optimal, up to 30% of all cancers are not detected at screening. The major reason is that normal breast tissue conceals the tumour, especially if the breast tissue is "dense". There is a call for more individualised screening, since DM has reduced sensitivity especially in women with dense breasts. Furthermore, women with high breast density may have up to a fivefold increased risk for breast cancer. 3D mammography has been developed in recent years, digital breast tomosynthesis (DBT) and is being tested in screening trials. Another method considered is 3D automated ultrasound (US). Magnetic resonance imaging is currently used for screening women with an increased familiar risk of breast cancer. There is no evidence for the use of US or MRI in population-based screening. The scope of individualised screening is to increase the screening efficacy by combining background data for risk estimation, identify different risk groups and tailor what screening method would be the optimal. This talk will provide an overview of methods for risk estimation and how this information potentially may be integrated in individualised screening in the future.

Learning Objectives:

1. To learn about the current knowledge of how to estimate breast cancer risk and if this can be applied in a screening context.
2. To understand what imaging modalities for breast cancer screening we have at hand now and for the future.

Author Disclosure:

S. Zackrisson: Speaker; Speaker's fees and travel support from Siemens Healthcare AG and Astra Zeneca.

A-388 11:25

Interval cancers in population-based screening programmes

S.R. Hoff; *Aalesund/NO (sorohoff@gmail.com)*

Interval cancers are breast cancers diagnosed after a negative screening episode and before the next scheduled screening examination. It is difficult to compare interval cancer rates across different screening programmes because the programmes differ in how they define, identify and quantify interval cancers. In the Norwegian Breast Cancer Screening Program the interval cancer rate is 1.7/1000 negative screening examinations, which represents 25% of the total number of breast cancers diagnosed in screened women. Some interval cancers are visible on previous screening mammograms if these are retrospectively reviewed, and might thus be classified as cases of "missed cancer". To achieve high sensitivity in a screening program, and to detect breast cancers in an early stage, the percentage of missed cancer should be as low as possible. Missed cancers represent failures in perception or interpretation or are the result of erroneous workup of a pathological finding. Analysing the mammographic findings of missed cancers is thus an important tool when striving to increase the radiologist's performance. Performing structured reviews of interval cancers to monitor the level of missed cancer is encouraged in European guidelines, which state that the level of missed cancer should not exceed 20% of all interval cancers. In the lecture, I will present a classification system for interval cancers dividing them into "missed", "true" and "minimal signs", as well as case examples of different types of interval cancers.

Learning Objectives:

1. To understand interval cancers, i.e. breast cancers, detected in the interval between two screening examinations.
2. To learn about systematic reviews of interval cancers, as the rate of missed interval cancer can be used as a quality measure of a screening program.

A-389 11:40

New developments in MRI and MR image analysis of breast cancer

J. Hakumäki; *Kuopio/FI (juhana.hakumaki@kuh.fi)*

A number of imaging parameters are available for breast cancer MRI today. In addition to "traditional" anatomical and dynamic contrast enhancement (DCE) imaging studies, other techniques and approaches are gaining ground and being explored. Based on recent findings, this talk will discuss the utility of diffusion-weighted imaging (DWI) of breast and regional lymph nodes, as well as MR spectroscopy. Current and future possibilities for determining metastases, tumour subtypes and prognosis by MRI are also discussed, together with approaches for advanced image processing.

Learning Objectives:

1. To understand the fundamentals of DWI, DCE and MR spectroscopy in breast imaging.
2. To become familiar with the optimised analysis methods for DWI, DCE and MRS.
3. To learn about multiparametric data analysis in 3 T breast MRI.

10:30 - 12:00 **Room K**

EFOMP Workshop: Radiation Protection for the female patient and female medical staff

EF 2

Pregnancy and lactation

Moderators:
P. Sharp; Aberdeen/UK
V. Tsapaki; Anixi/GR

A-390 10:30

Chairman's introduction

P. Sharp; *Aberdeen/UK*

Session Objectives:

1. To learn how to manage and counsel pregnant patients in case of x-ray exposure.
2. To become familiar with issues related to administration of radiopharmaceuticals to pregnant patients and nursing mothers.
3. To learn how to protect pregnant or potentially pregnant personnel working with x-rays.

A-391 10:35

Radiation protection of pregnant and lactating patients in nuclear medicine

S. Mattsson; *Malmö/SE (soren.mattsson@med.lu.se)*

Before a woman of childbearing age is examined or treated with radiopharmaceuticals, it is important to find out whether she is pregnant or not, and if she is breastfeeding or caring for an infant. If pregnancy or breastfeeding has been confirmed, it is important to examine if the nuclear medicine procedure can be postponed or if there are alternatives involving non-ionising radiation. For diagnostic nuclear medicine investigations, pregnancy is not an absolute contraindication and may in many situations provide essential diagnostic information, e.g. confirmation or exclusion of pulmonary embolism. Dose estimates are available for four stages of pregnancy (early, 3 months, 6 months and 9 months gestation) and for a large number of radiopharmaceuticals. Nevertheless, there are considerable uncertainties about how much activity may cross the placenta barrier and about the biokinetics in the foetus. A pregnant woman should not undergo therapeutic nuclear medicine procedures unless there are implications to save her life. If the procedure has to be performed, the possible foetal radiation dose should be calculated and the risk for malformations and childhood cancer estimated and the information shared with the patient. Many radiopharmaceuticals are excreted through the breast milk of nursing mothers. For radiopharmaceuticals used for diagnostic procedures, breast feeding interruption schedules are recommended keeping the effective dose to the infant under 1 mSv. Before start of therapy with radiopharmaceuticals, breast feeding has to be stopped. Higher doses such as those from therapeutic procedures can result in significant foetal harm and risk for the nursing infant.

Learning Objectives:

1. To discuss issues related to administration of radiopharmaceuticals to pregnant patients.
2. To discuss issues related to administration of radiopharmaceuticals to nursing mothers.
3. To be informed about the exposure of the embryo/foetus to radiation during nuclear medicine procedures performed on the mother.

A-392 11:05

Dose management of pregnant patients in x-ray imaging

J. Damilakis; *Iraklion/GR (damilaki@med.uoc.gr)*

Whenever a diagnostic or interventional x-ray examination of a pregnant patient is considered to be necessary, embryo/foetus dose estimation is an essential step in assessing the radiogenic risks to the unborn child. Accurate estimation of embryo/foetus radiation dose is also needed after accidental exposure of a pregnant patient from an x-ray procedure. When the uterus is remote from the directly exposed anatomical area, the embryo/foetus is exposed to scattered radiation and its dose is negligible (dose lower than 1 mGy). Normally, a detailed embryo/foetus dose evaluation is not needed for such studies. Radiologic examinations involving the abdomen and/or pelvis

may deliver relatively high radiation dose to the unborn child. For abdominal examinations, maternal body size and uterus position should be taken into consideration to obtain accurate dose estimation. Patient-specific Monte Carlo simulations have been used to accurately estimate radiation dose from an abdominal CT examination. A standard CT examination for appendicitis or ureteral stones performed on the mother would result in an embryo/foetus dose of about 10-25 mGy. Multi-phase abdominal CT examinations may deliver relatively high doses to the unborn child. Doses to the unborn child below 100 mGy should not be considered a reason for therapeutic abortion. The risk to the embryo/foetus for stochastic effects is assessed on the basis of radiation dose using appropriate risk factors. CODE (COnceptus Dose Estimation) tool (uploaded very recently on embryodose.med.uoc.gr) allows calculation of conceptus doses and risks from x-ray examinations performed on the expectant mother.

Learning Objectives:
1. To learn how to manage pregnant patients in case of intentional and accidental exposure to x-rays.
2. To be informed about the exposure of the embryo/foetus to radiation during diagnostic and interventional x-ray procedures performed on the mother.
3. To learn about new developments in embryo/foetus dose estimation.

A-393 11:35

Occupational radiation protection: protecting pregnant or potentially pregnant workers in interventional radiology

A. Trianni; *Udine/IT*

"no abstract submitted"

Learning Objectives:
1. To be informed about dose limits and regulations regarding occupational exposure of pregnant staff working with radiation.
2. To learn how to manage pregnant staff in medical imaging departments.
3. To become familiar with techniques that will keep the dose to the unborn child from the mother's occupation as low as possible.

10:30 - 12:00 **Room M 5**

E³ - ECR Academies: Diagnostic Urogenital Radiology

E³ 1022

Prostate

Moderator:
J.J. Fütterer; Nijmegen/NL

A-394 10:30

A. Ultrasound of the prostate

T. Fischer; *Berlin/DE (thom.fischer@charite.de)*

Prostate cancer is the most common malignancy in men and its incidence is continuously increasing. As with other malignant tumours, early diagnosis improves the chances of cure. Several studies have shown that the development of prostate cancer is associated with metabolic changes that alter perfusion in tumour tissue. B-mode and colour Doppler ultrasound (US) are limited in detecting and localising prostate cancer, mainly because these techniques do not reliably depict very small vessels with slow blood flow, which are typical of tumour vascularisation. The advent of US contrast media (USCM, CEUS) has markedly improved the detection of very slow blood flow in small vessels. In addition, we use ultrasound contrast agents to characterise focal prostate lesions and to monitor irreversible electroporation (IRE) therapy as well as for molecular imaging. Real-time MRI/US-fusion-guided PBx detects more clinically significant PCa compared with conventional transrectal ultrasound (TRUS). The aim of this session is to discuss state-of-the-art ultrasound techniques and applications in daily practice in comparison with conventional TRUS, which has low sensitivity in detecting prostate cancer.

Learning Objectives:
1. To become familiar with the technical requirements for performing US of the prostate.
2. To learn about the anatomy of the prostate.
3. To understand how to detect suspicious lesions for ultrasound-guided biopsy.
4. To understand the potential clinical utility of different ultrasound techniques such as Doppler, elastography, CEUS and image fusion.
5. To discuss the evidence for the use of these technologies in routine clinical practice.

Author Disclosure:
T. Fischer: Advisory Board; Toshiba, Siemens, Bracco. Speaker; Toshiba, Siemens, Hitachi.

A-395 11:00

B. Multiparametric MRI of the prostate

G.M. Villeirs; *Ghent/BE (geert.villeirs@ugent.be)*

Prostate multiparametric magnetic resonance imaging (mpMRI) combines T2-weighted MRI (T2w) with functional techniques such as diffusion-weighted MRI (DWI) as a marker of cellular density, dynamic contrast-enhanced MRI (DCE) to assess neoangiogenesis, and/or magnetic resonance spectroscopic imaging (MRSI) to assess tumour metabolism. The minimal technical requirements for these techniques were recently updated in the Prostate Imaging, Reporting and Data System (PIRADS) by the ACR in cooperation with the ESUR. T2w MRI provides sensitivity up to 85% for overall prostate cancer detection, but lacks specificity. DWI and MRSI both improve specificity, and correlate with tumour aggressiveness. DCE is useful for the peripheral zone only, due to false-positive enhancement of benign prostatic hyperplasia. The first version of the PIRADS standardised reporting system (Eur Radiol 2012;22:746) assigned a summary mpMRI probability score (1 = very unlikely to 5 = very likely) for presence of clinically significant cancer, based on the separate probability scores on T2w, DWI, DCE and/or MRSI. Validation studies using this system showed promising results (accuracy up to 86%) both in men with a negative prior biopsy and in biopsy-naive men with increased PSA. In the recently published PIRADS version 2, the probability scores for presence of clinically significant cancer are determined by DWI as the dominant technique in the peripheral zone and T2w in the transition zone, while DCE is used exclusively in doubtful cases (PIRADS 3); MRSI is no longer part of the routine evaluation process. Validation studies of this new PIRADS version are currently underway.

Learning Objectives:
1. To become familiar with technical aspects of DCE-MRI, DWI and MR spectroscopy.
2. To understand how to recognise the advantages and limitations of each technique.
3. To understand how to detect significant disease of prostate cancer in the peripheral zone.

A-396 11:30

C. Staging of prostate cancer

A.R. Padhani; *London/UK (anwar.padhani@stricklandscanner.org.uk)*

Imaging-based prostate cancer staging is central to directing patient management. Imaging interpretation should be undertaken using a patient risk-based approach (with knowledge of corresponding likelihood of ECE and nodal involvement). mpMRI interpretation/staging needs to be aligned with local clinical management plans. Nodal/ECE staging is impaired in low volume disease because MRI does not see microscopic disease. Effective communication of imaging findings/uncertainties can improve the outcomes for prostate cancer patients.

Learning Objectives:
1. To become familiar with the imaging techniques used for staging, including functional MRI.
2. To become familiar with the common sites of metastases.
3. To learn about what technique to use for follow-up of metastatic disease, including functional techniques.

Author Disclosure:
A.R. Padhani: Advisory Board; Siemens Heathcare. Consultant; Siemens Heathcare. Speaker; Siemens Heathcare.

12:15 - 12:45 **Room A**

Plenary Session

HL 2

Josef Lissner Honorary Lecture

Presiding:
K. Riklund; Umeå/SE

A-397 12:15

Liver imaging: where do we stand now?
V. Vilgrain; *Clichy/FR (valerie.vilgrain@bjn.aphp.fr)*

Since the publication of Taylor et al in 1976 titled: "Gray Scale Ultrasound Imaging: The Anatomy and Pathology of the Liver", tremendous progress has happened in liver imaging. Today, the three pillars are ultrasound which offers a multi-technique approach, the most recent one being liver stiffness measurement, CT enabling ultrafast acquisition with high spatial resolution, and MR imaging allowing morphological, quantitative, and functional imaging. These major improvements explain the increased detection of focal liver lesions, and the impressive capabilities of imaging for tissue characterisation. Understanding of mechanisms at a cellular level is now possible and opens new field for research and clinical applications.

12:15 - 13:45 **Room D2**

MIR @ ECR Session

MIR 1

Communication in radiology

Moderators:
B. Hamm; Berlin/DE
S. Morozov; Moscow/RU

A-398 12:15

A. Communication and conflict resolution in radiology: how to recruit and retain the best team
P.R. Ros; *Cleveland, OH/US (Pablo.Ros@UHhospitals.org)*

Recruitment and retention are key elements for success in all organisations, including medical institutions and specifically radiology departments. The basis for successful recruitment is the fit between position and candidate, which has to be as perfect as possible. Candidates are recruited mainly based on their credentials and they succeed or failed based on their fit with the position. Emphasis has to be placed on spending time and effort in a good recruitment process. Candidates have to believe they will have meaningful and enjoyable work and able to fulfill personal ambitions. Appropriate compensation and incentives are also a key ingredient as complimentary motivators. Retention includes besides the fulfillment of personal ambitions, a sense of true organisational appreciation, a belief in the department's mission and a sense of ownership and accountability. The internal work ethic is an additional key ingredient since peer pressure is one of the most powerful motivators. Conflict in any organisation is inevitable. There are many reasons for conflict, such as financial considerations, need to challenge the status quo and innovation factors. While conflict has an enormous destructive potential it contributes to the organisation's achievements and thus is ultimately beneficial. The way to make conflict a positive force is through open communication among interested parties to achieve a desirable win/win scenario and avoid winners and losers.
Learning Objectives:
1. To review the key principles of excellence in building medical imaging teams.
2. To understand how to recruit and retain the best radiology team members.
3. To appreciate the value of communication in conflict resolution and high performance radiology teams.

A-399 12:33

B. Impact of structured reporting on communication with referring physicians
D. Pinto dos Santos; *Mainz/DE (pintodossantos@uni-mainz.de)*

Structured reporting has been around for more than two decades now. It has been deemed the "nuclear fusion reactor" of radiology, but prose-like free-text reports remain the standard in today's radiological reporting. There is some evidence that radiologists and referring clinicians alike prefer more structured reports and that structured reports are perceived as more complete and easier to understand, thus improving communication and facilitating further patient management. This lecture will give a brief overview on the recent developments in the field of structured reporting (RSNA Reporting Initiative, IHE Management of Radiology Report Templates), the advantages and limitations of available software and templates and how it might affect communication of results and actionable findings to other physicians.
Learning Objectives:
1. To understand how structured reporting can improve communication with the referring physicians.
2. To learn about how structured reporting can support communication and tracking of actionable findings.
3. To become familiar with current developments in structured reporting.

A-400 12:51

C. Informed consent in the radiology department: when and how?
L.H. Ros Mendoza; *Zaragoza/ES (lhrosmendoza@gmail.com)*

Informed consent refers to the process by which a healthcare provider informs a consumer of their diagnostic or treatment options, and associated risks and benefits, and supports them to make a decision about their care. Informed consent should be obtained for, but not limited to, the following procedures: 1. Invasive diagnostic or therapeutic procedures. 2. Moderate sedation. Because of the documented low incidence of adverse events resulting from intravenous injection of contrast media, it may be exempted from the need for informed consent, but this decision should be based on institutional policy, and local community practice. Before the proposed procedure is performed, the following will be explained to the patient: a. The purpose and nature of the procedure or treatment. b. The method by which the procedure or treatment will be performed. c. The risks, complications, and expected benefits or effects of such procedure or treatment. d. The risk of not accepting the procedure or treatment. e. Any reasonable alternatives to the procedure or treatment. f. The right to refuse the procedure or treatment. When obtaining informed consent for diagnostic or image-guided procedures that may be associated with higher levels of radiation, an explanation of the likelihood and characteristics of deterministic injury should be included in the consent discussion prior to the procedure. Although information should be provided continuously, three specific points are crucial: 1. At the point of referral. 2. When an imaging appointment is made with the provider, and 3. Immediately prior to the procedure.
Learning Objectives:
1. To learn about the role and importance that informed consent currently has in radiology departments.
2. To discuss the radiological procedures and techniques which do or do not need informed consent.
3. To understand the importance of a thorough and accurate design of informed consent.

A-401 13:09

D. Patients' expectations in communication with radiologists
E. Briers; *Hasselt/BE (erikbriers@telenet.be)*

Patients do not enter the radiology department as tourists. They come with a prescription for some imaging. The prescription for imaging services is made up by a colleague, doctor, who is taking care of the patient. This means that the radiologist and the radiology department are a part of the diagnostics "work-up" of the patient. So the patient will expect the radiology department to fill the prescription to satisfy the prescribing physician and themselves. Patients can have expectations regarding communications on several aspects. They may not understand what will happen to them, or they may not understand why this specific investigation is done, or they may have difficulties to undergo the procedure or have medical issues that can interfere with the procedure. It would be easy to refer to the prescribing physician for most of the answers but they are in your department so you will have to come up with the answers. Communication requires not only factual knowledge of the science and techniques but also emotional involvement to better understand fears and worries. Most patients do not reach the level of knowledge of radiologists and somewhat more reach the level of specialist nurses. Radiologists, if they are required to inform, should first estimate the literacy level of the patient in front of them and then use the most appropriate level of information in the most appropriate way.
Learning Objectives:
1. To learn about patients' expectations when entering the radiology department.
2. To understand the knowledge gap between the "average" patient and the "average" radiologist.
3. To learn how to overcome the knowledge gap without making the message become childish or treating the patient as a child.
4. To appreciate the multiple levels of patient knowledge.

13:27
Discussion

12:30 - 13:30 **Room B**

E³ - The Beauty of Basic Knowledge: Breast Imaging

E³ 24C

Breast cancer staging: why and how

Moderator:
J. Camps Herrero; Valencia/ES

A-402 12:30

Breast cancer staging: why and how
K. Kinkel; *Chêne-Bougeries/CH (karen.kinkel-trugli@wanadoo.fr)*

MRI has the advantage of measuring the tumour size, detecting multifocality and contralateral disease with superior performance than mammography. "MRI only" lesions require histologic proof if they change management options. Sclerosing adenosis, papillomas and benign ductal hyperplasia are frequent false-positive findings after MRI-guided biopsy. Pre-operative MRI is controversial due to absent proof of increased disease-free survival. Recent studies demonstrate decreased re-excision rates in patients with pre-operative state of the art MRI and subsequent surgical management. Clip positioning after MRI-guided biopsy allows subsequent lesion localisation under mammographic or sonographic guidance to perform multiple excisions instead of mastectomy. For benign lesions a control MRI 6-12 months later is recommended.
Learning Objectives:
1. To learn the timing, limitation and advantages of the different imaging techniques in staging breast cancer.
2. To know how to deal with additional lesions and their clinical meaning.
3. To understand the critical role of the radiologist in the pretreatment evaluation of breast cancer.
Author Disclosure:
K. Kinkel: Other; Blinded reader of pelvic MRI for Bayer.

12:30 - 13:30 **Room D1**

E³ - The Beauty of Basic Knowledge: Chest Imaging

E³ 25C

Reporting chest radiology made easy

Moderator:
N. Howarth; Chêne-Bougeries/CH

A-403 12:30

A. Interstitial lung disease: 5 golden rules
S.R. Desai; *London/UK (sujal.desai@nhs.net)*

Interpretation of high-resolution computed tomography (HRCT) in patients with diffuse parenchymal lung disease (DPLDs) can be a challenge, even for experienced observers.The reasons for this include not only the wide spectrum of recognised DPLDs but also the sometimes complex radiological patterns, compounded by atypical HRCT manifestations in many cases. Thus, when evaluating HRCT studies, it is important to have a logical system of review. The first crucial step in this review process must be to confirm whether a 'real' abnormality exists; this might seem a simple task but the distinction between normality and abnormality is not always straightforward - consider, for instance, an HRCT study acquired at less than full inspiration which is subsequently reported to show 'diffuse ground-glass infiltration'. A second important consideration is that a certain amount of observer disagreement in HRCT interpretation is inevitable. Thirdly, the radiologist must strive to develop an understanding of the relationships between the dominant HRCT patterns and the likely pathological 'localisation' of disease (e.g. a pattern of consolidation generally [but not exclusively] indicates pathology in the airspaces). Fourth, in an attempt to avoid falling victim to the phenomenon of 'autosuggestion', the radiologist is encouraged to consider the clinical details AFTER reviewing the imaging findings. Finally, because 'common things are common', it is always advisable to be familiar with the typical HRCT patterns of the more 'common' lung disease (e.g. sarcoidosis and idiopathic pulmonary fibrosis).
Learning Objectives:
1. To review diagnostic signs of interstitial lung disease.
2. To learn how to avoid over-diagnosis.
3. To know the limitations of radiological diagnoses.

A-404 13:00

B. Pleural disease
C. Beigelman; *Lausanne/CH*

This course will be focused on focal pleural thickenings (PT) that are commonly encountered in routine practice. The diagnosis of pleural plaques (PP) may be made and reported with confidence when a typical appearance is observed in a context of previous asbestos exposure. Typical PP have a quadrangular shape, spare the costophrenic angles and the apices and are most commonly located below the level of the aortic arch. This should not be confused with other focal PT that may be related to normal structures, previous tuberculosis, pleural metastasis, silicosis, or other rarer conditions. Postero-basal PT in supine examination may also be functional which will be reversible on prone position. Any atypical shape or location should be considered with caution, requiring correlation with patient's clinical history and careful analysis of other CT findings and of previous imaging studies. Upper lobe scarring, centrilobular nodules, crow-feet, parenchymal bands or rounded atelectasis are respective clues of the final diagnosis. Any history of malignancy should suggest a pleural metastasis especially in case of appearance changing of a PT. A suitable report will avoid delayed diagnosis of malignant pleural involvement, as well as any other false-positive or negative result.
Learning Objectives:
1. To review the radiological appearance of pleural disease.
2. To learn how to identify typical pleural plaques.
3. To know how to distinguish pleural plaques from pleural metastases.

14:00 - 15:30 **Room B**

EFRS meets Sweden

EM 4

The professional role of Swedish radiographers in medical imaging

A-405 14:00

Introduction (part 1)
C. Vandulek; *Kaposvár/HU (cvandulek@gmail.com)*

During the EFRS meets Sweden session, radiographers have the opportunity to acquire information about the clinical and research role of radiographers in Sweden. The radiographer is a vital member of the healthcare team in both diagnostics and radiotherapy. They have the qualification and competence to interact with other professionals to provide an optimum diagnostic or therapeutic outcome. This session will elaborate on the important role of the education of Swedish radiographers highlighting the implementation of a caring approach in the educational program.

A-406 14:03

Introduction (part 2)
K. Hillergård; *Jönköping/SE (Kerstin.hillergard@rjl.se)*

The Swedish radiographer as a profession is young (recognised in approximately 1960) and the number of professionals as well as the level of scientific activity in the educational institutions is limited. Today there are about 3500 clinical working radiographers, 20 radiographers with a Ph.D. and just as many doctoral students. In Sweden, registered radiographers are responsible for performing the entire radiographic examination, thus they have to take care of the patient as well as dealing with the medical technology, e.g. injections, catheterizing and medical technical equipment. The education is 180 ECTS and is directed to the diagnostic radiographer and contains of both technology and caring science. The education needs to provide the caring and medical knowledge required, for the radiographer to take responsibility for the patient through the peri-radiographic process. Radiological examinations and treatments should always be performed in cooperation with the patient. Throughout the programme the theoretical studies on technology are intertwined with caring and medical science followed by practice. In Sweden, the law says that all higher education must rest on a scientific basis. The courses of the radiology programme are permeated with the research process and the evidence-based method of thinking through the student critically reviewing and evaluating both science and proven experience. The programme concludes with a degree project over ten weeks that is presented, publicly discussed and examined, and then also presented at the x-ray clinic where the student carries out most of their practical programme.

Session Objectives:
1. To become familiar with the knowledge, skills and attitudes needed for competent Swedish radiographers.
2. To learn about the caring approach within the Swedish radiography programme.
3. To understand the research as a process for learning in a Swedish radiography programme.

A-407 14:05

The Swedish radiographer as a professional
B.T. Andersson; *Lund/SE (Bodil-T.Andersson@med.lu.se)*

The Swedish radiographer as a profession is young (recognised in approximately 1960) and the number of professionals as well as the level of scientific activity in the educational institutions is limited. Today there are about 3500 clinical working radiographers, 20 radiographers with a PhD. The radiographer is registered, i.e., fully qualified, to assume responsibility and make use of her/his knowledge. The academic field of radiography has grown stronger since 2001 which can be related to a more "innovative" education at a number of universities, including both a professional radiographer degree and an academic degree with the opportunity to pursue higher academic studies in radiography. In Sweden, registered radiographers are responsible for performing the entire radiographic examination, thus they have to take care of the patient as well as dealing with the medical technology, e.g., injections, catheterizing and medical technical equipment. The radiographer has a unique position in terms of encountering, supporting and protecting the patient and next of kin and is responsible for the patient during the entire radiographic examination and stay at the radiology department. Diagnostic radiography covers all imaging modalities and the integration of these with the best quality and the most appropriate diagnostic examination (s) in a person-centred way. Furthermore, the radiographer is responsible for minimising harm to and maximising the safety of patients, staff and others; and assisting referring doctors to make the best possible use of imaging for patient management and treatment. Radiography comprises the peri-radiographic process, i.e., pre-, intra- and post-procedural care.
Learning Objectives:
1. To gain insight into the Swedish radiographer as a professional.
2. To become familiar with the knowledge, skills and attitudes needed for competent Swedish radiographers.
3. To consolidate knowledge about core competences and their relation to education and profession.
4. To appreciate the impact of person-centred care in the area of radiography.

A-408 14:23

Implementation of a caring approach within the Swedish radiography programme
M. Lundén; *Gothenburg/SE (maud.lunden@gu.se)*

The education is 180 ECTS and is directed to the diagnostic radiographer and contains of both technology and caring science. The education needs to provide the caring and medical knowledge required, for the radiographer to take responsibility of the patient through the peri-radiographic process. Radiological examinations and treatments should always be performed in cooperation with the patient, with the starting point from the individual patient's need and condition; so-called person-centred care. In the Swedish radiography program, the first semester includes studies in caring science, followed by practice at a general ward. The students learn how to attend to the patients' basic needs with an ethical and caring perspective. Later the students will study specific medical care and how to: insert a urine catheter, place injections, peripheral venous catheters and to administer intravenous medication or fluids. The students are tested through examination on both technical and caring ability. During the second half of the program the students practise at the intensive care unit, emergency department and in the operating theatre at the surgical clinic. As a radiographer you meet patients with complex and often multiple diseases in a vulnerable state and need to perform advanced technical examinations. This stresses the need for caring competence. Throughout the program the theoretical studies on technology are intertwined with caring and medical science followed by practice. Examinations and seminars often include both technology and patient assessment.
Learning Objectives:
1. To learn about the Swedish radiography programme.
2. To appreciate the importance of combining patient care and technical matters in the Swedish radiography programme.
3. To become familiar with and acknowledge the patient's perspective in the radiography programme.
4. To understand how a caring approach can be accomplished in a radiography programme.

A-409 14:41

Implementation of a research process and quality improvement within the Swedish radiography programme
K. Fridell; *Stockholm/SE (kent.fridell@ki.se)*

Teaching and research are activities that result in knowledge development; it can be asked whether the one is more effective than the other. Research is unequivocally focused on developing new knowledge, while teaching, in the literature, has a more indistinct focus. In Sweden, the law says that all higher education must rest on a scientific basis; it is governed by things such as the Swedish Higher Education Act and degree objectives. These emphasize a great many things, including the importance of the student having knowledge and understanding of the main field of study of the programme (radiography). The courses of the radiology programme are permeated with the research process and the evidence-based method of thinking through student critically reviewing and evaluating both science and proven experience. Scientific methodology and theory are integrated in several courses during the programme. Start with an introduction to science and the scientific approach. Medical history, focus on the development and future of radiology. The field of knowledge of radiography is presented, with current issues of research. Continue with information searches in databases. Followed by various scientific perspectives and methods for data collection and analysis. Critical reflection and analysis are continuously practiced through article reviews. The concepts of 'evidence-based' (knowledge-based) and 'Profound Knowledge of Improvement' are introduced and practiced. The programme concludes with a degree project, presented, publicly discussed and examined, and then also presented at the x-ray clinic where the student carries out most of their practical programme.
Learning Objectives:
1. To learn about different aspects of the research process in a Swedish radiography programme.
2. To become familiar with different methods for quality improvement and how these can be integrated in a Swedish radiography programme.
3. To understand the research as a process for learning in a Swedish radiography programme.

A-410 14:59

Cultural highlights
G. Örnberg; *Umeå/SE (gunnela.ornberg@vll.se)*

15:17
Panel discussion

14:00 - 15:30 **Room L8**

EIBIR Session

EIBIR 2

MITIGATE: What does it take to perform clinical trials in interventional radiology?

A-411 14:00

Introduction (part 1)
S.O. Schönberg; *Mannheim/DE*

The session aims at presenting an overview of the clinical trials in interventional radiology in Europe. A member of the Scientific Programme Committee of the Cardiovascular and Interventional Radiological Society of Europe (CIRSE) will present the overall situation and challenges ahead. Two successful case examples of respective investigator initiated and industry co-sponsored trials will be introduced. Finally the concept of a clinical trial in oligometastatic GIST, which will start in mid 2016, will be presented by a partner of the MITIGATE consortium. MITIGATE is an FP7 co-funded project that aims at developing new protocols and guidelines to effectively diagnose and treat patients with metastatic GIST resistant to current treatment.
Author Disclosure:
S.O. Schönberg: Other; The Institute of Clinical Radiology and Nuclear Medicine has research agreements with Siemens Healthcare Sector.

A-412 14:05

Introduction (part 2)
W.R. Jaschke; *Innsbruck/AT (werner.jaschke@i-med.ac.at)*

Many advancements in clinical medicine are related to results obtained from randomised clinical trials. For example, modern pharmacotherapy is based on a standardised approach for discovery, development and testing of new pharmacological agents. On the contrary, many surgical and interventional procedures were introduced into clinical medicine without performing clinical

trials. Nevertheless, it is common sense in modern medicine that diagnosis and treatment of medical conditions should be based on science, not on speculation or individual experience. The proof of principle has, therefore, to be supplemented by scientific data. If a retrospective comparison between surgery and interventional radiology reveals a non-inferiority of the interventional procedure or potential improvement of patient care (example: treatment of non-surgical candidates), the interventional procedure obtains wider acceptance. This is usually the starting point for conducting a controlled clinical trial. A controlled clinical trial should ultimately help to decide which therapy results in the best outcome. A typical example is the introduction of carotid artery stenting. The proof of principle was that this procedure can be performed safely without an increase of disabling complications. The procedure gained wide acceptance with a dramatic increase of the number of procedures performed worldwide. Controlled clinical trials showed, however, that older patients who usually suffer more from operative trauma do not benefit from the percutaneous approach. But the controlled trials indicated also that for all other patients carotid artery stenting offers comparable results to surgery and is, therefore, an attractive alternative to surgery.

Session Objectives:

1. To introduce the aims of the session.
2. To highlight the importance of clinical trials in interventional radiology.
3. To introduce the related objectives of the MITIGATE project.

A-413 14:10

Overview on clinical trials in interventional radiology in Europe

A. Gangi; *Strasbourg/FR*

"no abstract submitted"

Learning Objectives:

1. To learn about the European framework for clinical trials in interventional radiology.
2 To learn about the requirements for clinical trials in interventional radiology in Europe.
3. To learn about successfully conducted clinical trials in interventional radiology.

A-414 14:30

How to implement investigator-initiated or industry-sponsored trials in interventional oncology: SORAMIC vs SIRFLOX

J. Ricke; *Magdeburg/DE*

"no abstract submitted"

Learning Objectives:

1. To learn about two examples of clinical trials in interventional oncology.
2. To learn about the implementation of clinical trials in interventional oncology.
3. To learn more about industry involvement in clinical trials in interventional oncology.

A-415 14:50

Design of a clinical trial in oligometastatic GIST: results from the MITIGATE consortium

C. Decristoforo; *Innsbruck/AT (Clemens.Decristoforo@tirol-kliniken.at)*

Within the MITIGATE project (Closed-loop Molecular Environment for Minimally Invasive Treatment of Patients with Metastatic Gastrointestinal Stromal Tumours, EU-FP7, grant agreement no 602306) a clinical trial in patients with therapy-resistant GIST will be initiated in 2016. A novel radiopharmaceutical for PET/CT targeting GIST tumours, developed and characterised within the MITIGATE project will be applied for tumour visualisation and characterisation. This presentation will describe the requirements to bring a novel radiotracer into the clinical application focussing on the pharmaceutical standards (GMP), the design of a first-in-human application meeting Good Clinical Practices (GCP) and the European regulatory environment involved. Primary objectives of the trial will be safety and pharmacokinetics, but it aims also to provide a basis for better characterisation of GIST tumours by molecular imaging opening new therapeutic options in this rare disease.

Learning Objectives:

1. To learn about the aims of the clinical trial performed in the MITIGATE project.
2. To learn about the design of a clinical trial in oligometastatic GIST.
3. To learn about the expected impact of the clinical trial.

Author Disclosure:

C. Decristoforo: Grant Recipient; MITIGATE, FP7, grant agreement no 602306.

15:10

Discussion

14:00 - 15:30 **Room D2**

MIR @ ECR Session

MIR 2

Improving quality and safety in radiology

Moderators:
E.J. Adam; London/UK
D.A. Koff; Hamilton, ON/CA

A-416 14:00

A. How to run a safe department?

P. Cavanagh; *Taunton/UK (petecavanagh@gmail.com)*

There is a need for imaging departments to systematically address patient safety in all aspects of its service. It is not sufficient to rely on the professional expertise of the staff as human error will always be present. This presentation will introduce a framework that will aid departments in delivering highly reliable services and thus proactively avoiding harm. The framework focuses on four key drivers that need to be considered: 1) Leadership and teamwork, 2) A monitoring and learning system, 3) Patient-focussed and responsive care, 4) Reliable and resilient systems. The presentation will provide examples to address all of these components of safety.

Learning Objectives:

1. To understand the key drivers for developing a safe radiology service.
2. To learn about a framework that helps to implement a safe system within a radiology department.
3. To learn about approaches that can be used in your department.

A-417 14:18

B. Patient satisfaction with radiology departments: are we doing our best?

G. Paulo; *Coimbra/PT (graciano@estescoimbra.pt)*

In the last decade we have assisted to a massive technological evolution and new scientific developments that have dramatically changed our social habits and our way of living. There is a new "digital society" arising, with special needs, different information and everyday more demanding, pressuring governments and institutions to adapt towards these new citizens' request. It is understandable that the two social sectors more exposed to this "new social order" are education and healthcare, where good and effective communication plays an essential role and becomes more demanding everyday. This new paradigm is a key driver for a (n) (r)evolution in the daily practice of health professions, demanding for a permanent focus on patient care and safety, based on high professional standards. Healthcare is characterised by specific features such as: a) the impossibility of patients to make choices, due to asymmetry of knowledge between them and healthcare providers; b) the fact that patients create an agency relationship with healthcare providers, delegating to them the decision about the care delivered. Due to these characteristics and to the fact that patients are fragile when they need care, there is a natural tendency for patients to rely on healthcare professionals. This demands for a focus on patient care and safety, based on high professional standards. To achieve excellence, it is essential to build a well-functioning teamwork between radiographers, radiologists, medical physicists and other health professionals, with the aim to create synergies and to maximise each profession's knowledge for the benefit and safety of the patient.

Learning Objectives:

1. To learn about the importance of a harmonised and structured communication process with patients.
2. To become aware of patients' needs and fragilities at the point of care.
3. To understand the importance of health professionals' teamwork as a tool to developing a patient safety culture.

A-418 14:36

C. Is there any evidence for decision support?

G. Boland; *Boston, MA/US (gboland@partners.org)*

Reducing point of care clinical variation is emerging as a key opportunity to improve quality, patient safety, value and ultimately better outcomes for patients. In radiology, variation bounds, both with ordering habits of referrers and the recommendations radiologists make, despite evidence-based, best practice guidelines. The reasons are multifactorial including cultural, historical practice patterns but also the increasing and necessary volume of knowledge required at the point of care. Decision support systems are being recognised as a tool to aid point of care decision making that guides care teams to consistently deliver best practices and, in turn, reduce variation. This talk will discuss the background, needs and outcomes of decision support systems. It will highlight the current body of evidence supporting its use and suggest the

future research necessary to embed decision support systems into routine clinical practice.
Learning Objectives:
1. To understand the goals of clinical decision support tools.
2. To discuss and evaluate the emerging tools available.
3. To discuss the evidence for improving clinical outcome.
Author Disclosure:
G. Boland: Consultant; Radiology Consulting Group.

A-419 14:54

D. Dose monitoring and benchmarking: opportunities to improve radiation protection
D. Caramella; *Pisa/IT (davide.caramella@med.unipi.it)*

IT tools are now commercially available to allow a real-time analysis of dose performances in radiology departments. The knowledge obtainable using these new IT tools may reduce all variations that are not clinically justified and trigger focused training initiatives. However, dose monitoring systems may provide incomplete and even misleading data. Therefore, appropriate actions need to be taken to increase the reliability of data provided by the software. An important output of dose monitoring is a better communication strategy with patients who can be reassured by the documented efforts made for guaranteeing dose optimisation, thus strengthening the public perception of radiology departments as trusted dose gatekeepers.
Learning Objectives:
1. To demonstrate the importance of systematic dose monitoring in radiology.
2. To understand how dose monitoring may reduce clinically unjustified variations within and between hospitals.
3. To propose a paradigm shift from risk communication to safety reassurance.
Author Disclosure:
D. Caramella: Speaker; Bayer.

15:12
Discussion

14:00 - 15:30 **Room M 4**

Joint Session of the ESR and ESMRMB

Cardiac MRI

Moderators:
J. Bremerich; Basle/CH
E.R. Danielsen; Copenhagen/DK

A-420 14:00

Overview of cardiac MR methods
S. Kozerke; *Zurich/CH (kozerke@biomed.ee.ethz.ch)*

Starting from a fundamental picture of MR imaging, the basic building blocks of cardiac MR methods will be explained including gradient-echo, spin-echo, balanced steady-state free precession, cardiac and respiratory gating, single-shot and multi-shot imaging. These building blocks will be combined with dedicated pre-pulses to suppress fat and enhance T1, T2* and T2 tissue contrasts. Modifications to permit quantification of velocity and diffusion properties will be discussed leading to a comprehensive set of tools to study both congenital and acquired heart disease. This section will be rounded off by a foray into very fast imaging utilizing parallel receivers and redundant or sparse information. Thereupon, specific protocols to assess cardiac morphology, cardiac function, tissue integrity, tissue perfusion, ventricular and valvular flow will be presented. Typical pitfalls and artefacts will be discussed along with approaches to reduce or avoid them. Finally, standard and advanced concepts of data processing and visualisation will be presented.
Learning Objectives:
1. To become familiar with the most important methods in Cardiac MRI covering both methods for examination of congenital and acquired heart disease.
2. To learn about cardiac MRI pulse sequences, the principles of ECG gating, and how movement is handled.
3. To become familiar with dynamic and anatomical cardiac MRI methods.
4. To learn how to recognise pitfalls and imaging artefacts typical for cardiac MRI.
5. To understand reconstruction and volume rendering principles as they apply to cardiac MRI.
Author Disclosure:
S. Kozerke: Grant Recipient; Swiss National Science Foundation, European Research Programme.

A-421 14:30

Clinical use of MR in congenital cardiac disease
V. Muthurangu; *London/UK*

"no abstract submitted"
Learning Objectives:
1. To learn about the variety of congenital cardiac disease that benefit from MRI, and to understand which methods are useful in the different diseases.
2. To understand the imaging features and basic clinical features of congenital heart disease including neonatal heart disease, congenital heart disease in childhood and adult congenital heart disease.
3. To appreciate MRI features of congenital vascular anomalies of the cardiovascular system.
4. To appreciate the role of quantitative evaluations in cardiac MRI for congenital heart disease.

A-422 15:00

Clinical use of MR in acquired cardiac disease
T. Leiner; *Utrecht/NL*

"no abstract submitted"
Learning Objectives:
1. To appreciate the wide range of clinical questions in acquired cardiac disease that may benefit from MRI, and to understand how the different techniques assist clinical decision making.
2. To learn about the MRI features and basic clinical features of cardiomyopathy including acute myocarditis, dilated cardiomyopathy, restrictive and obstructive cardiomyopathy, cardiomyopathy related to systemic disease, infiltrative cardiomyopathy.
3. To appreciate the role of quantitative evaluations in cardiac MRI for acquired heart disease.
4. To understand the role, benefits and limitations of cardiac stress testing in cardiac MRI.

16:00 - 17:30 **Room A**

E³ - ECR Academies: Interactive Teaching Sessions

E³ 1221

Use of staging and classification systems

A-423 16:00

A. RECIST 1.1 training
A. Graser; *Munich/DE (a.graser@radiologie-muenchen.de)*

RECIST 1.1 has been developed as an improvement of RECIST 1.0 to allow for reproducible and exact measurement of overall tumour load in patients with metastatic disease that are being treated as part of clinical trials. Furthermore, it can be used to guide decision-making in everyday clinical practice. This lecture will explain basic RECIST rules, teach about types of lesions (target versus non-target), and measurement strategies. Furthermore, clinical cases will be used to train correct use of the system. Recent additions to RECIST, e. g. Choi criteria, will also be covered. Finally, limitations of RECIST in clinical practice will be discussed.
Learning Objectives:
1. To understand the principle of the RECIST system.
2. To become familiar with the daily oncologic work-up.

A-424 16:45

B. Gastrointestinal-abdominal masses
A. Ba-Ssalamah; *Vienna/AT (ahmed.ba-ssalamah@meduniwien.ac.at)*

The spectrum of abdominal masses is broad, as is the differential diagnosis. Cross-sectional imaging modalities, in particular computed tomography (CT) and magnetic resonance imaging (MRI), are routinely used to evaluate the size, morphology, location and relationship of the lesion to adjacent organs. It is essential to understand how to tailor the exam to the clinical indication, i.e. which modality is best, and which contrast agent to use for MRI. The role of PET-CT and PET-MRI, with various radiotracers, that can give us further insight into the metabolic properties of these masses, will be discussed. Furthermore, we will explain the enhancement pattern and tracer behaviour of the mass which may help us to narrow the differential diagnosis. Demonstrating the content of the lesion, such as fat, fluid, solid components or calcifications, is an important imaging clue, too. Abdominal masses, such as the lipoma and liposarcoma, as well as solid-organ tumours like the myelolipoma and angiomyelolipoma, will be illustrated. Treatment-related lesions, such as the abdominal wall desmoid, retroperitoneal fibrosis and splenosis, will be shown. Malignant entities, including peritoneal carcinomatosis and pseudomyxoma peritonei, as well as lymphoma and GIST,

will be demonstrated. We will include some uncommon entities that may present with and without symptoms, such as epiploic appendagitis, omental infarction, and mesenteric panniculitis. Finally we will illustrate exophytic masses originating from abdominal organs, such as the liver, pancreas and bile ducts, causing diagnostic challenges.
Learning Objectives:
1. To learn the characteristic features of some common and atypical abdominal masses.
2. To identify the key imaging findings that assist surgeons or oncologists treating specific abdominal masses.
Author Disclosure:
A. Ba-Ssalamah: Consultant; Bayer Austria. Speaker; Bayer HealthCare.

16:00 - 17:30 **Room B**

Joint Session of the ESR and the EANM

Hybrid imaging: radiology and nuclear medicine

A-425/A-426 16:00

Introduction
K. Riklund; *Umeå/SE (katrine.riklund.ahlstrom@umu.se)*

V. Lewington; *London/UK (valerie.lewington@kcl.ac.uk)*

The ESR meet nuclear medicine session aims to increase collaboration between radiology and nuclear medicine in hybrid imaging to make the best use for patients today. During the session, two examples of good collaboration between specialists from radiology and nuclear medicine will be presented. In the long term, meeting between radiology and nuclear medicine can contribute to the use of complementary skills from both specialities to work toward a common goal of the multidisciplinary development of medical and molecular imaging.
Session Objectives:
1. To learn about collaboration in hybrid imaging.
2. To understand the added value of using both radiology and nuclear medicine in medicine.

A-427 16:03

Dementia: the role of radiology
S. Haller; *Geneva/CH (sven.haller@me.com)*

CT and MRI are routinely performed during the workup of cognitive decline. The first part of the presentation will review typical imaging findings including patterns of atrophy and white matter changes for the most common forms of dementia, in particular Alzheimer dementia (AD), vascular dementia (VaD) and frontotemporal lobar degeneration (FTLD). The presentation will also discuss the fact that dementia with Lewy bodies (DLB) is underestimated in MRI because there are no specific patterns of atrophy, and how susceptibility weighted imaging might resolve this blind spot of MRI. The second part of the presentation will discuss that patterns of hypoperfusion on arterial spin labeling (ASL) closely match the established patterns of hypometabolism on FDG PET, and how the functional assessment of hypoperfusion on ASL might complement the structural assessment of standard MRI during workup of cognitive decline.
Learning Objectives:
1. To learn the typical atrophy patterns of various types of dementia, notably Alzheimer Dementia and fronto-temporal lobar degeneration.
2. To understand the basic principle of arterial spin labelling (ASL).
3. To become familiar with typical patterns of hypoperfusion in dementia.

A-428 16:21

Dementia: the role of nuclear medicine
V. Garibotto; *Geneva/CH (Valentina.Garibotto@hcuge.ch)*

Imaging biomarkers, and among these PET and SPECT, are increasingly used in the clinical practice for the evaluation of patients with cognitive disturbances and their importance in the diagnostic process is well recognised in the recently updated criteria for dementias, e.g. Alzheimer's disease and Lewy body dementia. PET and SPECT may provide functional information, such as the evaluation of brain glucose metabolism by FDG PET and brain perfusion by SPECT, identifying patterns of changes typical for the different forms of dementia. PET and SPECT, as molecular imaging modalities, can also show the involvement of specific neurotransmission systems (i.e. dopaminergic) and target pathological hallmarks of dementias, such as brain amyloidosis and tau aggregates. A key issue for the validation of nuclear medicine biomarkers in dementia is the standardization of image analysis and interpretation, an ongoing effort in the scientific community. The information of PET and SPECT should also be routinely analysed in association with the radiological information, mainly provided by MRI, to be realised through a close collaboration between the neuroradiology and nuclear medicine specialists. Finally, in the recent years, hybrid PET/MRI imaging has become clinically available. This technology combines the two modalities of reference for dementia imaging and might be the examination of choice, when available, to obtain all clinically relevant information in a single session.
Learning Objectives:
1. To become familiar with the PET and SPECT tracers available for molecular imaging in dementia.
2. To become familiar with typical patterns of hypometabolism in dementia.
3. To understand the added value of molecular imaging by PET and SPECT in dementia.
4. To discuss the potential role of hybrid MR/PET in this field.

A-429 16:39

Prostate cancer: PET/CT in early biochemical relapse
E. Lopci; *Rozzano/IT*

Prostate cancer (PCa) is the most common malignancy in men in the Western countries. It shows a variable biological behavior that ranges from clinically silent and indolent tumours to very aggressive forms of cancer. Based on age, stage, risk stratification, and performance status, treatment options vary from watchful waiting to treatment with radical intent, such as radical prostatectomy (RP), external beam radiation therapy (EBRT), or androgen deprivation therapy (ADT). Despite that biochemical relapse (BCR) occurs in round 30% of patients after RP and up to 60% after EBRT. In this context, it is crucial to identify the site and extent of tumour recurrence, to establish the most appropriate therapeutic strategy. Conventional imaging modalities (CIM) do not show optimal performance in the detection of PCa relapse, whereas molecular imaging with PET has demonstrated to be a useful tool in differentiating potentially curable local recurrence from metastatic disease in patients presenting with BCR. The aim of the current presentation is to explain the role of PET imaging in the investigation of BCR in patients with prostate cancer, by focusing primarily on established tracers including C-11 choline and F-18 fluoride in this clinical context, and by giving an insight into the potential of emerging tracers, such as radio-labeled prostate-specific membrane antigen (PSMA).
Learning Objectives:
1. To learn about the role of PET imaging in the investigation of biochemical relapse in prostate cancer.
2. To become familiar with the role of established tracers including C-11 choline and F-18 fluoride in this clinical context.
3. To gain insight into the potential of emerging tracers, such as Ga-68 PSMA.

A-430 16:57

Prostate cancer: multiparametric MR in the diagnosis and clinical management of prostate cancer
F. Mrakic Sposta; *Milan/IT (federica.mrakic_sposta@humanitas.it)*

Prostate cancer is the second most common cause of cancer-related deaths in most of Western countries. In the last decade, much interest has been focused to diagnose prostate cancer. The advent of multiparametric MR has made it possible to change the way in which prostate biopsy is done, allowing to direct biopsies to suspicious lesions rather than randomly. Mp-MR is used for the detection of prostate cancer and also to investigate the presence of extra capsular spread, seminal vesicle and adjacent organ invasion. The patient and urologist rely on the ability of the radiologist to reliably detect and localise focal tumours. Multiparametric MR is accurate for detecting and localising very distal apical tumours. Use of DWI and DCE-MR techniques may facilitate detections of these tumours by more clearly showing a small area of abnormal signs intensity along the capsule. DWI-ADC and morphological sequences may help increasing the sensitivity and specificity of cancer detection. The aim of our study is to demonstrate how mp-bp/MR could improve detections and localise focal tumours.
Learning Objectives:
1. To learn about the role of multiparametric MRI in the investigation of prostate cancer.
2. To become familiar with the role of morphological sequences, DWI sequences and ADC maps in MRI exams.
3. To gain insight into the potential spectroscopy study of Choline, Citrate and Creatine.

17:15
Panel discussion: How can collaboration between radiology and nuclear medicine develop imaging and research in hybrid imaging?

16:00 - 17:30 **Room C**

E³ - ECR Academies: Modern Imaging in Colorectal Cancer

E³ 1218

Rectal cancer: update on organ saving treatments

Moderator:
L.K. Blomqvist; Stockholm/SE

A-431 16:00

A. The surgical perspective
G.L. Beets; *Amsterdam/NL (g.beets@me.com)*

Organ preservation in rectal cancer can be achieved with or without radiotherapy. Very early tumours can be treated with a transanal local excision. Larger tumours can be downsized with a long course of chemoradiation, and the remaining scar can be excised locally, or a watch-and-wait policy can be followed in clinical complete responses. Organ preservation represents a trade-off between a highly improved function and a higher risk for local recurrence. Patients with a high operative risk and patients who are require a permanent colostomy are often very willing to consider organ preservation. Additional to clinical examination and endoscopy, MR imaging plays an important role in considering organ preservation options: Primary staging: the best candidates for local excision without radiotherapy are small (< 3 cm), good to moderately differentiated T1N0 tumours. Endorectal ultrasound is often also used to discriminates T1 from T2. The lymph node status is often used in decisions on the use of neoadjuvant radiotherapy. Restaging: after a long interval of 8-12 weeks the surgeon would like to know if there is a good response, and if there possibly is a complete response. It is important to know if initially involved lymph node has been sterilised. Follow-up: A higher rate of local recurrences is anticipated, and early detection will allow salvage with standard rectal surgery. Local recurrences can occur in the lumen, in the bowel wall, and in the lymph nodes. When compared to standard treatment, organ preservation strategies require additional information from MRI.
Learning Objectives:
1. To learn about new organ saving treatments in rectal cancer and the clinical background.
2. To know how to select and follow the patients.
3. To understand the factors relevant for clinical decision making.
4. To understand what the surgeon wants to know from radiologists.

A-432 16:30

B. The oncological perspective
V. Valentini; *Rome/IT (vvalentini@rm.unicatt.it)*

In the frame of knowledge-based oncology the clinical decision represents the most critical step in guarantee consistency among individualised therapy, adaptive treatment and the models used to support an appropriate choice. When a preoperative radio (chemo)therapy course is proposed to the patient to look for an organ sparing possible treatment option, the clinical decision model is deeply affected by imaging. The diffusion of the cancer in/through the rectal wall and the nodal spread detection deeply condition the treatment choice in term of indication and radiation field size. A broad portfolio of external radiotherapy techniques + combined with boost strategies by endocavitary brachytherapy can be offered to the patients an high chance to have tumour clearance nowadays. The evaluation of tumour response by qualitative and quantitative imaging methodologies can support an optimisation of the decision model finalised to offer to the patient organ preserving strategies and take all the benefit of a less aggressive treatment to foster a better long-term quality of life.
Learning Objectives:
1. To understand the different radiation oncologists' treatment proposals based on the anatomical and pathological information from imaging.
2. To become familiar with patients' expectations, taking into consideration the various preoperative radiation treatment schedules with or without chemotherapy.
3. To know how radiation treatment can improve the number of patients with complete response and how it is challenging for the oncologist and the patients.

A-433 17:00

C. The radiological perspective
R.G.H. Beets-Tan; *Amsterdam/NL (r.beetstan@nki.nl)*

MR imaging has nowadays become the imaging method of choice for staging rectal tumours. Although organ preservation is the standard treatment for anal cancer, organ saving treatment for rectal cancer patients has only recently been discussed. The shift in rectal cancer treatment towards organ preservation is eminent. The objective of this lecture is to understand the role of imaging for the selection of rectal cancer patients for non operative management. To know the performance of (MR) imaging for the assessment and prediction of complete response after preoperative chemoradiotherapy. To understand its performance for the detection of tumour regrowth during long term surveillance of these patients.
Learning Objectives:
1. To learn how radiologists can answer the relevant clinical questions.
2. To understand the role of imaging during the selection for and the follow-up of organ preservation.
3. To know the performance of (MR) imaging for the assessment and prediction of complete response after chemoradiotherapy.

16:00 - 17:30 **Room O**

Paediatric

RC 1212

Key issues in paediatric imaging

A-443 16:00

Chairman's introduction
J. Portelli; *Msida/MT (jonathan.portelli@um.edu.mt)*

Paediatric imaging covers a very broad spectrum. Indeed, paediatric imaging incorporates the wide range of imaging examinations that can be performed to investigate and/or treat various conditions, disorders and/or diseases that may present in paediatric patients, which, in turn, may range from very small preterm babies to obese adolescents. For this reason, imaging practitioners, particularly radiologists and radiographers, need to be fully knowledgeable of how to adjust parameters and techniques so as to keep the associated radiation dose to a minimum, without compromising the diagnostic efficacy of the paediatric imaging examination performed. It is in this context that this refresher course will seek to highlight several "key issues" that imaging practitioners should consider, especially when imaging paediatric patients. Indeed, apart from providing the fundamentals relating to the relationship between image quality and radiation dose, this course will offer advice and provide practical examples on how imaging practitioners can optimise imaging and reduce radiation doses while maintaining acceptable image quality. In addition, since more MRI examinations are being requested and performed on paediatric patients, this refresher course will also seek to emphasise the importance that imaging practitioners have a good understanding of the safety issues and potential pitfalls relating to paediatric MRI scans, so as to enhance the safety and success of these examinations. A panel discussion to evaluate and highlight the essentials for the education and training of paediatric imaging practitioners will conclude the session.
Session Objectives:
1. To understand the importance of dose reduction parameters.
2. To learn how to improve image quality in paediatric patients when performing studies with ionising radiation.
3. To learn about requisites for a safe and successful paediatric MRI scan.

A-444 16:05

A. Key issues in the x-ray department
E. Sorantin; *Graz/AT (erich.sorantin@medunigraz.at)*

Image quality can be defined in many ways - radiologically using qualitative criteria or quantitatively using digital image processing to derive parameters like signal/noise ratio, quantum efficacy, etc. A clinical approach would be "Everything depicted, what is necessary to make the diagnosis…". For that reason several guidelines developed like the "EC Guidelines For Diagnostic Radiographic Images in Paediatrics" were released. Since children are more radiation sensitive than adults, dose plays a major role and several dose quantities like dose area product for plain films or fluoroscopy or CTDI, DLP and SSDE for CT are available. The most frequent fluoroscopic examinations in children are upper GI studies and VCU, but in daily clinical work several other examinations are performed - like colon contrast enemas (e.g. defaecography) or placement of duodenal tubes. Therefore, settings including usage of grids, or frame rates have to be adjusted to the examination. Additionally, correct patient positioning and shutter usage are easy tools to save radiation. A defined protocol on how to perform a barium swallow or a VCU including the type and number of projections documented represents good medical practice and helps to keep the radiation dose low. During the presentation straightforward examples of parameter settings and examination protocols will be given for fluoroscopy, which can be used in daily praxis.

Learning Objectives:
1. To learn about the image quality and patient dose.
2. To become familiar with standards of acceptable image quality.
3. To become familiar with ways to reduce dose, especially in daily fluoroscopy.

Author Disclosure:
E. Sorantin: Board Member; Austrian Society for Radiology and Nuclear Medicine. Consultant; Ulrich Medical Coop. Investigator; Multicenter Study for Optimisation of Intravenous Contrast Medium Injection in Pediatric CT - academic study, Study in Pharmacokinetics, safety and efficacy of Dotarem in children up to 2 years of age - GUERBET.

A-445 16:28

B. Dose reduction and image quality in paediatric CT

R.A.J. Nievelstein; *Utrecht/NL (R.A.J.Nievelstein@umcutrecht.nl)*

The recent revolutionary developments in multidetector CT (MDCT) technology have contributed to a substantial increase in its diagnostic applications and accuracy in children. A major drawback of MDCT is the use of ionising radiation and, consequently, the risk of radiation-induced side effects, particularly the induction of cancer, which is of special concern in children. That is why there is increasing interest of international scientific organisations and literature in MDCT dose reduction and optimisation strategies. Reducing the radiation dose in children starts with "justification of scan" or performing MDCT in children only when properly indicated. This requires adequate communication between referring physician and radiologist, as only with a complete clinical picture a well-considered decision can be made which imaging modality is best to answer the clinical question. If MDCT is indicated, "optimisation of scan" for children is essential to reduce the dose as much as possible. This starts with adequate patient preparation, including age- and intellect-adapted information to child and parents, inviting parents to stay with the child, and creating a child-friendly scanner environment. This will help to reduce the anxiety of the child and increase the success rate. The next step will be optimisation of the scan and technical parameters to the size of the child, body region of interest and clinical question. This includes the settings of several factors such as scout view, scan length, exposure settings as well as image reconstruction techniques. This lecture will focus on all these technical and non-technical aspects relevant for paediatric MDCT optimisation.

Learning Objectives:
1. To discuss simple steps for dose reduction in paediatric CT.
2. To learn about the image quality and patient dose.
3. To understand common errors when performing paediatric CT.

A-446 16:51

C. Patient compliance and motion-free protocols in general paediatric MRI

G. Schneider; *Homburg/ Saar/DE (dr.guenther.schneider@uks.eu)*

As in imaging in adults, motion is the major challenge in paediatric MR imaging, especially when imaging of the thorax and the abdomen is performed. Often more time is spent overcoming motion than is spent increasing resolution, unlike in MRI of other anatomic regions like the brain or joints.This presentation will describe challenges in paediatric abdominal MRI and how to overcome them. Specific topics discussed are motion-compensation techniques like for example respiratory triggering, non-Cartesian k-space filling like radial imaging and signal averaging techniques; reduction of other artefacts; optimisation of non-enhanced T1-, T2-weighted, and dynamic contrast-enhanced T1-weighted imaging; and special considerations in imaging of paediatric patients will be discussed. For dynamic imaging of the abdomen fast sequences for children that are able to perform a breath-hold are discussed, in small children under sedation or general anaesthesia, dynamic sequences in abdominal imaging are performed typically with free breathing and techniques as for example increasing the number of signals acquired to improve SNR and reduce breathing motion will be presented. Another topic covered will be unenhanced and contrast-enhanced imaging of the vascular system and MRA in paediatric patients, with special regards to imaging of the thorax in CHD, vascular malformations and vascular pathologies in general. In contrast to adult patients in newborn babies and small children bolus tracking or test bolus timing is often inadequate due to very fast transit time, unpredictable order of enhancement of different vascular territories in CHD and thus special techniques have to be used in imaging.

Learning Objectives:
1. To understand the cost of time versus quality images in paediatric MRI.
2. To learn about the importance of safety and pre-designed protocols in paediatric MRI.
3. To discuss options and technology available for free-breathing children.

Author Disclosure:
G. Schneider: Investigator; Bracco. Research/Grant Support; Siemens, Bracco. Speaker; Siemens, Bracco, Guerbet.

17:14
Panel discussion: What are the essentials in education and training for paediatric imaging

16:00 - 17:30 **Room N**

E³ - ECR Academies: Modern Cardiac Imaging

E³ 1220

Essentials of modern imaging in cardiac diseases

Moderator:
G.I. Kirova-Nedialkova; Sofia/BG

A-447 16:00

A. Major challenges in diagnostic imaging of cardiac diseases

M. Oudkerk; *Groningen/NL (m.oudkerk@umcg.nl)*

Next generation cardiac imaging focusses on non-invasive techniques providing more information than the former invasive imaging techniques. Therefore the development of functional parameters as cardiac imaging biomarkers are essential. Furthermore non-invasive tissue characterisation is coming within the scope of the latest imaging techniques.Different cardiac imaging modalities, their role and position within decision algorithms together with cost-effectiveness will be discussed and put into perspective.

Learning Objectives:
1. To learn about limitations of standard approaches to diagnosis and assessment of risk in cardiac diseases.
2. To appreciate how these limitations could be overcome with the help of cardiac diagnostic imaging.
3. To learn about new opportunities for assessment of risk and prognosis.

Author Disclosure:
M. Oudkerk: Board Member; NWO / ZonMw IMDI - Innovative Medical Devices Initiative NL. Research/Grant Support; ERC advanced grant, NWO grants Topsector Life Sciences.

A-448 16:30

B. Backbone of cardiac imaging: CT and MRI

M. Gutberlet; *Leipzig/DE (matthias.gutberlet@helios-kliniken.de)*

According to the national and international guidelines cardiac cross-sectional imaging becomes more and more important, especially in patients with known or suspected stable coronary artery disease (CAD). Coronary CTA and cardiac stress-MRI are indicated in patients with an intermediate pretest probability (PTP) of CAD. Due to its high negative predictive value the morphologic test coronary CTA is especially recommended in the group with a low intermediate PTP and ischemic tests like stress-MRI in all the other patients. According to the results of the ESCR Cardiac MR/CT-Registry (https://www.mrct-registry.org) with more than 100.000 submissions the different clinical indications for cardiac MRI (CMR) and cardiac CT will be discussed. The main indication for cardiac computed tomography is exclusion of CAD, which accounts for approx. 65% of all cardiac CT examinations and for CMR the main indication is suspected myocarditis and cardiomyopathies in approx. 43% of all MR-examinations followed by suspected or known CAD in 35%.

Learning Objectives:
1. To review the technical and methodological aspects of coronary and cardiac CT and MRI.
2. To learn about major clinical applications of coronary and cardiac CTA.
3. To become familiar with clinical indications for cardiac MR from a practical point of view.

A-449 17:00

C. Hybrid systems for cardiac applications: essentials

J. Knuuti; *Turku/FI*

"no abstract submitted"

Learning Objectives:
1. To learn about types of hybrid scanners for cardiac imaging.
2. To become familiar with types of tracers for cardiac imaging.
3. To become familiar with approaches to selecting scanners and tracers according to the clinical indications.

16:00 - 17:30 **Studio 2016**

Genitourinary

RC 1207
MRI for gynaecologic imaging: how I do it

A-450 16:00
Chairman's introduction
C.D. Alt; *Düsseldorf/DE*

This level II session gives tips and tricks on how to optimise female pelvic imaging for benign and malignant disease, nodal status evaluation and recurrent or metastatic disease. The three talks give basic knowledge of an optimal patients' preparation and performance of MRI sequences for female pelvic imaging, discuss the pros and cons of (dynamic) contrast-enhanced imaging and diffusion-weighted imaging and also provide insights into advanced techniques like MR angiography, IVIM-DWI and the evaluation of tumour heterogeneity in ovarian cancer.
Session Objectives:
1. To learn how to optimise MRI of the female pelvis.
2. To understand the diagnostic benefit of integration of advanced techniques.

A-451 16:05
A. Basics of patient preparation and T2W-imaging
N.M. deSouza; *Sutton/UK (nandita.desouza@icr.ac.uk)*

T2-W MR imaging forms the mainstay of pelvic imaging. To optimise its diagnostic potential, it is essential that the sequence is implemented with acquisition parameters that deliver the best tissue contrast for discriminating the lesion from the background signal. Even with optimal tissue contrast, images may be subject to degradation by patient-related factors. Physiological motion in the pelvis arises largely from bowel peristalsis and bladder filling. Buscopan (hyoscine butylbromide) 20 mg or glucagon (1 mg) may be used as antiperistaltic agents. Intramuscular administration is important; intravenous delivery results in a very short period of antiperistaltic action insufficient to last through the scanning period. Intramuscular delivery ensures a slower release with a mechanism of action of 30-40 mins. Bladder filling during the scan also degrades image quality. An empty bladder at the outset is preferred. To minimise diuresis during the scan time, avoidance of diuretic-inducing caffeine containing drinks or excessive fluid take should be discouraged for 4 hours prior to scanning. For large field-of-view images T2-W scans in true orthogonal planes to the B_0 field are reconstructed. The sagittal plane is best for visualising the uterus, while the transverse plane is ideal for assessing parametria, adnexae and pelvic side wall. For the ovaries, the coronal plane may be helpful. Small field-of-view images ideally use planes along the anatomical axes of the organs. High-quality T2-W imaging in orthogonal planes is usually sufficient for detecting, characterising, staging pelvic malignancy, monitoring treatment response and assessing disease recurrence of a range of gynaecological pathologies.
Learning Objectives:
1. To understand the value of patient preparation.
2. To learn how to optimise and tailor protocols in female pelvic imaging.
3. To understand the role of T2WI, and how and when to use 3D techniques.

A-452 16:28
B. Contrast agents
R.A. Kubik-Huch; *Baden/CH (rahel.kubik@ksb.ch)*

Gadolinium-based contrast material is not usually necessary for evaluating benign uterine disease, but is recommended in fibroid evaluation. Gadolinium-enhanced sequences are performed for staging endometrial carcinoma, being useful in the assessment of the depth of myometrial tumour invasion. The optimal tumour/myometrial contrast timing was reported between 90 and150 seconds. Thus, the utility of dynamic acquisition has been debated. Contrast-enhanced imaging will not be routinely performed in cervical carcinoma. It is recommended in the MR assessment of sonographically indeterminate adnexal masses and mandatory for staging ovarian carcinoma. Dynamic contrast-enhanced MRI may provide quantitative information about tumour perfusion, being useful for monitoring therapeutic effects and predicting therapeutic outcome. MR angiography should be performed in patients scheduled for fibroid embolisation or in suspected pelvic congestion syndrome. Gadolinium-based contrast agents will cross the placenta and enter the foetal bloodstream. The agents are excreted into the amniotic fluid and will not be removed effectively from the foetal environment. Although there is currently no evidence of adverse foetal effects, contrast agents should be avoided in the pregnant patient. Only a small amount of gadolinium is excreted into the breast milk and absorbed by the infant, without any adverse effects being reported. Therefore, breast feeding can be continued, but it might be the preference of the mother to discard the breast milk in the 24 hours after contrast medium. If contrast agents need to be administered in these patients, linear gadolinium chelates should be avoided.
Learning Objectives:
1. To become familiar with the safety considerations and guidelines for the use of gadolinium with a special focus on imaging pregnant and lactating patients.
2. To learn why, how and when to use IV contrast-enhanced imaging in MRI of the female pelvis.
3. To understand different gadolinium T1W techniques and their clinical value in routine imaging, as well as to become familiar with quantification techniques.

A-453 16:51
C. Diffusion and ADC
E. Sala; *New York, NY/US (salae@mskcc.org)*

DW-MRI is a functional imaging technique that displays information about water mobility, tissue cellularity and the integrity of the cellular membranes. It also permits the quantitative evaluation of the apparent diffusion coefficient (ADC) from images with different b-values. The ADC value is measured in mm^2/s and is calculated by the slope of the line of the natural algorithm of signal intensity versus b-values. DW-MRI should be performed at two or more b-values, which include one or more low b-values (50-100 s/mm^2) since perfusion contribution to diffusion is then eliminated and a very high b-value (750-1000 s/mm^2). Both breath hold and non-breath hold DW sequences can be used. However, the type of DW sequence differs among manufacturers and the radiologist should be familiar with the strengths and limitations of their own scanners. Combination of DWI with conventional MRI sequences improves lesion detection and radiologist confidence in imaging interpretation. DW-MRI can be useful for accurately determining the depth of myometrial invasion in endometrial cancer. This can be particularly helpful in cases of tumours that are either iso- or hyper-intense relative to the myometrium or when the use of intravenous contrast medium is contraindicated. In addition, ADC values are inversely related to the cellularity of tumours which may be useful for distinguishing between benign and malignant tissues and for monitoring tumour response to treatment in cervical and ovarian cancer.
Learning Objectives:
1. To understand the technical principles of DWI.
2. To learn how to optimise and integrate DWI in pelvic imaging.
3. To illustrate the added diagnostic value of DWI in female pelvic imaging.

17:14
Panel discussion: Multiparametric MRI of the female pelvis - should it replace tailored protocols?

16:00 - 17:30 **Room L8**

EIBIR Session

EIBIR 3
Gateway to European funding for research projects

A-454 16:00
Introduction
G.P. Krestin; *Rotterdam/NL (g.p.krestin@erasmusmc.nl)*

With decreasing national R&D budgets and a substantial increase of the European budget for research, the new framework program of DG Research Horizon 2020 became an attractive source for funding for many researchers in Europe. However, the competition is fierce and success rates around 3% are discouraging many scientists to engage into a complicated, time-consuming application process with insecure outcomes. The European Institute for Biomedical Imaging Research has developed a track-record of successful services for imaging scientists engaging into the adventure of submitting a grant application within the Horizon 2020 funding scheme. The speakers of the session are sharing their experience as successful applicants, proposal evaluators and project managers with the audience and try to unravel the mysteries of Horizon 2020.
Session Objectives:
1. To learn about the mission, structure and general services of the European Institute for Biomedical Imaging Research (EIBIR).
2. To understand the framework and policy for European research funding.
3. To learn about future calls relevant to the imaging community.
Author Disclosure:
G.P. Krestin: Advisory Board; Zebra Medical Vision. Consultant; Bracco SA. Equipment Support Recipient; GE Health Care. Research/Grant Support; GE Health Care, Siemens Health Care, Bayer.

A-455 16:15

Maximising your chances to obtain European research funding: opportunities, strategies, services

P. Zolda; *Vienna/AT (pzolda@eibir.org)*

Due to the shrinking national research budgets, European higher education institutions more frequently strive for alternative funding sources. By 2020, the European Commission will have provided €71bn in funding for research through its programme Horizon 2020 (H2020). The clear goal of H2020 is to fund initiatives, which will help overcome the European economic crisis and create new jobs. In its first round of calls H2020 has attracted a significant number of European researchers. However, with a success rate of 14%, the programme has set a high bar. There are currently seven call topics relevant to the biomedical imaging community in the work programme for Health that all require a broad and multi-disciplinary approach. Apart from scientific excellence and the strength of the consortium applicants have to demonstrate the impact of their proposal and make a convincing case for how the project`s innovations will make it to the market. Addressing all of these points in conjunction with various partners from all around the world can be complex and challenging. The European Institute for Biomedical Imaging Research (EIBIR) aims to make this process easier and better coordinated by supporting researchers and industry partners in the preparation and coordination of biomedical imaging research projects throughout Europe and beyond. The EIBIR services include advice on funding opportunities, identifying consortium partners and proposal writing support by our team of experienced scientific writers with knowledge of the European Commission's requirements.

Learning Objectives:

1. To learn about strategies to obtain funding under Horizon2020.
2. To learn about how EIBIR can support research consortia in the preparation and implementation of projects.
3. To get useful tips for preparing a competitive proposal.

A-456 16:40

An evaluator's perspective

M. Dewey; *Berlin/DE (marc.dewey@charite.de)*

Funding opportunities provided by the European Commission are very versatile but also extremely competitive. Simply having a brilliant idea will not be enough to survive the evaluation process. Networks of researchers can submit collaborative research proposals to the European Commission for funding through the Horizon 2020 programme. However, it is important to note that the research topics are defined in a top-down process, i.e. the topics are clearly outlined in the calls for proposals and researchers should submit proposals matching the topic. In this session, you will learn how to best write your proposal so that evaluators are more likely to assign high or even maximum scores.

Learning Objectives:

1. To learn from the experience of an external expert evaluator under H2020.
2. To understand the mechanisms of proposal evaluation.
3. To get insider information, such as what it takes to prepare a proposal that can convince evaluators.

A-457 17:00

Success story of a maximum score project in Horizon 2020

C.K. Kuhl; *Aachen/DE (ckuhl@ukaachen.de)*

Under the scientific lead of the Department of Diagnostic and Interventional Radiology at the University Hospital of Aachen, RWTH, and the coordination of EIBIR, a consortium of ten European partners from academia and industry obtained funding for the H2020 project HYPMED: "Digital Hybrid Breast PET/MRI for Enhanced Diagnosis of Breast Cancer", or HYPMED. The project will, for the very first time, integrate an innovative, fully digital MRI-transparent PET detector directly into a novel, fully PET-transparent breast MRI surface coil. The resulting PET-RF insert will allow precision imaging of breast cancer by truly combined, i.e. synchronous high-resolution and ultralow-dose dedicated breast positron emission tomography with highest level structural and multi-parametric functional MR imaging. HYPMED is one of eight proposals selected from 348 submitted to this call by the European Commission and received an outstanding evaluation, leading to the highest score possible for an H2020 proposal. EIBIR supported and guided the consortium during the proposal-writing phase and led the negotiations during the preparation of the contract with the European Commission. The EIBIR team's experience and professionalism were vital elements in the success of this proposal, and in their role as coordinating partner for project management and dissemination they will be key to the successful implementation of the project during the next four years.

Learning Objectives:

1. To learn about a successful application on hybrid MR/PET in breast cancer.
2. To understand the actions that led to the submission of a strong application.
3. To learn about next the steps of the project.

17:20

Questions and answers

16:00 - 17:30 **Room E1**

Musculoskeletal

RC 1210

Systemic disease: what to look for in the musculoskeletal system

Moderator:
A. Cotten; Lille/FR

A-458 16:00

A. Imaging the diabetic foot

J. Kramer; *Linz/AT (kramer@ctmri.at)*

The most foot infections result from contiguous spread and occur in patients with pedal ulcers that result from predisposing conditions such as diabetes, vascular disease, altered biomechanics, or neuropathy. However, most pedal infections are seen in patients with diabetes mellitus because long-standing diabetes mellitus can lead to a combination of decreased pain perception and impaired microcirculation. The first step in the evaluation of possible changes of the foot regarding diabetes mellitus is a meticulous clinical assessment together with laboratory parameters, especially if an ulcer is already visible. In patients with diabetes mellitus a distinction between osteomyelitis and neuropathic osteoarthropathy of the foot frequently presents a clinical and radiologic challenge. Early diagnosis of osteomyelitis in diabetic foot ulcers is crucial because antibiotic therapy can be curative and may prevent amputation. The sensitivity of plain films in the diagnosis of osteomyelitis has shown variable results and its specificity is also lowered due to missing distinction of osteomyelitis from neuropathic joint disease. MR imaging is considered the investigation of choice for diagnosing foot osteomyelitis. In osteomyelitis, the loss of signal in T1-weighted images and higher intensity on T2-weighted images reveal the pathology within several days. Furthermore, MR images provide good anatomical correlation and using contrast agent infectious changes (bone involvement, abscesses) can be depicted very well. In many cases there is a need to perform a combination of different modalities (x-ray, CT, MRI, scintigraphy) to come to an accurate diagnosis, which is needed for an exquisite therapeutic management.

Learning Objectives:

1. To learn about the range of imaging abnormalities seen in the diabetic foot.
2. To become familiar with features that distinguish infection from other abnormalities in the diabetic foot.

A-459 16:30

B. MSK manifestations of non-malignant haematological disease

A.H. Karantanas; *Iraklion/GR (akarantanas@gmail.com)*

Blood disorders are serious illnesses that require rigorous medical care. Benign haematologic disorders are blood conditions resulting from a wide spectrum of pathogenetic mechanisms. These may result from reduced or overproduction of blood cells, infiltration of the bone marrow (BM) from fibrosis/histiocytes/mast cells and BM ischaemia-necrosis. Imaging findings may be clinically irrelevant, as in cases of marrow reconversion and iron deficiency anaemia demonstrated with the presence of excessive red marrow on MRI. Aplastic anaemia is characterised by myeloid depletion in which BM is devoid of haematopoietic elements. The signal on MRI is that of fat on all pulse sequences. Myelofibrosis which belongs to the spectrum of myeloproliferative group shows symmetric sclerotic trabeculae on radiographs and low signal on both T1 and T2w sequences. Various imaging findings are seen in myelodysplastic syndromes and mastocytosis. In other cases, imaging findings are critical for early diagnosis, staging and prognosis, i.e. the use of MRI in avascular necrosis. In haemophilia, thalassaemia and sickle cell disease, osseous and joint involvement relates not only to the disease itself but also to complications or treatment, i.e. infection and haemosiderin deposition. Rare diseases such as Erdheim-Chester will be discussed together with specific imaging findings and newer MRI techniques. Although many disorders can be diagnosed with plain radiographs, BM in benign haematological disease is best appreciated with MRI. MRI may also serve as a biomarker in the management of patients with inborn errors of metabolism who require enzyme replacement therapy such as in Gaucher's disease.

Learning Objectives:
1. To understand the way haematological conditions can affect the musculoskeletal system.
2. To become familiar with patterns of imaging abnormality seen in the musculoskeletal system in patients with non-malignant haematological disorders.

A-460 17:00

C. MSK manifestations of renal disease
G. Guglielmi; *Andria/IT (giuseppe.guglielmi@unifg.it)*

Kidney disease encompasses a large number of pathologies and taking into account their radiological findings, two groups of diseases: those where MSK manifestations are related to chronic kidney disease (CKD) and those no-CKD related. CKD includes a spectrum of different pathophysiologic processes associated with impaired kidney function, and a progressive decline in glomerular filtration rate (GFR). Due to its increasing prevalence, CKD and its complications are considered one of the major public health problem. Among these complications, disorders of calcium and phosphate metabolism have a remarkable importance, and can be further classified into the group of renal osteodystrophy (chronic kidney disease-mineral and bone disorder, CKD-MBD). Renal osteodystrophy is classically subdivided into two metabolic states: those associated with high bone turnover with increased PTH levels (including osteitis fibrosa cystica, the classic lesion of secondary hyperparathyroidism) and those associated with low bone turnover with low or normal PTH levels (adynamic bone disease and osteomalacia). No-CKD comprises a large number of diseases, but tubular diseases of the kidney are mainly involved in MSK manifestation. In this setting, conditions listed are pathologic deposition of calcium salts in soft tissues (chondrocalcinosis) and crystal-associated arthropathies, such as calcium pyrophosphate dihydrate (CPPD) and hydroxyapatite (HA) crystal deposition.
Learning Objectives:
1. To demonstrate the way renal disease can affect the musculoskeletal system.
2. To become familiar with patterns of imaging abnormality seen in the musculoskeletal system in patients with renal disease.

16:00 - 17:30 **Room F1**

Oncologic Imaging

RC 1216
New insights in bone tumour imaging

A-461 16:00

Chairman's introduction
D. Vanel; *Bologna/IT (daniel.vanel@ior.it)*

The first step of imaging of a bone tumour remains always radiographs. They allow to diagnose the "leave me alone lesions" and nothing else is needed, and some obviously malignant lesions. When there remains a diagnostic problem, the next step is CT, to study better short and flat bones, small calcifications, density, periosteal bone formations. MRI has a limited diagnostic role (fluid levels and edema) but is the best technique for local staging. Numerous primary malignant tumours receive neoadjuvant chemotherapy, and some radiation therapy. Imaging should evaluate the changes induced by the treatment, treatment effectiveness, help adapt chemotherapy. The staging may change with this preoperative treatment, and surgical technique and indications can be modified. MRI and PET help diagnose myeloma extension, and again evaluate the extent of the disease, classify better and chose the treatment. How imaging can diagnose, evaluate and follow better the tumours will then be discussed.
Session Objectives:
1. To become familiar with the treatment strategies in bone tumours.
2. To learn about the role of current imaging techniques in management of bone tumours.

A-462 16:05

A. New insights in treatment-associated changes in patients with bone tumours
C.R. Krestan; *Vienna/AT (christian.krestan@meduniwien.ac.at)*

The age-dependent incidence of osteosarcoma, Ewing sarcoma and chondrosarcoma will be outlined. Multimodal treatment of high-grade bone sarcomas according to the most recent ESMO Guidelines (Annals of Oncology 2014) including neoadjuvant and postoperative chemotherapy will be introduced and discussed. The surgical goals in sarcoma treatment including limb salvage and surgical margins will be explained as well as the impact of multimodal therapy on survival and prognosis in bone tumours. Large studies of extremity bone sarcomas have shown local recurrence rates affecting 4% to 7% of patients. That is the reason why both systemic and local surveillance is important. Because the majority of recurrences usually develop within the first 2 years following therapy, follow-up imaging is most aggressive during this early post-treatment period.The pathophysiology and imaging characteristics of treatment-induced (radiotherapy /chemotherapy) changes in imaging the bone marrow and the surrounding tissues will be explained. Diffusion-weighted MR imaging including ADC values can identify residual viable tumour tissues and tumour necrosis induced by neoadjuvant chemotherapy in osteosarcoma. Dynamic contrast enhanced MRI can be indicative of a histologic response to neoadjuvant therapy. 18-FDG (fluordeoxyglucose)-PET CT and PET-MRI will play an important role not only in local and systemic staging, but also in evaluating therapeutic response and differentiating local tumour recurrence from post-therapeutic oedema or fibrosis.
Learning Objectives:
1. To understand the treatment strategies in bone tumours.
2. To learn the essentials of sarcoma imaging.
3. To understand post-treatment appearances including chemo- and radiation-induced bone marrow changes.

A-463 16:28

B. New insights in staging and restaging musculoskeletal tumours
J.L. Bloem; *Leiden/NL (j.l.bloem@lumc.nl)*

Staging encompasses determination of local tumour extent, including skip lesions, and detection of metastases. We use MR before and during neoadjuvant chemotherapy for local staging and biopsy guidance, CT for detecting pulmonary metastases, and PET-CT for comprehensive (regional) staging following recurrence after initial treatment. It is important to realise that anatomic and surgical compartments that are used in analysing local tumour extent on MRI are violated after surgery and have to be used differently for staging recurrence. Pitfalls and specific points that will be discussed are MR protocol, differentiation between tumour and reactive zone, impact of marrow stimulation on staging, osteosarcoma and not Ewing can cross physis, whole bone images are needed for skip metastases (6% in Ewing, 10% in osteosarcoma), blue cell tumours (Ewing, lymphoma) may permeate cortex without gross destruction, immobile joints without cartilage (OA, SI) are easily crossed by some sarcoma's, fascia is an important barrier (there is no fascia between the 3 vastus muscles), bone sarcoma usually displaces neurovascular bundle, tumour in prefemoral fat is extra-articular, this is commonly mistaken for intra-articular extension.
Learning Objectives:
1. To learn about the role of current imaging techniques in management of bone tumours.
2. To learn the essentials in staging and restaging in bone tumours.

A-464 16:51

C. New insights in imaging for multiple myeloma
G. Sommer; *Basle/CH (gsommer@uhbs.ch)*

Multiple myeloma (MM) is the second most common haematological malignancy and accounts for approximately 1% of all cancers. Symptomatic MM is defined by end-organ damage according to the CRAB criteria (elevated calcium, renal failure, anaemia, and bone destruction). Monoclonal gammopathy of unknown significance (MGUS) and smoldering myeloma are precursor states of symptomatic MM. The traditional role of imaging in the initial diagnosis of MM is to detect the destruction of mineralised bone. Skeletal survey has been used for decades as the imaging modality of choice for this purpose. Today, it is widely replaced by low-dose computed tomography (CT), which is significantly more sensitive. The severity of disease is traditionally classified by the Durie and Salmon staging system, which includes the number of osteolytic lesions detected by imaging. There is a growing body of evidence supporting the application of magnetic resonance imaging (MRI) and ^{18}F-fluorodeoxyglucose positron emission tomography (FDG-PET) for assessment of MM. MRI can detect infiltration of bone marrow before mineralised bone is affected. Diffusion-weighted MRI can improve sensitivity in early disease and estimate tumour burden by measuring tissue cellularity. FDG-PET can quantitatively measure metabolic activity of MM lesions and is sensitive for the detection of extramedullary disease. Both MRI and FDG-PET are potentially useful for assessment of prognosis and therapy management. Their clinical role in the framework of hybrid imaging protocols such as PET/CT and PET/MRI remains to be defined.
Learning Objectives:
1. To understand the current concepts of evaluation of multiple myeloma with FDG PET/CT and MR/PET.
2. To understand the role of diffusion-weighted MRI in patients with multiple myeloma.

17:14
Panel discussion: The future of bone tumour imaging

16:00 - 17:30 **Room F2**

Professional Challenges Session

PC 12a

Comprehensive cardiothoracic radiology: the way to go?

A-465 16:00

Chairman's introduction: A perspective from both worlds: cardiac and thoracic imaging

E.J.R. van Beek; *Edinburgh/UK (edwin-vanbeek@ed.ac.uk)*

The field of thoracic imaging traditionally was divided between lungs/mediastinum and cardiac imaging. However, in recent years, there have been several reasons why an integration of cardiothoracic radiology has become both feasible and necessary for appropriate patient care. The hardware and software has improved to an extent that scans are acquired faster with reduced contrast requirements, thus allowing for more complicated contrast injections where appropriate. Radiation dose reduction also allows for multiple image data acquisitions as required. Lastly, improved temporal and spatial resolution allows for non-ECG-gated studies as well as ECG-gated studies to be available for both the pulmonary and systemic circulation within a single examination. The needs for integrated imaging are based on the common aetiologies of cardiovascular and pulmonary diseases (with smoking the main culprit), while the interaction between the lungs and heart are now recognised as causing major impacts on mutual prognosis of diseases. This session intends to demonstrate the opportunities, the view point from chest and cardiac imaging approaches and the importance of a holistic approach to cardiothoracic imaging. A panel discussion will discuss opportunities, caveats and pitfalls with a view to incorporation of this methodology for routine clinical practice.

Session Objectives:

1. To learn about the possible integration of cardiac and thoracic imaging for routine patient care.
2. To understand the need for a holistic approach to cardiothoracic imaging.
3. To become familiar with the main protocols and applications of cardiothoracic imaging.

Author Disclosure:

E.J.R. van Beek: Advisory Board; Vital Images. CEO; Quantitative Clinical Trials Imaging Services Ltd.

A-466 16:05

Challenges and opportunities

A. de Roos; *Leiden/NL (A.de_Roos@lumc.nl)*

Cardiac imaging has become a major field in radiology for education, practical use and research mainly due to advanced CT and MRI technology in the last decades. Pulmonary imaging has a longer tradition in radiology as a specialty in its own right using the same CT and MRI technologies. Also PET-CT and PET-MRI technology are advancing the field of chest imaging, both cardiac and pulmonary. The heart and lungs form a functional unit that may require integrated imaging for comprehensive evaluation of the cardiopulmonary system. Combined heart and lung imaging may improve diagnostic strategies for evaluating cardiopulmonary disease (e.g. right heart failure in lung disease and pulmonary hypertension), enhance the role of radiology in chest imaging (radiologists are uniquely well positioned for both heart and lung imaging), crossing traditional borders may constitute a new business model for new clinical applications as well as to enhance research opportunities. Opportunities and challenges for combined multi-organ imaging will be discussed.

Learning Objectives:

1. To learn about challenges in training and education.
2. To learn about multi-organ interaction.
3. To learn about clinical and research opportunities.

A-467 16:30

Perspectives from thoracic imaging

M. Rémy-Jardin; *Lille/FR (martine.remy@chru-lille.fr)*

Despite the well-documented atherogenic effects of smoking, radiologists'attention remains mainly directed toward depiction of emphysema and airways disease in smokers. However, recent guidelines for COPD patients have underlined the major impact of cardiovascular comorbidities, recommending that they should be actively looked for and appropriately treated if present. This recommendation has a theoretical major impact on the way of performing and reporting chest CT examinations of smokers who represent a common category of patients for specialised but also nonspecialised radiologists. This presentation will describe the broad spectrum of cardiovascular comorbidities in smokers and their impact on clinicians'understanding of patients' symptoms. The second part will focus on the possibilities to screen for cardiovascular comorbidities on HRCT examinations of the chest, i.e., the standard protocol for characterisation of smoking-related respiratory disorders. The situations justifying a move towards chest CT angiography will be discussed with emphasis on the tools that can help quantify cardiovascular abnormalities on cross-sectional imaging.

Learning Objectives:

1. To describe the clinical situations justifying such an integration.
2. To discuss the most adapted scanning protocols.
3. To describe the complementarity between morphology and function in daily practice.

A-468 16:55

Perspectives from cardiac imaging

J. Bremerich; *Basle/CH (jbremerich@uhbs.ch)*

Although radiology evolves towards organ or modality specialization, radiologists must maintain a general and comprehensive view of the entire patient. The lung and the heart are good examples for a close relation of distinct organs. The current presentation seeks to illustrate this interrelation and stimulate the interest of both, cardiac and pulmonary imagers for a comprehensive approach beyond organ borders. Pulmonary hypertension is a good example for direct cardiopulmonary interaction, since this disease typically originates from the lungs, but patients may suffer or even die from failure of the right heart. Various techniques are available for assessing the effects on the heart such as increased wall stress, disturbed function, distorted geometry, increased volumes and impaired functional reserve of the right ventricle. Moreover, congenital pulmonary or cardiac diseases require detailed analysis of morphology and function before surgery and for follow-up. CT is an excellent tool for assessment of cardiopulmonary morphology and lung tissue analysis with submillimeter resolution whereas MRI is an outstanding tool for imaging function, morphology and for tissue characterisation. Modern radiology evolves towards organ- and modality-based subspecialisation. With this background it is of paramount importance to provide a comprehensive view for our patients. This is well exemplified in cardiopulmonary diseases.

Learning Objectives:

1. To understand the role of the heart in cardiopulmonary diseases.
2. To learn about cardiac imaging modalities and their application in pulmonary diseases.
3. To become familiar with specific cardiac imaging protocols.

17:20

Panel discussion: How to best increase our impact on this interdisciplinary field?

16:00 - 17:30 **Room D1**

Chest

RC 1204

Occupational lung diseases: the known and the less known

A-469 16:00

Chairman's introduction

N. Karabulut; *Denizli/TR (nkarabulut@yahoo.com)*

Occupational lung diseases refer to a spectrum of pulmonary diseases caused by work-related or environmental exposure to toxins and chemicals. The aerosolized or respirable agents in the form of fibers, fumes or dust may induce a multitude of thoracic diseases. Occupational lung diseases include pneumoconiosis (dusty lung), hypersensitivity pneumonitis, bronchiolitis, byssinosis (brown lung disease), and occupational asthma. Pneumoconioses result from inhalation and deposition of mineral dust and inorganic particles with subsequent injury of the lung. The causative dusts can be fibrogenic (e.g. silica, coal, talc, asbestos), granulomatous (e.g. beryllium), and benign or inert (e.g. iron, tin, barium). Occupational exposure to certain organic dusts, molds, and chemicals can lead to hypersensitivity pneumonitis. The role of radiologist is not only to assist in confirming a suspected diagnosis by recognizing broad spectrum of imaging patterns but also to help in identification of new occupational exposures or new sources of known exposures. Denim sandblasting has been recognised in the new millennium as a novel cause of acute or accelerated silicosis with poor outcome. It develops following exposure to high concentrations of silica, and is differentiated from chronic silicosis by its more rapid development (within a few years) following first exposure. As it is an untreatable disease, the recognition of imaging findings in the early stages of silicosis is crucial. The most common CT findings include

multiple ill-defined centrilobular nodules, patchy ground glass opacity, interlobular septal thickening, consolidation, and enlarged mediastinal lymph nodes.

Session Objectives:

1. To clarify the terms used to describe occupational lung diseases.
2. To illustrate one modern cause of OLD: denim sandblasters.

A-470 16:05

A. Silicosis and coal workers' pneumoconiosis

K. Marten-Engelke; *Göttingen/DE (kmarten@med.uni-goettingen.de)*

Despite federally mandated safety standards, silicosis and coal worker's pneumoconiosis (CWP) continue to occur in several industrial workplaces. Silicosis is caused by inhalation of crystalline silica dioxide, particularly in occupations such as mining, sandblasting, surface drilling or stone cutting. Exposure to crystalline silica can result in adverse pulmonary responses such as acute silicosis, accelerated silicosis or chronic silicosis. It may also be associated with systemic and autoimmune diseases or tuberculosis. High-resolution CT features in chronic silicosis include a micronodular pattern, pseudoplaque formation, and hilar/mediastinal lymphadenopathy with or without egg-shell calcification. If progressive massive fibrosis (PMF) develops, confluence of silicotic nodules into larger opacities with a tendency to migrate towards the hila is noted. CWP is caused by inhalation of washed coal or mixed dust. As in silicosis, simple and complicated forms occur. HRCT features in simple silicosis closely resemble chronic silicosis; however, the nodules display less distinct margins and tend to be smaller. PMF occurs less frequently than in silicosis.

Learning Objectives:

1. To recognise clinical features and occupational history of silicosis and CWP.
2. To appreciate HRCT features of these disorders as well as important differential diagnoses.

A-471 16:28

B. Asbestos-related disease

S.J. Copley; *London/UK (suecopley@hotmail.com)*

The effects of asbestos fibres on the lung and pleura are due to mechanical effects due to physical properties, interference with mitosis and the release of toxic oxygen radicals which induce DNA damage. Environmental exposure to asbestos fibres does occur, but the commonest occupations exposed are those in the construction industry. The pleuropulmonary complications of asbestos exposure are variable, depending on the type of fibre and intensity of exposure. The commonest manifestation of asbestos exposure in the thorax is pleural plaque formation, although other complications are benign pleural effusion, diffuse pleural thickening, asbestosis, mesothelioma and lung cancer also occur. The lecture will concentrate on the benign pleuroparenchymal manifestations of asbestos exposure and demonstrate the imaging features of these conditions.

Learning Objectives:

1. To know the wide range of findings associated with asbestos exposure.
2. To appreciate the role of CT-HRCT in the assessment of these patients.

A-472 16:51

C. Hypersensitivity pneumonitis

P.-Y. Brillet; *Bobigny/FR*

Hypersensitivity pneumonitis (HP) is a worldwide, diffuse parenchymal lung disease characterised by an abnormal inflammatory immunologic reaction to specific inhaled antigens (usually < 5 µm in diameter) contained in organic dusts. Farmer's lung and bird fancier's lung remain the most prevalent forms of the disease, but other causes may be frequent, due to domestic or occupational exposure. HP is a complex disease of varying intensity, clinical presentation, and natural history with chronic forms leading to irreversible pulmonary fibrosis. The diagnosis needs a multidisciplinary approach that integrates computed tomography (CT) images. CT findings vary according to the degree of infammation and/or fibrosis. Certain patterns are highly suggestive of HP (centrilobular micronodules, mosaic perfusion with air trapping, headcheese sign) whereas others are nonspecific (ground glass opacities, cysts, emphysema). In fibrotic cases, nonspecific interstitial pneumonia and usual interstitial pneumonia patterns may be observed. The absence of predominance of the fibrosis distribution and the presence of air trapping are in favour of the diagnosis. Complications and differential diagnoses will be discussed.

Learning Objectives:

1. To know about the various professional exposures that can cause HSP.
2. To learn how to recognise the acute, sub-acute and chronic forms of this disease.

17:14

Panel discussion: What are the key findings for diagnosing occupational lung diseases?

16:00 - 17:30 **Room D2**

MIR @ ECR Session

MIR 3

Improving radiology departments

Moderators:
J.K. Bell; Manchester/UK
P. Mildenberger; Mainz/DE

A-473 16:00

A. Health and wellbeing in the workplace

C.L. Cooper; *Manchester/UK (cary.cooper@mbs.ac.uk)*

This address explores the behavioural and health symptoms of stress, and the costs of workplace stress and lack of mental well-being in the workplace. It highlights the main causes or sources of workplace stress, such as how one is managed, long hours, lack of autonomy or control over the job, the home-work interface and other factors intrinsic to a specific job. A three-prong approach to managing stress at work is explored, from primary interventions (e.g. well-being audits), to secondary interventions (e.g. resilience training, etc). to tertiary interventions (e.g. workplace counselling and EAPs).

Learning Objectives:

1. To assess the costs of poor health and wellbeing at work in personal and organisational outcomes.
2. To explore the workplace stressors that deplete wellbeing at work.
3. To highlight strategies for enhancing wellbeing at work and minimising stress.

A-474 16:18

B. The role of radiology departments in patient-centred care: requirements for improvement

R.L. Arenson; *San Francisco, CA/US (ronald.arenson@ucsf.edu)*

Patient-centered care is rapidly gaining emphasis globally. Placing the patient's welfare first is also part of precision medicine, also been called personalised medicine. Radiologists need to become part of this movement or possibly be marginalized outside of the primary healthcare team. Radiologists need to communicate directly with patients, certainly after procedures are completed also introducing themselves and the other members of the team such as technologists and/or nurses beforehand. They also need to provide patients with their reports and their images, if the patients wish to receive them. Interventional radiologists and neurointerventionalists have already embraced this patient contact and see patients in clinics as well as pre- and post-procedures. Not all referring physicians favour such radiologist communication with patients since some feel this interferes with their physician-patient relationship and that radiologists are not well versed in the details about the patient's care. One approach to this contact with patients involves the partnership of pathologists and radiologists called integrated diagnostics. In this model, the diagnosticians (radiologists and pathologists) become the gate-keepers deciding when the patients need to see other specialists. This process requires physician extenders or nurse practitioners as well as sophisticated decision support software for order or consultation request entry. The best approach to sharing images with patients is the RSNA Image Share Network providing standard communication protocols that allow images to be shared across institutions and physicians under patient control.

Learning Objectives:

1. To become familiar with information system tools for radiology to become more patient-centric.
2. To understand the importance of radiologists' interactions with patients.
3. To appreciate the transformation needed for radiology to adapt to new health systems.

A-475 16:36

C. Key features for organisational and financial sustainability

E. Schouman-Claeys; *Paris/FR (elisabeth.schouman-claeys@aphp.fr)*

Medical imaging is facing the current context of economic difficulties, globalization, shorter life cycles, increasing levels of investments as well as more burdensome expectations from its consumers and employees. In this context, sustainability of the services at a high-quality level implies organisational adjustments. These are constrained by the necessity of financial viability. Both private and public structures are facing such challenges. Potential solutions are not fundamentally different from those used in other sectors. The presentation underlines the critical role of (1) evaluation of the organisations, (2) technical, competitive, societal, and strategic watch (3) risk analysis of organisational and financial models (4) professionalization of what has become business management. The guiding principles should be a high consideration for the values of human resources, a widespread use of

information systems and key performance indicators, and the willingness to change when necessary.
Learning Objectives:
1. To search for economies of scale, developing closer collaboration and possible merging.
2. To promote comprehensive and customised service offers.
3. To rethink the role of each category of staff and develop collaborative care.
4. To focus on the need for long-term goals and innovative policies.
5. To appreciate that investments on quality systems are a source of direct and indirect income.

A-476 16:54

D. Clinically relevant reporting in the era of precision medicine
H. Hricak; *New York, NY/US*

In the era of precision medicine, the complexity of cancer care and the growing use of "big data" are placing new demands on our workflow, reporting style and relevance to patient management. In oncology, the diagnostic radiologist's role is to help referring clinicians grapple with complexity by answering key clinical questions clearly and concisely. Increasingly, this role demands specialised knowledge maintained through close involvement in day-to-day cancer care. The radiologist must be able to recognise different types of cancer for initial diagnosis, apply various tumour staging criteria, and understand the impact of stage on clinical management. Because of the introduction of targeted therapies with novel mechanisms of action—which have captured 46% of the oncology market globally—the radiologist must also be familiar with a growing array of response assessment criteria that go beyond conventional size measurement. Furthermore, the radiologist must be able to recognise treatment complications and post-treatment recurrence. Given the variety of information that must be reported, the use of structured reporting templates, with standardised terminology and diagnostic certainty lexicons, is essential to ensure thorough and clear reporting. Imaging is becoming increasingly quantitative and biology driven. New molecular imaging techniques are entering the clinical realm and the development of theranostic agents that simultaneously image and treat could soon give radiologists an even more integral role in treatment design and delivery. To maximise their "added value" and relevance, radiologists will increasingly need to cultivate an understanding of molecular biology and the ability to work closely with specialists from other disciplines.
Learning Objectives:
1. To learn about key elements of reporting for precision medicine.
2. To understand the synergy between imaging reports and clinical management.
3. To appreciate how advances in oncology change the requirements for radiology reporting.
4. To become familiar with emerging trends in molecular imaging and theranostics that are impacting the demands on clinical radiology.

17:12
Discussion

16:00 - 17:30 **Room K**

E³ - Rising Stars Programme

Basic Session 3: Interventional radiology: tumour ablation

A-477 16:00

Kidney
K. Katsanos, A. Adam; *London/UK (konstantinos.katsanos@gstt.nhs.uk)*

Renal cell carcinoma (RCC) comprises approximately 3.8% of all new cancers and its early detection rate has been increasing over the last decade. Treatment options for early stage T1a tumours (< 4 cm) include active surveillance (usually slow growth pattern of 1.0-1.5 cm/year), partial nephrectomy (open or laparoscopic or robotic) and percutaneous thermal or cryo-ablation. To date, ablation is usually offered to patients with underlying comorbidities, multiple unilateral or bilateral tumours, as a less invasive nephron sparing treatment in case of already impaired kidney function or if the patient declines surgery. Tumour size and anatomical location are key factors to decide suitability for ablation and they are both considered predictors of local tumour control. The procedure is routinely performed under cross-sectional image guidance that allows precise lesion targeting and intravenous conscious sedation for pain control. Percutaneous hydro-dissection or other techniques may be employed to displace and prevent injury of adjacent anatomical structures. The procedure may be performed on an inpatient or outpatient basis. The authors will discuss pertinent decision making, procedural techniques, follow-up imaging and expected clinical outcomes in detail. Meta-analyses and large observational cohort studies have shown that thermal or cryoablation of small renal masses produce oncologic outcomes similar to surgical nephrectomy and is associated with significantly lower peri-procedural complications and a significantly less decline of renal function. More randomised, controlled trials are necessary.

A-478 16:30

Liver
L. Crocetti; *Pisa/IT (laura.crocetti@med.unipi.it)*

Image-guided thermal ablation is becoming increasingly accepted for the treatment of certain benign and malignant tumours of the lungs, liver, kidneys, bone, and soft tissues. Numerous thermal and non-thermal ablation modalities are available, including radiofrequency (RF) ablation, microwave ablation, cryoablation, irreversible electroporation and chemical ablation (with ethanol and acetic acid). The number of available ablation modalities, the rapid changes in the associated technology (especially recently), the relative lack of randomised controlled or comparative trials, the wide discrepancies in published results (with associated difficulties in interpreting the results), and the variability of practice in different centres have led to confusion about best practice in patients. The mechanisms of action of various ablation modalities are at the centre of many of the relative advantages, disadvantages, and limitations encountered in clinical practice. Ultimately, combining an understanding of the physical properties of the ablation modalities with an understanding of the thermal kinetics in tissue and using the most appropriate ablation modality for each patient are key to optimising clinical outcomes. A basic understanding of the underlying physical processes is critical to determining the most advantageous modality.

A-479 17:00

Bones
A. Gangi; *Strasbourg/FR*

"no abstract submitted"

16:00 - 17:30 **Room G**

Neuro

RC 1211
Cerebrovascular disease

Moderator:
M. Vernooij; Rotterdam/NL

A-480 16:00

A. Vascular distribution territories: arterial and venous
A. Dörfler; *Erlangen/DE (arnd.doerfler@uk-erlangen.de)*

After a short overview on the vascular anatomy of the brain with a focus on vascular distribution territories the main aim of this presentation is to present different neurovascular pathologies closely associated with arterial and venous vascular distribution territories. Another aim is to provide a better understanding of pathophysiology of different neurovascular disease in an interactive matter. In addition, advantages and limitations of CTA and MRI compared to conventional angiography are presented.
Learning Objectives:
1. To become familiar with a comprehensive vascular anatomy of the brain.
2. To understand the advantages and limitations of CTA and MRA.
3. To recognise the different imaging patterns in stroke and their prognostic value.

A-481 16:30

B. Detecting microhaemorrhages: why are they important? What are they? Should we use GRE T2* or SWI or both?
H.R. Jäger; *London/UK (r.jager@ucl.ac.uk)*

Cerebral microbleeds (CMBs) have become detectable since the introduction of haemorrhage-sensitive MR sequences by virtue of the susceptibilty-induced magnetic field dicturbance they cause. They are visible on T2* GRE which can be performed as 2D or 3D sequence. The size of the artefact depends on a number of imaging paramenters including the magnetic field strenght and echo time. SWI enhances the susceptibility effects by multiplying T2* weighted magnitude images with filtered phase images and allows the generation of minimum intensity projection (mIP) images. SWI is not only more sensitve to detection of CMBs than T2* GRE but allows also better visualisation of cortical supserficial siderosis (cSS) and cerebral veins. CMBs are important features of the two commonest forms of cerebral small vessel disease: hypertensive arteriopathy and cerebral amyloid angiopathy (CAA). In the former CMBs are predominantly located in the deep brain structures and infratentorially, wheras in CAA they are located in the periphery with a predelection for the posterior

part of the brain. CAA is also associated with cSS. CMBs occur in the normal ageing population and are seen with increasing frequency in patients with Alzheimer's disease, ischemic stroke and intracerebral haemorrhage. The presence of CMB correlates with cognictive performance. CMBs are also associated with a greater risk of cerebral haemorrhage in patients receiving antiplatelet, antithrombotic and thrombolytic therapy. Other conditions associated with CMBs are CADASIL, haematological diseases, traumatic brain injury, endocarditis, and cranial radiation treament. Important microbleed mimics are cavernomas and haemorrhagic metastases.

Learning Objectives:

1. To understand the basic physics of the two sequences.
2. To understand the role of both sequences in stroke and other disorders.
3. To recognise imaging patterns that may mimic stroke clinically and radiologically.

A-482 17:00

C. Cerebral perfusion studies in cerebrovascular disease: techniques, indications and applications

P.M. Parizel; *Antwerp/BE*

The purpose of cerebral perfusion imaging is to measure cerebral blood flow, expressed in mL/100 gram of tissue/minute. Cerebral perfusion studies can be be performed using CT or MRI. Despite the usefulness of diffusion-weighted imaging for demonstrating acute cerebral infarction, CT perfusion offers the advantages of speed, accessibility, relatively low cost, and ease of patient monitoring. Therefore, in this presentation we shall focus on CT perfusion (CTP), which, together with CT angiography (CTA), has changed the strategy for acute stroke imaging. CTP and CTA can be performed rapidly immediately following a non-contrast CT scan. In patients with acute cerebrovascular disease (stroke), advantages of CTP include: identification of potentially salvageable brain tissue (penumbra) and visualisation of irreversibly infarcted brain tissue (core); moreover, CTP can be used for outcome prediction after thrombolysis. In chronic cerebrovascular disease, CTP is able to assess overall microcirculatory tissue perfusion, and to show differences between hemispheres and regions in the brain. Notably, CTP also helps to identify collateral circulation, which plays an important role in chronic arterial stenosis. In summary, in patients admitted with suspicion of an acute stroke, CTP (and CTA) provides a unique insight into the pathophysiology of the cerebral circulation. These techniques are now essential tools in the management of patients with cerebrovascular disease, and they allow assessment of the infarct core, salvageable brain tissue, site of occlusion, and collateral circulation. In this way, CTP (and CTA) helps to identify patients who are potential candidates for advanced therapies such as thrombolysis or thrombectomy.

Learning Objectives:

1. To understand how imaging can help select patients for treatment of acute ischaemic stroke.
2. To show the importance of collateral flow in ischaemic patients.
3. To explain the actual EBM treating patients with acute ischaemic stroke.

16:00 - 17:30 **Room M 1**

EuroSafe Imaging Session

EuroSafe 3

Joint Session of the ESR and HERCA: the new EU-BSS Directive - a step forward to patient safety

A-483/A-484 16:00

Chairmen's introduction

G. Frija; *Paris/FR (guy.frija@egp.aphp.fr)*

S. Ebdon-Jackson; *Didcot/UK (steve.ebdon-jackson@phe.gov.uk)*

The Directive 2013/59/Euratom represents a major overhaul of radiation protection legislation in Europe, consolidating and amending the existing Euratom Directives to produce a single Basic Safety Standards Directive addressing occupational and public safety and medical exposures. Significantly for medical practices it replaces the previous Directives 96/29/Euratom and 97/43/Euratom, into a single piece of legislation. The new Directive has implications for radiologists, medical physicists and radiographers and other healthcare professionals with regard to the justification and optimisation of exposures, dose recording and reporting of accidental and unintended exposures, requirements for patient information and the use of diagnostic reference levels. The Directive must be transposed into national legislation by all EU member states by 6 February 2018. Until then, member states, regulators, scientific and professional societies as well as industry are working to create and shape national legislation, regulations and practices to ensure a high standard for radiation safety in medicine. The aim of this joint ESR-HERCA session is to learn more about the requirements in the new Basic Safety Standards Directive, to understand their impact on radiological practices and to provide regulators, radiologists, medical physicists, radiographers and other healthcare professionals with professional and legal responsibilities and opportunity to present and discuss their perspectives.

Session Objectives:

1. To provide information about the radiation protection legislation in Europe.
2. To provide an overview of the revised EU-BSS Directive.
3. To address important new and additional requirements, to provide the status quo of the transposition, and to develop a common understanding.

A-485 16:04

Overview of EU radiation protection legislation

J. Griebel; *Neuherberg/DE (jgriebel@bfs.de)*

The radiation protection legislation in the European Union (EU) is based on the Euratom Basic Safety Standards (Euratom BSS). Its development has followed the recommendations of the ICRP and has always taken into account the provisions of the International Basic Safety Standards which is under the auspices of the International Atomic Energy Agency (IAEA). On 17 January 2014, the revised Euratom BSS Directive, the Council Directive 2013/59/Euratom, was published in the Official Journal of the European Union. Member States have until 6 February 2018 to complete the process of transposition into their national regulations. While the Euratom BSS Directive is based on the Euratom Treaty, other important pieces of EU legislation, related to the medical application of ionising radiation, are not. For example, the Medical Device Directive (Council Directive 93/42/EEC), regulating the legal placement of a medical device on the European market, was developed under the auspices of the Treaty establishing the European Economic Community (EEC). The Euratom Treaty enjoys the status of 'lex specialis' which in the case of conflict gives its provisions primacy over other EU legislation. The presentation will address the provisions of the Council Directive 2013/59/Euratom with respect to the medical application of ionising radiation and will illustrate the evolution of this legal framework. In addition, the interrelation with the medical device legislation will be discussed and areas of potential conflict will be addressed.

Learning Objectives:

1. To learn about the radiation protection legislation in Europe.
2. To understand the interrelation with other pieces of EU legislation relevant for medical imaging.
3. To understand the basic framework of the revised EU-BSS Directive with respect to medical exposures.

A-486 16:19

Regulators' expectations

S. Ebdon-Jackson; *Didcot/UK (steve.ebdon-jackson@phe.gov.uk)*

EC Basic Safety Standards Directive 2013/59/Euratom provides a comprehensive approach to protection against the dangers arising from exposure to ionising radiation and for medical practices introduces a framework for the protection of the public, those occupational exposed and those undergoing medical exposures. It replaces a range of previous Directives, most importantly 96/29/Euratom and 97/43/Euratom. The principle of justification is well established in medical radiological practice and the latest Directive builds on established requirements from the previous Medical Exposures Directive. These include the responsibilities of the referrer and medical radiological practitioner within the justification process and those of the Member State in ensuring that referral guidelines are available to referrers. The factors involved in appropriate justification are addressed. In addition, the latest Directive introduces more detailed requirements for asymptomatic individuals, whether participating in health screening programmes or as part of an individual health assessment. For the first time, the Directive introduces requirements relating to accidental and unintended exposures. These are based on a graded approach relating to radiological risk and transposition will entail the competent authority to present approaches to local recording, analysis and reporting of significant events. This paper presents how regulators see the development of national legislation, regulations, guidelines and local procedures to ensure effective transposition and implementation of the Directive. These procedures should provide clarity regarding the responsibilities of those managing and undertaking medical exposures.

Learning Objectives:

1. To understand the need for meaningful justification of exposures prior to them taking place.
2. To understand the relative roles of the referring physician and the imaging specialist in the justification process for exposures.
3. To appreciate the factors that may require reporting of accidental or unintended events to the regulator when the additional dose to individuals may not be clinically significant.

A-487 16:39

Tools to support implementation of the BSS Directive: ESR perspective

G. Frija; *Paris/FR (guy.frija@egp.aphp.fr)*

The ESR works with HERCA and the European Commission to ensure that radiologists' perspective on the BSS directive is taken into account in the transposition. Responsibility for justifying exposures is clearly assigned to the radiologist and it is important to ensure that this requirement is adequately embedded in clinical practice. This can only be achieved if radiologists, medical physicists and radiographers work as a team to ensure each examination is justified, optimised and appropriate. It is also important to consider referring physicians in this process - the appropriateness and clarity of requests are key to ensuring efficient justification processes and maintaining reasonable waiting times. Imaging referral guidelines are an effective tool to support referrers in requesting exams appropriately, and their availability to referrers is mandated in the BSS directive. These guidelines must be delivered to referrers in a usable way, which can be achieved through the use of CDS systems. These tools can make the workflow between referrers and radiologists more effective and efficient. The ESR also encourages the use of clinical audit as a way to improve patient care. The ESR have published its Level I Audit templates in autumn 2015, with further templates to follow in 2016, thereby helping radiology departments fulfil this statutory requirement in the EU directive. In addition, the ESR's EuroSafe Imaging campaign promotes a comprehensive approach to radiation protection and serves as a vehicle for stimulating the behaviours necessary to implement the BSS directive and establish a genuine culture of radiation protection.

Learning Objectives:

1. To detail the current ESR potential.
2. To highlight the difficulty of the task.
3. To give some proposals.

A-488 16:51

Tools to support implementation of the BSS Directive: medical physicists' perspective

J. Damilakis; *Iraklion/GR (damilaki@med.uoc.gr)*

The implementation of the new BSS (Council Directive 2013/59/Euratom) constitutes a major challenge for the regulators, medical physicists and practitioners in European Union, Member States, Candidate States and EFTA states. The new directive takes into consideration the latest knowledge and advancement in medical technology and this entails new requirements in almost all areas of medical radiation protection. Therefore, new tools are required to support implementation. These include 1) introduction of decision support tools for the implementation of referral guidelines, 2) use of dose tracking systems, 3) development and application of tools for patient exposure records, 4) development of tools for patient dose reduction, 5) development of methods for accurate organ dose estimation and risk assessment, 6) development of methods for accurate conceptus dose estimation, 7) introduction of education and training platforms and 8) development and application of tools for accurate and prompt measurement of occupational exposure.

Learning Objectives:

1. To learn about the role of the Medical Physics Expert (MPE) in the EU-BSS Directive.
2. To understand the main points of the BSS Directive and their relevance for Medical Physicists.
3. To understand how the EU-BSS may influence European Medical Physicists' professional lives.

A-489 17:03

Tools to support implementation of the BSS Directive: radiographers' perspective

C. Vandulek; *Kaposvár/HU (cvandulek@gmail.com)*

Diagnostic and therapeutic radiographers have a key role in the course of diagnostic imaging, interventional procedures and radiotherapy treatments. A high level of competence and understanding of responsibilities and tasks of radiographers is needed to ensure adequate protection of patients and staff during medical diagnostics and radiotherapy treatments. The fact that in a growing number of diagnostic examinations and treatments radiographers are the only professionals present underlines the importance of the implementation of the BSS keeping in consideration the roles and responsibilities of the radiographer. The implementation at a national level imposes challenges which can be overcome through careful monitoring of the process.

Learning Objectives:

1. To clarify the role of radiographers in the EU-BSS Directive.
2. To understand the challenges of implementation of the Directive at a national level from the radiographers' perspective.
3. To understand the importance of collaborative actions to enhance the effective implementation of the Directive.

17:15

Discussion: Regulators' vs practitioners' perspective: two sides of the same coin

16:00 - 17:30 **Room M 2**

E³ - ECR Master Classes (Vascular)

E³ 1226a

Interventional radiology for deep venous thrombosis (DVT): ready for prime time?

Moderator:
J.I. Bilbao; Pamplona/ES

A-490 16:00

A. Imaging of DVT

P. Haage; *Wuppertal/DE (patrick.haage@helios-kliniken.de)*

The imaging pathway for deep vein thrombosis (DVT) and often coexisting pulmonary embolism (PE) envelop clinical pretest probability assessment, ultrasound imaging, D-dimer testing, and CT/MR pulmonary angiography (CTA, MRA). Clinical symptoms in suspected DVT are undependable, particularly because many deep venous occlusions are clinically subtle. In addition D-Dimers are often elevated; however, the values are not very specific, because they can likewise be elevated in MI, sepsis, or many other systemic illnesses. Pretest probability strategies are, therefore, vital. A score of 2 or higher indicates the probability of DVT is "likely"; < 2 considers the probability for DVT as "unlikely". In patients with symptoms in both legs, the more symptomatic leg is used. To conclude, clinical pretesting is the essential first step in the diagnostic pathway and always comes prior to imaging. A low clinical pretest probability of DVT and negative D-Dimer result exclude the assumption and preclude the need for subsequent imaging. In case of likely DVT, the diagnostic algorithm should incorporate clinical probability, D-Dimer and ultrasound.

Learning Objectives:

1. To learn imaging techniques for diagnostic assessment.
2. To understand the indication and role of each modality.
3. To appreciate how imaging helps therapy planning.

A-491 16:30

B. Declotting in the emergency room: why not?

R. de Graaf; *Maastricht/NL (r.de.graaf@mumc.nl)*

Deep venous thrombosis (DVT) is a potentially lethal condition, mainly due to the risk of pulmonary emboli. Anticoagulation and elastic compression stockings have been considered the treatment of choice. These measures have proven to limit the risk of pulmonary emboli and death and limit complaints in the acute phase. However, with this regimen still a high number of patients develop a post-thrombotic syndrome (PTS). PTS is caused by incomplete elimination of clot, locoregional inflammation and chronic damage to the vein wall and valves. PTS is characterised by leg swelling, pain, skin pigmentation and venous ulcers. Socioeconomic consequences and diminished quality of life are irrefutable. During the last decade, clot-removing therapies have been proposed to reduce PTS incidence. Systemic thrombolysis was abolished suddenly because of unacceptable bleeding risks. Recently, pharmaco-mechanical catheter-directed thrombolysis (CDT) has proven more promising, and laid the foundation for the first randomised controlled trial (RCT) showing significant reduction in PTS after CDT. Results of more randomised controlled trials are awaited in the near future and are expected to indefinitely settle the paradigm shift in DVT treatment. Meanwhile, innovations in thrombus removal techniques continue to develop. It seems likely that minimal invasive thrombus removal techniques will deny the need for lytics, facilitating ambulatory care for DVT patients. Undeniable, both patients and society will benefit immensely from these treatment prospects.

Learning Objectives:

1. To learn the latest evidence base for endovascular therapy of DVT.
2. To understand the management of acute DVT in 2016.
3. To appreciate the impact of endovascular therapy.

A-492 17:00

C. Filter indications 2016: new oral anticoagulants and other developments

M.J. Lee; *Dublin/IE*

Anti-coagulation (AC) remains the main stay of treatment of venous thromboembolism (VTE) with multiple RCT's demonstrating efficacy. Permanent filters were sparingly used 20 years ago and for absolute indications such as VTE and contra-indication to AC, breakthrough PE while adequately anticoagulated, and/or VTE with AC complications such as bleeding. Since the development of retrievable IVC filters, the rate of filter insertion has increased dramatically year by year, particularly in the USA. This explosive growth has been due to retrievable filters and placement of filters in patients without venous thromboembolism i.e. prophylactic placements. Unfortunately, these retrievable filters placed, are not conisistently retrieved leading to extensive medico-legal issues, particularly in the US. There is little level-one-evidence for the use of IVC filters. The only level one trials, PREPIC I and PREPIC II will be discussed. The BSIR and CIRSE Filter Registry results will also be discussed. The importance of follow-up by interventional radiologists who place filters will be emphasized and strategies to achieve follow-up and 100% retrieval will be discussed.

Learning Objectives:

1. To learn an update on the role of inferior vena cava (IVC) filters in 2016.
2. To understand the criteria for failed medical therapy in 2016.
3. To understand best IVC filter practice.

16:00 - 17:30 **Room M 3**

E³ - ECR Master Classes (Paediatric)

E³ 1226b

Expanding horizons in paediatric imaging

Moderator:
S. Franchi-Abella; Le Kremlin-Bicêtre/FR

A-493 16:00

A. Elastography in paediatrics

M. Anooshiravani-Dumont; *Geneva/CH (Mehrak.Dumont@hcuge.ch)*

Elastography allows detection of changes in the mechanical properties of tissues based on viscoelastic characteristics. This type of information is interesting in clinical diagnostics since the development of a pathological process is often accompanied by changes in tissue stiffness.The most common modality of elastography is the one coupled with the ultrasound. There are several clinical ultrasound systems for quantitative stiffness measurements: transient elastography, acoustic radiation force impulse (ARFI), point shear wave elastography, supersonic shear wave elastography (SSWE). The values obtained are expressed either in kPa or m/s depending on the machine. Paediatric indications of elastography have increased in recent years. Currently many studies have validated the interest of elastography in liver disease to evaluate hepatic fibrosis and thus decrease the number of liver biopsies. Elastography can help in the screening of neonatal biliary atresia, follow-up of portal hypertension, chronic liver disease, liver transplant dysfunction, etc. Some paediatric publications have also shown utility in thyroid, renal and musculoskeletal pathologies. More recently, magnetic resonance elastography has been used in adults. This technique is a promising tool that allows a spatial pattern analysis of hepatic fibrosis; however, till now, there are only very few published paediatric series.

Learning Objectives:

1. To understand the basic principles.
2. To learn about clinical applications.
3. To discuss limitations and potentials.

A-494 16:30

B. Diffusion-weighted imaging: toy or solution?

P.D. Humphries; *London/UK (humphriespaul@gmail.com)*

Diffusion-weighted imaging (DWI) is a long established tool for neuro-imaging in both adults and children. Over recent years, DWI is increasingly being utilised for body applications, which poses potential challenges owing to a greater degree of bulk patient motion. In this talk, we will consider the evidence for the acquisition of body DWI in children, assess current and potential future clinical applications and critically appraise the role of DWI in emerging multi-parametric imaging.

Learning Objectives:

1. To discuss peculiarities of diffusion-weighted acquisition in children.
2. To demonstrate clinical applications.
3. To discuss perspectives and limitations.

Author Disclosure:
P.D. Humphries: Speaker; Guerbet MRI seminar.

A-495 17:00

C. Contrast-enhanced ultrasound in children

D. Kljucevsek; *Ljubljana/SI (damjana.kljucevsek@gmail.com)*

The increased use of contrast-enhanced ultrasound (CEUS) in children has been described. Ultrasound contrast agents (UCAs) have not been registered in individuals younger than 18 years. A written informed consent should be obtained before the examination. All UCA applications remain off-label in children. Therefore, the safety profile of UCAs is of great importance. In fact, so far only one severe anaphylactic reaction and some mild adverse reactions (urticaria, rush, a brief alteration of taste sensation, mild tinnitus) have been reported after intravenous administration of UCA in children. Although UCAs have a favourable safety profile, appropriate precautionary measures should be undertaken. During intravesical application no adverse effect related to UCAs has been reported. Contrast-enhanced voiding urosonography (VUS) is a paediatric-specific application for vesicoureteral reflux detection and also for urethral imaging (transperineal approach). VUS procedure and grading are well standardised. Its diagnostic accuracy is well-established, documented, and integrated in urodiagnostic algorithm. Intravenous CEUS is performed in some centres. UCA dosage should be appropriately adjusted according to a patient's weight or age. In general, the organ/body site of interest is chosen. Common applications include detection, characterisation and/or treatment monitoring of tumours, inflammatory conditions, or trauma. Dynamic CEUS enables a quantification of enhancement and it is a step forward towards functional imaging. CEUS is recognised as a problem-solving alternative imaging modality. EFSUMB Paediatric Registry Data Base is established to collect European experience in the use of CEUS in children, which could support further spread of CEUS in paediatric daily routine use.

Learning Objectives:

1. To discuss safety issues.
2. To demonstrate technique and interpretation of contrast-enhanced voiding cysto-urethro-sonography.
3. To discuss endovascular applications.

16:00 - 17:30 **Room M 4**

E³ - ECR Master Classes (Emergency Radiology)

E³ 1226c

Whole body CT in trauma patients

Moderator:
H. Alkadhi; Zurich/CH

A-496 16:00

A. Improving the triage: which patients should undergo whole-body CT (WBCT)?

D.R. Kool; *Nijmegen/NL (dignakool@gmail.com)*

Whole body CT (WBCT) has become a widely used technique for the initial diagnostic imaging in blunt polytrauma patients. Developments in modern multidetector CT technology and increased understanding of optimal scan and contrast protocols enable us to scan head to pelvis with an adequate image quality and makes it possible to diagnose injuries in a short period of time. While the diagnostic value of WBCT seems clear, the disadvantage of the increased radiation exposure is also evident and WBCT should only be performed in patients who will benefit from it. Current evidence suggests that WBCT is associated with faster evaluation of trauma patients and reduction in the emergency department length of stay. However, there are doubts about the clinical relevance of additional injuries detected by WBCT and the survival advantage of routine WBCT compared with selective CT. Studies evaluating the influence of WBCT on survival in trauma patients are predominately retrospective, have limitations and conflicting results. The benefits of routine WBCT on mortality cannot be established yet and prospective, preferably randomised studies are needed to determine whether early WBCT improves survival compared with selective CT. On the other hand, there is no consensus in literature and no validated clinical decision rule that define patients in whom WBCT can be safely omitted either. Several unanswered questions persist about the role of WBCT in major trauma. The most important issues are appropriate patient selection to prevent unnecessary radiation exposure, how to manage incidental findings and the presumed increase in healthcare costs.

Learning Objectives:
1. To appreciate the evidence in the literature concerning the benefits of WBCT in trauma.
2. To become aware of the disadvantage of WBCT in trauma patients.
3. To become familiar with the literature concerning the evidence-based selection of patients who will or will not benefit from CT.

A-497 16:30

B. How can we improve our WBCT protocol?
B. Leidner; *Ekerö/SE (bleidner@gmail.com)*

Main content of presentation: 1. Correlate CT technology advances to continuous improvements in diagnostic possibilities inclusive of traumatic cerebrovascular injuries; as well as radiation dose considerations and reduction. 2. Providing some facts for a cost/benefit analysis considering the radiation of WBCT and contrast media administration also covering special patient groups. 3. Besides presenting the literature basis for protocol optimisation, the talk will cover practical issues including patient positioning, access for contrast media administration and WBCT protocol diagnostic limitations.
Learning Objectives:
1. To become familiar with the evidence in literature concerning the optimal scan protocol in trauma patients in regard to necessary scan phases and contrast media protocols.
2. To appreciate the importance of radiation dose in patients undergoing WBCT.
3. To become familiar with the possibilities of radiation dose reduction in WBCT.

A-498 17:00

C. Optimising the value of radiologists in trauma care
K.H. Nieboer; *Brussels/BE (k.hans.nieboer@gmail.com)*

For the efficient treatment of polytrauma patients, trauma surgeons and emergency ward physicians are trained to prioritize their clinical assessment by the Advanced Trauma Life Support (ATLS®) or European Trauma Management Course (E™). To facilitate this initial treatment from a radiological point of view, trauma radiologists need to speak the same language. Radiologists should use the same prioritization protocol as surgeons and physicians, and understand the ABCDE protocol to optimise the imaging and reporting sequence in the polytrauma setting. Trauma surgeons use a primary and secondary survey, in which radiology is an adjunct. Whole body CT (WBCT) is considered an adjunct to the secondary survey, but shifts towards the primary survey as the additional value of WBCT is recognised. With reducing scan- and reconstruction times, we should focus on the immediate initial reporting of life-threatening injuries at the CT console according to the ABCDE principles. First we assess the airway, followed by the lung parenchyma (breathing) and search for major haemorrhage and especially ongoing bleeding (circulation). After this, we check the spine and the brain for injury (disability). This primary oral assessment should be followed by the secondary (structured) reporting. From this final report, the important positive findings and relevant negative findings should be communicated immediately to the trauma team and/or intensive care unit. Acute imaging findings in the primary and secondary WBCT assessment, that influence the patient management and the need of timely, relevant and effective verbal and written communication will be discussed.
Learning Objectives:
1. To become familiar with the surgeons' need for fast and accurate information on imaging findings in trauma patients.
2. To recognise imaging findings that influence management decisions in trauma patients.
3. To optimise the timely communication of imaging findings in relation to patient management priorities.
Author Disclosure:
K.H. Nieboer: Speaker; GE Healthcare.

16:00 - 17:30 **Room M 5**

Professional Challenges Session

PC 12b

How to become the undergraduate teacher you always wanted to be

A-499 16:00

Chairmen's introduction (part 1)
S.J. Golding; *Oxford/UK (stephen.golding@nds.ox.ac.uk)*

If teaching is to be effective it must be aligned precisely to the needs and the circumstances of the student. Undergraduates differ from other groups which radiologists teach, not least in their expectations, attitudes and their grasp of modern communications technology. This session is provided by experts in this specialised field to advise teachers on key approaches to securing and maintaining the interest of this particular group and will be of value to anyone interested in teaching radiology to the medical undergraduates.

A-500 16:03

Chairmen's introduction (part 2)
M. Maas; *Amsterdam/NL (m.maas@amc.nl)*

Teaching is a skill that needs training and continuous education. Undergraduate teaching perhaps is even more challenging, since all young professionals in the audience are not necessarily focussed on you, the radiologist, the teacher. Although this may be frightening, I will assure you in this presentation that it is a challenge, an opportunity to get in touch with the young bright minds. This talk will expose successful ways of teaching, both large groups and small groups. The necessary talents you should enhance to become the teacher you always wanted are discussed in an interactive manner. Authenticity, innovation, open mind are key words. Looking forward discussing things with you.
Session Objectives:
1. To understand how radiology teaching needs to be modified to suit the undergraduate.
2. To understand how undergraduates' interest is enhanced by appropriate learning objectives and novel delivery methods.
3. To appreciate how undergraduate study embraces modern media.

A-501 16:05

The undergraduate curriculum: how to get the balance right
B. Ertl-Wagner; *Munich/DE (Birgit.Ertl-Wagner@med.uni-muenchen.de)*

Radiology is a medical specialty with a high relevance during undergraduate training. It tends to be almost omnipresent during medical education. During preclinical training, cross-sectional and radiographic anatomy, radiation biology, radiation protection and imaging physics are important topics. In the clinical years of undergraduate education, imaging-based education is a crucial component in teaching diagnostic and therapeutic decision-making strategies. To attract the best and the brightest medical students to the field of radiology, it is of vital importance for radiologists to be involved both in curricular planning and in the on-going education in their medical faculties. The undergraduate (U level) curriculum of the ESR provides an aid in developing a curriculum for radiological undergraduate education programmes. It is a modular system that can be adapted to the respective teaching situation.
Learning Objectives:
1. To understand that undergraduate learning is directed to what they need to know.
2. To understand how learning objectives are defined to support learning.
3. To learn the role of defining appropriate curricula in teaching undergraduates.

A-502 16:20

Teaching methods' top tips: how you can capture and maintain your students' attention
C. Nyhsen; *Sunderland/UK*

When teaching medical students, PowerPoint presentations are often chosen as the preferred lecture format as they can be reliably shown year after year. Although presented material may be of excellent quality, published surveys have shown that students prefer interactive sessions, in particular when real-case scenarios are discussed with close relation to daily medical practice. The objective of this talk is to inspire attendees to try implementing different teaching methods, thus breaking down teaching sessions into smaller elements, engaging students to a higher degree (thereby hopefully improving learning outcomes and retention of information) as well as making it more

enjoyable for teachers. The focus will be on "low tech" teaching methods which do not require sophisticated software or hardware facilities. Possibilities of how to integrate quizzes and assessments in a positive way will also be included.
Learning Objectives:
1. To appreciate the wide variety of teaching methods available.
2. To learn how to relate these appropriately to the various settings in which radiologists teach.
3. To understand how students' interest is secured by innovative teaching delivery.
4. To appreciate how learning can be reinforced through quizzes and assessments.

A-503 16:35

Online resources: how to find the best case material and tutorials for your medical students

P. Pokieser; *Vienna/AT (peter.pokieser@meduniwien.ac.at)*

Integrating case material and tutorials into radiologic education of medical students, requires to consider the principles of modern medical education. Peer-reviewed case collections are available freely in the internet and allow to present excellent examples of clinical imaging at all levels, from anatomical basics of all modalities and body regions up to clinical workup of complex conditions to be integrated into learning settings for clinical reasoning of advanced students. Nevertheless, evidence of educational research votes for the "involved teacher", who interacts with students personally. To combine own case materials with well-known national or international resources represents a good basis to construct your course. The so-called digital natives are very knowledgeable to find resources themselves. In the opposite to the former learner types, who had difficulties to access review articles and scientific evidence, modern students have good skills to learn theoretical background from online sources or books. They are especially interested to learn experiences of clinical radiologists by interactive examples. Not to forget the needs of teachers, "work-related teaching", an important topic of educational research, points to the practical benefits of "fresh" cases to be presented to students. Integrating own cases, can provide better clinical informations and a kind of dedication, which is much appreciated by students. This lecture will emphasize on how to create different designs of case presentations for best use of time and resources, including a look into the upcoming direction to interdisciplinary teaching, some examples will be shared and discussed.
Learning Objectives:
1. To appreciate which freely available online resources exist.
2. To learn how online resources can be used in daily teaching.
3. To learn how e-learning resources can be created locally to make the best use of teaching time and resources.

A-504 16:50

Using social media for undergraduate education: this generation's communication

N. Pyatigorskaya; *Paris/FR (nadya.pyatigorskaya@gmail.com)*

Modern social services, such Facebook, Twitter, LinkedIn, Google Plus, and many others, have been playing an important role in everybody's personal and professional life since a number of years. Social media can be used by radiologists for the purpose of exchanging professional information with each other, visibility, social communication, networking and searching for a job. Moreover, the users can get the latest information concerning their profession, congresses, and other events and and use the media for e-learning and scientific monitoring. The two powerful tools most commonly used are Facebook and Twitter. Twitter is a microblogging social network, where users can post short messages. These messages can contain photos or links. In this way, each user can share his interests, findings or opinions. To follow particular users, you just have to subscribe to their account to track all the users' tweets, and vice versa. Thus, following the right people, institutions and organisations makes it possible to constantly be aware of the relevant latest information. In Facebook, the information can be shared by a page (personal page or official page or by a group, which can be either open or closed. Twitter and Facebook can be of great importance for being aware of the radiological community news and provide a powerful tool of e-learning. To gain the best profit from these media services, it is important to find pages and accounts that you like and wish to follow.
Learning Objectives:
1. To be aware of the use of social media as e-learning tools.
2. To understand how to use media such as Facebook and Twitter to keep abreast of learning trends and developments.
3. To understand how to follow social media accounts, by demonstration.

17:05

Panel discussion: Teaching the undergraduate: in what ways is this similar to teaching radiology to other groups and in what ways does it differ?

Saturday, March 5

08:30 - 10:00 **Room A**

E³ - ECR Academies: Interactive Teaching Sessions

E³ 1321
MR imaging in sports medicine I

A-505 08:30
A. Muscle injury in sports
M.G. Mack; *Munich/DE (m.mack@radiologie-muenchen.de)*

According to the UEFA injury study 2014, almost 50% of all injuries in professional soccer players are related to muscles, tendon and the musculotendinous junction. During this lecture you will learn, how normal and injured muscle will look like. The standard imaging protocol is including axial T1- and fsPD sequences, angulated coronal and sagittal fsPD sequences with a slice thickness between 1 and 6 mm. You will learn to differentiate between functional muscle disorders without structural injuries (like fatigue-induced muscle disorder (Type 1a) delayed-onset muscle soreness (Type 1b), and spine (Type 2a) or muscle-related neuromuscular disorder (Type 2b)) and structural injuries (minor partial tear (Type 3a), moderate partial tear (Type 3b) and total/subtotal tear (Type 4) of the muscle, the musculotendinous junction and tendinous avulsion). Most structural injuries are stretch-induced injuries and have to be differentiated from contusion injury and distraction injury. In soccer, 92% of all muscle injuries affect the four major muscle groups of the lower limbs (hamstrings, adductors, quadriceps and calf muscles) and occur mainly in non-contact situations.
Learning Objectives:
1. To understand the anatomy of the most common injured muscles.
2. To learn the evaluation of muscle injuries and the impact regarding recovery.

A-506 09:15
B. Knee trauma
M.O. De Maeseneer; *Brussels/BE (Michel.Demaeseneer@uzbrussel.be)*

The purposes are 1. To learn the anatomy of the most commonly injured structures. 2. To recognise typical combinations of injuries. The main stabilizer of the medial retinaculum is the MPFL. The MPFL is intimately related to the vastus medialis obliquus muscle and its femoral insertion is located in between the medial epicondyle and the adductor tubercle. Injuries of the MPFL may occur at the patellar or femoral insertion. Typical patterns of bone contusions of patellar dislocation include oedema in the medial aspect of the patella and anterolateral femoral condyle. When patellar dislocation occurs with the knee flexed, the bone marrow oedema is located more along the mid aspect of the lateral femoral condyle. The medial supporting structures are made up of the MCL and posterior oblique ligament, the MCL being a three-layered structure. Patterns of bone marrow oedema due to valgus trauma include lateral bone contusions. The semimembranosus is the main stabilizer along the posteromedial corner, but injuries of this structure are rare. The anterior cruciate ligament is made up of two bundles and injuries are typically associated with bone marrow oedema along the lateral condyle and posterolateral tibia. Segond avulsion is a characteristic bony avulsion along the lateral tibia, at the insertion site of the iliotibial band and anterolateral ligament. The posterolateral corner includes the arcuate, popliteofibular and fabellofibular ligament. Injuries may lead to the 'arcuate sign' and anteromedial bone contusions. O D'Donoghue's triad is a characteristic association of medial meniscus, anterior cruciate and MCL lesions.
Learning Objectives:
1. To learn the anatomy of the most common injured structures.
2. To recognise typical combinations of injuries.

08:30 - 10:00 **Room B**

Abdominal Viscera

RC 1301
IgG4-related disease: what is it and what do I need to know?

A-507 08:30
Chairman's introduction
S.A. Jackson; *Plymouth/UK (simon.jackson1@nhs.net)*

IgG4-related disease represents a systemic fibro-inflammatory condition, which includes autoimmune pancreatitis. The condition was first reported in 2003 by Kamisawa and colleagues and during the same year autoimmune pancreatitis was also sub-classified into two histologically separate sub-types, with the "classical" type 1 form comprising part of the IgG4-related disease spectrum. Multiple modality imaging plays a central role in the diagnosis of both pancreatic and extra-pancreatic disease involvement which can affect multiple organs. This session will review the systemic manifestations of IgG4-related disease, including both pancreatic and hepatobiliary findings. In particular, various tips and tricks will be presented, to aid a confident imaging diagnosis in patients with IgG4-related disease.
Session Objective:
1. To briefly introduce this multi facet disorders that may involve several organs and represent a diagnostic challenge.

A-508 08:35
A. Pancreatic manifestations
R. Pozzi-Mucelli; *Verona/IT (roberto.pozzimucelli@univr.it)*

The pancreatic manifestation of IgG4-related disease is autoimmune pancreatitis (AIP) which represents a distinct form of chronic pancreatitis. Histologically, AIP is characterised by a dense lymphoplasmacytic infiltrate of mainly CD4+ T lymphocytes and immunoglobulin G4 plasma cells, located around the pancreatic ducts with mass-forming regions of fibrosis. AIP has been classified into focal or diffuse forms. The differential diagnosis between focal AIP and pancreatic adenocarcinoma represents a medical need; since AIP responds to steroid therapy and surgery should be avoided. CT and MRI findings of AIP are characterised by an enlargement of the gland, either focal or diffuse. At CT the affected areas are isodense before contrast enhancement, hypodense (due to hypovascularity) in the arterial phase with progressive increase in density in the venous and late phases following contrast administration. The involved areas appear hypointense on T1-weighted MR images, mild hyperintense on T2-weighted images with reduced diffusion at DWI. The lesion appears hypovascular during the arterial phase, with progressive enhancement and delayed retention of contrast in the venous and late phases. MRCP is able to assess the involvement of the pancreatic duct system and these features are important in the differential diagnosis with the pancreatic adenocarcinoma in which the main pancreatic duct is characterised by single short stenosis, with marked dilation of the upstream ductal system. In cases in which AIP involves the head of the pancreas, dilatation of the common bile ducts and the intrahepatic ducts can be seen.
Learning Objectives:
1. To describe clinical and biological presentation of IgG4-related pancreatitis.
2. To describe morphological and functional (DWI, PET/CT, etc). imaging features of IgG4-related pancreatitis.
3. To identify imaging findings for the differential diagnosis with other solid pancreatic lesions, i.e. pancreatic cancer, and to avoid unnecessary invasive therapeutic procedures.

A-509 08:58
B. Hepatobiliary manifestations
M. Ronot; *Clichy/FR (maxime.ronot@bjn.aphp.fr)*

IgG4-related cholangitis is frequent in patient with IgG4-related disease. IgG4-RC should be carefully diagnosed based on a combination of clinical, serological, morphological and histopathological features. Asian Diagnostic Criteria (Japan-Korea Consensus) and Mayo Clinic Diagnostic Criteria (The HISORt Criteria) have been commonly accepted. On imaging, the affected segments demonstrate irregular stenosis, focal, or diffuse circumferential thickening of the wall with contrast enhancement. The most commonly involved segment are the intrapancreatic segment of the common bile duct showing tapering with upstream biliary dilatation, and the biliary convergence. It remains difficult to distinguish IgG4-RC from primary sclerosing cholangitis (PSC) or bile duct malignancy based on imaging features alone. The presence of other organs involvement, especially pancreatic abnormalities, and elevated serum IgG4 level favor a diagnosis of IgG4-RC. The presence of an inflammatory bowel disease is more frequent in PSC. Biopsy should be used in all patients with a suspicion of malignancy. Although some patients may respond to biliary drainage or surgical resection, IgG4-RC displays a good response to steroid therapy, as is the case for pancreatic lesions. Thus, early introduction of steroid therapy is recommended, especially for patients with obstructive jaundice.
Learning Objectives:
1. To describe clinical, biological presentation and morphological and functional imaging findings for the diagnosis of IgG4-related cholangitis.
2. To discuss the role of imaging to avoid unnecessary invasive diagnostic and/or therapeutic procedures.
3. To discuss the diagnostic criteria to differentiate IgG4-related cholangitis from other causes of cholangitis and biliary cancer.

A-510 09:21

C. Systemic manifestations

G. Morana; *Treviso/IT (gmorana@ulss.tv.it)*

IgG4-related diseases include swelling of involved organs, a lymphoplasmacytic infiltrate with IgG4-positive plasma cells, and a variable degree of fibrosis. Elevated serum concentrations of IgG4 are found in 60-70 percent of patients. IgG4-RD often affects more than one organ. Immunoglobulin G4-related disease (IgG4-RD) generally occurs most commonly in middle-aged and older men, although disease extent and severity appear to be similar in men and women. IgG4-RD associated disorders - other than Type 1 AIP and IgG4-related sclerosing cholangitis - include salivary and lacrimal gland involvement, inflammatory orbital pseudotumour, idiopathic retroperitoneal fibrosis and mesenteritis, chronic sclerosing aortitis and periaortitis, Riedel's thyroiditis, interstitial pneumonitis and pulmonary inflammatory pseudotumours and tubulointerstitial nephritis and membranous glomerulonephritis. The likelihood of IgG4-RD is significantly increased if high serum levels of IgG4, allergic symptoms, and/or other fibrotic processes are also present. Because of the systemic nature of the disease, imaging workup of IgG4-RD should always include whole body examinations to detect multiorgan involvement. Tumour-like swelling of involved organs, nodular, interstitial and ground-glass opacities in the lung, retroperitoneal fibrosis and sclerosing mesenteritis, mass-like, patchy appearance, organ swelling and pelvic wall thickening in case of kidney involvement are imaging findings of IgG4-RD.

Learning Objectives:

1. To describe extra-pancreatic and extra-biliary manifestation of IgG4-related disease.
2. To describe the imaging findings of the most common extra-pancreatic and extra-biliary organ involvement.
3. To discuss the role of "whole body" imaging modality for the diagnosis and the follow-up of IgG4-related systemic disease.

Author Disclosure:

G. Morana: Speaker; BRACCO IMAGING SpA.

09:44

Panel discussion: Tips and tricks in clinical practice

08:30 - 10:00 **Room C**

E³ - ECR Academies: Modern Imaging in Colorectal Cancer

E³ 1318

Colon cancer: staging and restaging of local disease

Moderator:

P. Lefere; Roeselare/BE

A-511 08:30

A. Computed tomography for staging

E. Rollven; *Stockholm/SE (Erik.rollven@karolinska.se)*

Colon cancer is the third-most common malignancy in the western world. The treatment is surgical removal of the tumour-containing segment of the bowel together with local and regional lymph nodes. Adjuvant chemotherapy is standard treatment for patients with stage III disease and in some patients with stage II disease, depending on presence of additional histological risk factors. Well-known important prognostic factors in colon cancer are tumour stage (T-stage), extramural vascular invasion (EMVI) and lymph node involvement (N). A complete preoperative evaluation of patients with colon cancer includes staging of the primary tumour and evaluation of distant metastases in the liver and lungs with computed tomography (CT). In recent years, some studies advocate and support the use of CT also for local staging of colon cancer including treatment planning and selection of patients for neoadjuvant treatment. If selection of patients for neoadjuvant treatment is being used routinely in the clinic, pretreatment knowledge if stage III disease is present will be even more important.

Learning Objectives:

1. To understand the rationale behind local staging of colon cancer.
2. To learn how to assess and report imaging findings.
3. To become familiar with assessment challenges.

A-512 09:00

B. Imaging for restaging after neoadjuvant treatment

M. Maas; *Maastricht/NL (moniquemaas@live.nl)*

Patients with colon cancer are currently staged by CT for local cancer stage and presence of metastasis. Currently, standard clinical practice consists of surgery without neoadjuvant treatment, regardless of the local tumour stage. However, there has been an increasing interest in the use of neoadjuvant chemotherapy in high-risk colon cancer. Upfront chemotherapy has the advantages to avoid a delay in the administration of chemotherapy and leads to downsizing of the tumour, facilitating surgery. Even though this is not standard clinical practice yet, the expectation is that it will be implemented in the future. Staging with radiology plays a crucial role, both in primary staging (identification of high-risk colon cancer) and restaging after chemotherapy. The presentation will discuss the rationale behind neoadjuvant chemotherapy and will address issues and pitfalls in (re)staging.

Learning Objectives:

1. To understand the rationale behind local restaging of colon cancer.
2. To learn how to assess and report imaging findings.
3. To become familiar with assessment challenges.

A-513 09:30

C. Assessment of vasculature prior to laparoscopic resection

A. Laghi; *Latina/IT (andrea.laghi@uniroma1.it)*

Laparoscopic surgery, despite well-known advantages and continuous technological innovations, still has limitations such as the lack of tactile sensation and reduced view of the operative field. Reduced field of view becomes particularly relevant when performing laparoscopic colorectal resection, especially when operating on unfavorable anatomy, often resulting in difficult and time-consuming dissections in search for blood vessels or anatomical landmarks. Variability of the number and course of mesenteric vessels is extremely common and, consequently, risk of iatrogenic vascular and visceral organ injuries is increased compared to open surgery. Previous knowledge of the patient's mesenteric vascular anatomy, including arterial branching variants and relationships with adjacent veins, reduces operative time and the incidence of intraoperative complications. Current technology allows to easily achieve three-dimensional map of patient's mesenteric vascular anatomy together with a colonic map, using contrast-enhanced computed tomography colonography. Compared with a standard technique, it is necessary to acquire an additional scan during the early arterial phase to achieve vascular map. Apart from CT colonography information, relevant vascular findings related to colonic laparoscopic surgery include the evaluation of the branching pattern of the superior mesenteric artery before a right hemicolectomy and right transverse colon surgery and the analysis of accessory left colic artery and the branching pattern of the inferior mesenteric artery when planning left transverse colon surgery and left hemicolectomy. Before sigmoidectomy an evaluation of the sigmoid artery branching pattern should be included. The origins of other splanchnic arteries from the superior or inferior mesenteric arteries must also be considered.

Learning Objectives:

1. To understand CT protocols for angiography.
2. To understand colon vascular anatomy and variants.
3. To learn about radiological demonstration of surgically relevant findings.

Author Disclosure:

A. Laghi: Speaker; Bracco, Guerbet, Takeda, Alfa Wassermann.

08:30 - 10:00 **Room Z**

Special Focus Session

SF 13a

MR/PET: role in oncology

A-514 08:30

Chairman's introduction

G. Cook; *London/UK (Gary.Cook@kcl.ac.uk)*

The session will cover some of the emerging clinical applications of PETMRI. Firstly the principles and potential oncological applications will be discussed. Then the strengths and potential weaknesses of PET/MRI will be discussed with special focus on head and neck, prostate and gastrointestinal cancers. Oncological applications that may become the initial routine indications will be presented.

Session Objectives:

1. To understand the principles of MR/PET in oncological imaging.
2. To understand the strengths and weaknesses of MR/PET in oncological applications.
3. To understand the level of evidence existing for the clinical use of MR/PET in head and neck, prostate and GI cancers.

Author Disclosure:

G. Cook: Investigator; Blue Earth a Diagnostics. Research/Grant Support; Siemens, GE, Alliance Medical.

A-515 08:32

Principles and possibilities of MR/PET

A. Kjaer; *Copenhagen/DK (akjaer@sund.ku.dk)*

Hybrid PET/MRI scanners are now commercially available and have been installed in many cancer imaging centers. While fully integrated PET/MRI scanners are of great value as research tools, the clinical potential is less obvious, especially whether additional value is obtained when compared to PET/CT or standalone MRI and PET. In this session, potential clinical applications within oncology where combined PET/MRI could be valuable will be reviewed. Also functional-functional imaging concepts, including our recently introduced method of hyperPET, where PET/MRI could become a true game-changer will be discussed.

Learning Objectives:

1. To understand the principles of MR/PET in oncological imaging.
2. To understand the strengths and weaknesses of MR/PET in oncological applications.
3. To understand possible future oncological applications of MR/PET.

A-516 08:52

MR/PET: imaging head and neck cancer

S. Bisdas; *London/UK (sotirios.bisdas@nhs.net)*

Clinical assessment of head and neck cancer and therapy efficacy rely on accurate tumour and nodal staging along with detection of distant metastases. These tumour features can be thoroughly investigated by means of high-resolution morphological MRI and metabolic PET imaging. Hybrid MR/PET has been recently launched in the oncological imaging and combines the advantages of both separate modalities, broadly summarised in high-resolution morphological and metabolic tissue profiling, in a simultaneous way being user- and patient-friendly. The experience in routine MR/PET imaging of head and neck cancer is continuously evolving, highlighting also the needs for cost efficient, dedicated MR/PET imaging protocols and solid clinical indications. Yet this technology opens new highways in clinical research and any coupling with advances in radiopharmaceuticals and physiological/functional MRI will result into paradigm shift in head and neck cancer imaging.

Learning Objectives:

1. To understand the strengths and weaknesses of MR/PET in head and neck cancer imaging.
2. To understand the level of evidence existing for the clinical use of MR/PET in head and neck cancer.
3. To understand possible future applications of MR/PET in head and neck cancer.

A-517 09:12

MR/PET: imaging prostate cancer

A.J. Beer; *Ulm/DE (Ambros.Beer@uniklinik-ulm.de)*

The first clinical simultaneous whole body hybrid PET/MR system was installed in October 2010 with huge expectations following the introduction of this new hybrid imaging technique. However, while some studies with mostly limited patient numbers showed some advantages of PET/MR versus PET/CT for various indications, prostate cancer imaging turned out to be one of the most promising fields of application in many centers using PET/MR. Especially the excellent soft tissue contrast in the pelvis and dynamic-contrast-enhanced MRI add synergistic information to the PET data and can help to identify small areas of local tumour recurrence in patients with rising PSA after definitive treatment like radical prostatectomy or radiation therapy. But also for biopsy planning in patients with suspicion of prostate cancer but negative sextant biopsy, PET/MR has huge potential especially when using PSMA-ligands and combining it with high-resolution T2w imaging and DWI. However, PET/MR also has drawbacks compared to PET/CT, like a substantially longer examination time and issues with patient comfort. One aim of this talk is to point out clinical scenarios, where PET/CT is sufficient or might even be superior to PET/CT, and for which patients PET/MR is the modality of choice. In summary, prostate cancer imaging might turn out to be one of the often-quoted "killer applications" the PET/MR community has long been looking for.

Learning Objectives:

1. To understand the strengths and weaknesses of MR/PET in prostate cancer imaging.
2. To understand the level of evidence existing for the clinical use of MR/PET in prostate cancer.
3. To understand possible future applications of MR/PET in prostate cancer.

Author Disclosure:

A.J. Beer: Speaker; Siemens Medical Solutions.

A-518 09:32

MR/PET: imaging of GI cancer

V.J. Goh; *London/UK (vicky.goh@kcl.ac.uk)*

In the last two decades, strides have been made in the imaging of gastrointestinal cancers with continued technological advances. Magnetic resonance imaging (MRI) and 18 F-flurodeoxyglucose positron emission tomography (18 F-FDG PET) in particular have transformed clinical practice by providing high-resolution imaging and high sensitivity for tumour detection, respectively. For example, in the staging setting high spatial and contrast resolution of locoregional MRI has been beneficial for assessing operability, the need for neoadjuvant therapy, and response assessment for rectal cancer; while 18 F-FDG PET has provided a guide to metastatic disease burden and neoadjuvant response assessment. For anal cancer both MRI and 18 F-FDG PET are utilised routinely for staging. For oesophageal cancer, advances in MRI hold promise for augmenting 18 F-FDG PET assessment of tumour stage. Hybrid MR/PET promises to improve patient care by streamlining imaging within the patient pathway and facilitating the integration of morphological and physiological information but brings its own challenges. This lecture will highlight concepts and methodology, and discuss the evidence needed to support its future clinical application.

Learning Objectives:

1. To understand the strengths and weaknesses of MR/PET in GI cancer.
2. To understand the level of evidence existing for the clinical use of MR/PET in GI cancers.
3. To understand possible future applications of MR/PET in GI cancer.

Author Disclosure:

V.J. Goh: Research/Grant Support; Siemens Healthcare.

09:52

Panel discussion: Which clinical indications have enough evidence for routine MR/PET rather than PET/CT?

08:30 - 10:00 **Room O**

Paediatric

RC 1312

Imaging children with cancer

Moderator:
P. Tomà; Rome/IT

A-519 08:30

A. Imaging of abdominal masses at diagnosis: clues for benignity vs malignancy

A.M.J.B. Smets; *Amsterdam/NL (a.m.smets@amc.uva.nl)*

Imaging plays an important role in the diagnosis of an abdominal mass in a child. However, imaging needs to be done and interpreted in the light of the age of the child, the clinical presentation and history and the physical examination. Ultrasound is a most valuable technique for examining the paediatric abdomen and should always be the first imaging test to be performed. Depending on the findings, complementary cross-sectional imaging might be necessary. The use of CT or MR should be based on the clinical indication, the highest possible yield of diagnostic information and with the ALARA principle in mind. Different types of abdominal masses occurring at different ages will be discussed with emphasis on diagnostic clues for benignity and malignancy; possible pitfalls will be illustrated.

Learning Objectives:

1. To become familiar with clinical characteristics and imaging features of a mass suggesting benignity.
2. To emphasise clinical and imaging manifestations of abdominal malignancies.
3. To learn how to report according to international standards.

A-520 09:00

B. From whole body MRI to MR/PET

J. Schäfer; *Tübingen/DE (juergen.schaefer@med.uni-tuebingen.de)*

Since 2004, state-of-the-art whole body MR imaging (WB-MRI) with high spatial resolution has become feasible using dedicated WB-MRI systems with multiple receiver channels. Particularly for children and juveniles imaging of systemic disorders without radiation exposure by WB-MRI represents a paradigm shift that is ground breaking. Thus, further imaging is often unnecessary. However, specific interpretation of findings remains challenging especially without the use of diffusion-weighted imaging. The development of hybrid-imaging using PET-CT has led to a relevant improvement of PET diagnostics concerning reduction of acquisition time, higher resolution as well as accuracy of anatomical allocation. For staging and response evaluation of

various tumours (e.g. Hodgkin disease) PET-CT has shown to be more specific than CT or MRI. However, when the full diagnostic performance of PET-CT is required the radiation exposure increases significantly with the CT part accounting for up to 80% of the patient dose. Consequently, PET-MRI might be the optimal hybrid-imaging technology for children with malignant solid tumours. Moreover, the full potential of multiparametric imaging can only be realised using PET-MRI for precise and comprehensive staging and restaging. The development of new disease-specific PET tracers (e.g. antibody imaging) is an important topic for the evaluation of novel targeted therapies. In this perspective, the MRI part plays an important complementary role. In daily practice, it is crucial to understand the differences of physiologic and anatomic characteristics that lead to specific findings in PET and MRI.

Learning Objectives:

1. To understand differences and pitfalls of whole body MRI and MR/PET in children compared to adults.
2. To compare MR/PET to PET/CT.
3. To discuss the impact of whole body MRI and MR/PET.

Author Disclosure:

J. Schäfer: Grant Recipient; Deutsche Kinderkrebsstiftung. Research/Grant Support; Siemens Healthcare.

A-521 09:30

C. Imaging of complications of therapy

K. McHugh; *London/UK (kieran.mchugh@gosh.nhs.uk)*

Paediatric cancers, particularly when advanced, and the treatment of cancer in childhood can cause numerous complications many of which are apparent on radiological evaluation. Chemotherapy, which is used to treat most malignancies, may result in short- and long-term complications. Immediate complications of drug toxicity include immunosuppression with resultant infectious complications in the liver or lungs commonly, hepatic toxicity or hepatic veno-occlusive disease, numerous gastro-intestinal disorders, and renal insufficiency. Later sequelae include ischaemic necrosis of bone, lung fibrosis, myocardial damage, cardiovascular issues and delayed impairment to renal function. The cumulative toxicity from chemotherapy plus the long-term hazards of radiotherapy in young patients increase the risk of second malignancies, myeloid leukaemias in the first decade after oncologic treatments, followed by radiotherapy-induced cancers in the anatomical regions which received the therapeutic irradiation. It is estimated that up to half a million European citizens are survivors of paediatric cancer. 60% of them have at least one chronic health problem, many of which necessitate radiological assessment.

Learning Objectives:

1. To become familiar with short- and long-term complications of therapy.
2. To understand complications of surgery, radiotherapy and drug toxicity.
3. To emphasise the effects of immunosuppression in children undergoing chemotherapy.

08:30 - 10:00 **Room N**

Head and Neck

RC 1308

Pitfalls in interpretation of head and neck disease

Moderator:
J. Frühwald-Pallamar; Vienna/AT

A-522 08:30

A. Anatomical variants without clinical consequence

F.A. Pameijer; *Utrecht/NL (f.a.pameijer@umcutrecht.nl)*

Variant: "Something that is slightly different". Imaging methods can provide an extraordinary amount of useful data to specialists treating head and neck (cancer) patients. It is crucial that these data are used to full advantage of individual patients. The most important factor in this process is mutual cooperation between the physicians in charge of patient care and the diagnostic imaging specialist. Anatomical variants in the head and neck are frequently encountered and may result in interpretation problems for the radiologist: usually, anatomical variants are without clinical consequence. However, normal variants may simulate disease. If not recognised, normal variants may lead to unnecessary interventions. The presentation aims to familiarise general radiologists, who have an interest in head and neck imaging, with common anatomical variants encountered on head and neck CT and MR studies. Many examples from daily practice will be discussed.

Learning Objectives:

1. To gain insight into the great variability of head and neck anatomy.
2. To be able to recognise pseudolesions.

A-523 09:00

B. Anatomical variants posing surgical risks

D. Farina; *Brescia/IT (nappaje@yahoo.it)*

Several anatomic variants may pose a threat during surgery. A large part is found in the sinonasal region, basically due to the widespread use of endoscopy which, inherently, provides the operator with narrow accesses and limited exposure of submucosal anatomic structures. Onodi cell is probably the most feared anatomic threat, because if not correctly indicated by the radiologist and identified by the surgeon, it generates a high risk of disastrous intracranial penetration. Similarly, bone dehiscence of the lamina papyracea of the ethmoid increases the risk of iatrogenic damage, mainly of intrinsic ocular muscles. The inferior alveolar nerve is at high risk of surgical damage during molar teeth extraction, particularly when the curved apices of roots embrace the inferior wall of the nerve canal. In the neck the main threats are related to anomalous course of major vessels: not infrequently the common and/or internal carotid artery display a medialized course reaching the lateral aspect of the pharyngeal wall or even protruding in the retropharyngeal space towards the midline. Simultaneous medial deviation of the arteries on both sides is referred to as kissing (common or internal) carotids. The risk in these eveniences are mainly related to the possible effects of a deep biopsy performed by an unaware surgeon. At the cervicomediastinal junction, vascular rings may embrace the trachea or the oesophagus and, consequently, pose a threat during intubation or tracheostomy.

Learning Objectives:

1. To learn about structures at risk during functional endoscopic sinus surgery (FESS).
2. To become familiar with vascular variants in the head and neck.
3. To appreciate surgical anatomical landmarks in the head and neck.

A-524 09:30

C. Distinct head and neck disease or systemic disease?

B.F. Schuknecht; *Zurich/CH (bschuknecht@MRI-roentgen.ch)*

H&N manifestations of systemic diseases can be differentiated into pseudotumours and tumours, inflammatory and infectious lesions and miscellaneous disorders. H&N pseudotumours are tumefactive or diffuse lesions, composed of polymorphous inflammatory cells and/or myofibroblastic proliferation. The previously descriptive nomenclature has been categorised into two entities: inflammatory myofibroblastic tumour (IMFT) and IgG4-related disease (IgG4-RD). IMFT is rare fibrous pulmonary tumour. H&N IMFT accounts for 14-18% of extrapulmonary sites. DD include aggressive fibromatosis, nodular fasciitis and proliferative myositis. IgG4-RD has been recognised as systemic disease in 2003, the H&N being the second most common site. These lesions need to be distinguished from autoimmune conditions such as Sjögren`s disease, lupus erythematodes, rheumatoid arthritis and Cogan`s disease, from tumours such as neurofibromas, lymphoma. H&N manifestations of rare systemic infections include tuberculosis and HIV or fungal (mucormycosis). Localised amyloid deposition is usually not associated with myeloma and systemic amyloidosis, the paraglottic space, trachea and lymph nodes may be affected. Though considered rare the H&N is the location in 20% of reported cases. H&N manifestations of these conditions require MR assessment supplemented by DWI. In conjunction with clinical and laboratory findings certain imaging features and manifestation patterns may prompt inclusion of the aforementioned disease categories into the differential diagnosis, thus facilitating diagnosis and appropriate clinical management.

Learning Objectives:

1. To recognise head and neck manifestations of systemic disease.
2. To categorise lesions into different pathologic entities.

08:30 - 10:00 **Studio 2016**

Genitourinary

RC 1307

Lessons I learned from mistakes in kidney and adrenal imaging

A-525 08:30

Chairman's introduction

S. Dudea; *Cluj-Napoca/RO (sdudea1@gmail.com)*

The course will deal with misinterpretation in renal imaging. It will highlight pitfalls in renal imaging and ways to avoid them. Focus will be set on differentiating subtypes of renal cell carcinoma, fat-poor angiomyolipoma and complex renal cysts. The indications of PET/CT, its role in therapeutic response assessment and common pitfalls will also be presented. The role and pitfalls of percutaneous renal tumour radiofrequency ablation and how to

manage small lesions of the kidneys incidentally detected in abdominal imaging will conclude the course.
Session Objectives:
1. To understand RECIST criteria of kidney tumours in light of molecular medicine and functional imaging.
2. To learn about pitfalls and challenges in kidney and adrenal imaging.

A-526 08:35

A. Renal cancer
T. Bäuerle; *Erlangen/DE (tobias.baeuerle@uk-erlangen.de)*

For the clinical management of renal lesions, the radiologist is of major importance for the discrimination of malignant or benign differential diagnoses, and the differentiation of renal cell carcinoma (RCC) subtypes. The objectives of this lecture are to review the imaging properties of RCC subtypes (a) and to report two major differentials, namely (fat-poor) angiomyolipoma (b) and complex cysts (c). As correlated to the respective histology, current developments of morphologic and functional CT and MRI help to differentiate the most relevant RCC subtypes including clear cell, papillary and chromophobe RCC. For discrimination of RCC and fat-poor angiomyolipoma, multiparametric MRI techniques such as diffusion-weighted imaging, chemical shift imaging and the contrast enhancement ratio as well as quantitative CT are summarised. In the last part of the talk, focus is on the management of complex cysts, particularly elaborating on category IIF and III cysts according to the Bosniak classification. Overall, challenges and pitfalls will be reviewed for the management of potentially malignant renal lesions using multiparametric CT and MRI on the background of histologic disease characteristics.
Learning Objectives:
1. To differentiate the most relevant subtypes of renal cell carcinoma using morphologic and functional imaging techniques.
2. To learn about multiparametric CT and MRI methods for discriminate (fat-poor) angiomyolipoma and renal cell carcinoma.
3. To become familiar with the management of complex cysts.

A-527 08:58

B. PET/CT in nephrourology
P.A.T. Baltzer; *Vienna/AT (patbaltzer@gmail.com)*

The aim of this talk is to provide knowledge on the application of PET-CT in kidney and adrenal imaging. Where can PET information add to diagnosis, where not? What are the proper indications for PET-CT and where might CT be sufficient? What is the value of PET-CT in assessing therapeutic response to therapy? Further, common pitfalls of using PET-CT in the field of nephrourology will be discussed. After this talk, the auditorium should have increased its knowledge on the practical application of PET-CT in nephrourology.
Learning Objectives:
1. To become familiar with appropriate use of PET/CT method in pathological entities of nephrourology.
2. To learn about the basic and advanced imaging findings of PET/CT in nephrourology.
3. To become familiar with the common sources of mistakes in PET/CT in the area of nephrourology.

A-528 09:21

C. Common mistakes in tumour percutaneous radiofrequency ablation
J.-M. Correas, C. Delavaud, O. Hélénon; *Paris/FR (jean-michel.correas@aphp.fr)*

Mistakes at percutaneous radiofrequency ablation of renal and adrenal tumours can result from many reasons. The validation of the percutaneous treatment by a multidisciplinary committee is mandatory, in order to avoid poor management of cancer patients. The tumour should be evaluated for its precise size, volume and shape, and vascularity in order to avoid under or over treatment. The relationship to the collecting system and the bowel remains a key step as these structures are very sensitive to heat deposition. The ability to precisely insert the electrodes at the right position using US, and/or CT guidance and fusion techniques depends on the operator skills. Finally appropriate follow-up and good knowledge of post treatment appearance of the lesion are necessary to evaluate the treatment efficacy and propose an additional procedure in case of persisting or recurring tumours.
Learning Objectives:
1. To describe adrenal and renal ablation techniques to avoid mistakes.
2. To learn what to look for before and during ablation to avoid mistakes.
3. To learn what to look for after adrenal and renal ablation to detect mistakes.

Author Disclosure:
J. Correas: Speaker; StarMed.

09:44
Panel discussion: How to manage small lesions of the kidneys incidentally detected in abdominal imaging

08:30 - 10:00 **Room L8**

ESR Patient Advisory Group (ESR-PAG)

ESR-PAG 1

Patient-centred care in clinical radiology: do we really put our patients first?

A-529/A-530 08:30

Chairmen's introduction
N. Bedlington; *Vienna/AT (nicola.bedlington@eu-patient.eu)*

P. Cavanagh; *Taunton/UK (petecavanagh@gmail.com)*

At the ECR 2015, the 'driver diagram on patient-centred care' providing a framework for framework for delivering patient-centred care in radiology was launched. The aim of this session is to follow-up on the implementation of the driver diagram and to explore concrete examples of best practice of implementing patient-centred care in the radiology department and how these might be replicated. The session will culminate in an exchange of views based on the following key question: does your department perform well in patient-centred care? Is it really all about the patient?
Session Objectives:
1. To follow-up on the introduction of the 'driver diagram', a framework for delivering patient-centred care in radiology, presented during the ECR 2015.
2. To explore concrete examples of best practice of implementing patient-centred care in the radiology department and how these might be replicated.
3. To understand how the ESR is embedding patient-centred care in audit and standards.
Author Disclosure:
N. Bedlington: Board Member; Chair of the ESR Patient Advisory Group.

A-531 08:40

Implementing the 'driver diagram' on patient-centred care
P. Cavanagh; *Taunton/UK (petecavanagh@gmail.com)*

We all like to believe we put the patient at the centre of all we do but in radiology departments it is often the system that comes first and the patient second. The European Society of Radiology Patient Advisory Group, working in collaboration with the Audits & Standards committee has produced a patient-centred driver diagram to aid departments to promote a structured approach to putting the patient first. The key drivers are: 1) people are treated with dignity and respect, 2) communication with people who use the service is timely and accessible, 3) communication between healthcare professionals is timely and complete and shared with the patient and 4) the experience of people who use the radiology department is used to improve the service.
Learning Objectives:
1. To explore the implementation of the driver diagram for delivering patient-centred care in radiology.
2. To understand the need for balance between professional responsibility and patient autonomy.
3. To become familiar with methods and examples of good practice and on how to improve the patient-doctor relationship.

A-532 08:55

View of a patient representative from the neurological disease area
D. Walsh; *Dublin/IE (executivedirector@efna.net)*

This presentation will consider what active patient engagement looks like, beyond a conceptual understanding, from a neurology patient perspective. It will then explore the opportunities for patient engagement in implementing and subsequently assessing how the driver diagram can ensure the radiology department is really patient-centered based on this engagement. However, it will also explore the particular challenges faced and possible solutions in engaging with patients affected by neurological disorders which cause cognitive impairment, with a focus on communication.
Learning Objectives:
1. To learn how implementing the 'driver diagram' can help the radiology department to become really patient-centred but that they could use some help from the same patients to reach their objectives.
2. To learn that implementing the diver diagram in their department will be a step-by-step process that can be monitored by patients.

Author Disclosure:
D. Walsh: CEO; European Federation of Neurological Associations. Grant Recipient; EFNA receives grants from the pharmaceutical industry to advance our workplan. However, a consortia of industry are involved and no direct influence is permitted. Speaker; EFNA is occasionally invited to present a patient perspective at internal and external events organised by the pharmaceutical industry.

A-533 09:10

View of a patient with prostate cancer

E. Briers; *Hasselt/BE (erikbriers@telenet.be)*

A patient with prostate cancer is by definition a male person. As the median age of diagnosis is 69 years most of the men presenting with prostate cancer are senior citizens. This means that many of them have comorbidities in agreement with their age, which could interfere with some of the diagnostic procedures needed to ascertain the diagnosis. As a consequence, prostate cancer patients could be subdivided into some sub-populations. There is a group that has hardly any comorbidities, a group with some minor comorbidities and a group with major comorbidities that could decide on eventual treatment options. Further over these three subgroups there are the literacy groups, low, medium and high level where high level is academic and low level is 5th grade (11 years old). This gives a matrix of nine combinations that all require special attention as one aspect drives the risks and decisions the other drives the communication and it is up to the department to find the right processes to effectively communicate with each of these and with their loved ones. To become really patient-centred in application of the driver diagram, it is not enough to apply the diagram, it will be necessary to report on the experiences and to analyse them to improve the quality of personalised care and in it personalised communication. It will also require to set out objectives, targets to reach so that the department can measure the performance and learn where improvements are most needed.

Learning Objectives:
1. To understand that procedures as from the implementation of the 'driver diagram' should become a continuous process of quality improvement.
2. To understand that implementing the 'driver diagram' will sometimes require a change of attitude and personal perspective to bring the patient to the forefront instead of the radiology procedures.

A-534 09:25

Satisfaction assessment of patient users of an imaging department: an example from the south of France

D.-G. Carrié; *Toulouse/FR (dominiquecarrie@wanadoo.fr)*

Since 2008, an anonymous written satisfaction questionnaire is presented to each out-patient after having a CT or MR imaging at our institution. 1380 questionnaires have since been collected, the filling of these forms being left to the patient's discretion. In a Toulouse city medical imaging centre backed by a clinic of 170 beds, we examine approximately 16000 patients/year on our 2 scanners (16 slices GE) and 18000 on our two MRI (1.5 TGE), the out-patients accounting for 50% of activity for CT scanner and 80% for MRI. The modes of booking appointments, delay for obtaining one, appreciation of welcome by the administrative staff and paramedics, examination difficulty, modes of results retrieval, and other items have been assessed. Our patients obtain in 71% of cases the appointments at their convenience, 80% within less than a week for CT, 43% for MRI. Welcome has been evaluated very satisfactory or satisfactory for 84% of the cases, the examination qualified as "without problem" for 82% of CT, and 68% of MRI. Results of examinations are immediately retrieved by the patient in 55% of the cases. These forms are used to quantify a number of data, but above all, they allow our patients to express themselves and make us more aware of other deficiencies in our practices (lack of direct contact with radiologists, waiting too long for results, practical difficulties, etc). and to improve them.

Learning Objectives:
1. To present our experience of satisfaction assessment of patients of a medical imaging department, over a period of 8 years.
2. To show that this kind of regularly practised feedback evaluation allows us to identify possible failures, alert the medical and paramedical staff, and to try to remedy them in an appropriate way.
3. To show that the implementation of this kind of questionnaire is simple and allows us to refocus our practices around the expectations of our patients.

09:40
Panel discussion: Question to the audience: does your department perform well in patient-centred care? Is it really all about the patient?

08:30 - 10:00 **Room E1**

Special Focus Session

SF 13b
Cholangiocarcinoma: an update

A-535 08:30

Chairman's introduction

R. Manfredi; *Verona/IT (riccardo.manfredi@univr.it)*

Cholangiocarcinoma is a malignant tumour arising from the epithelium of the bile ducts. The relative incidence of cholangiocarcinoma among primary liver cancer reported in autopsy series ranges from 5 to 30%; it is, however, the most common primary malignancy of the biliary tree. Most of these tumours are adenocarcinomas. The Liver Cancer Study Group of Japan has proposed a new classification based on growth characteristics, with tumours being identified as mass-forming, periductal-infiltrating, and intraductal- growing types. This classification is considered to be the most reasonable because it describes the gross appearance, growing characteristics, biologic behaviour, and prognostic implication for patients and because it is helpful for radiologic interpretation. The imaging evaluation of patients with hilar cholangiocarcinoma has traditionally included computed tomography and sonography or a combination of the two techniques for diagnosis and preoperative assessment of resectability. In recent years, MR imaging in conjunction with MR cholangiopancreatography (MRCP) has proved to be helpful in diagnosing hilar cholangiocarcinoma and in determining resectability. Cholangiocarcinoma appears as a moderately irregular thickening of the bile duct wall (> 5 mm), with symmetrical upstream dilation of the intrahepatic bile ducts. Sometimes it may be difficult to differentiate the periductal-infiltrating type of cholangiocarcinoma, encompassing the bile duct confluence and the proximal segment of the common bile duct, from the intraductal-growing type, especially when the lesion is small.

Session Objectives:
1. To illustrate diagnostic imaging findings of cholangiocarcinoma helpful in the diagnosis and in the differential diagnosis of cholangiocarcinoma.
2. To illustrate diagnostic imaging findings helpful for treatment planning.
3. To understand indication and technique of interventional radiology for palliative treatment.

A-536 08:35

Classification of cholangiocellular carcinoma (CCC)

C. Cantwell; *Dublin/IE (cpmcantwell@gmail.com)*

Cholangiocarcinoma (CC) is the second most common primary hepatic malignancy. The prevalence and annual death rates from CC are increasing since the 1970s. CC develops from the bile ducts in an environment of chronic inflammation. Biliary intraepithelial neoplasia (BilIN) is commonly seen in the surgical specimen and is considered to be a precursor lesion. Most CCs are adenocarcinomas with abundant fibrous stroma. Interleukin 6 is a key cytokine involved in carcinogenesis. CC can be classified into intrahepatic and extrahepatic types. Intrahepatic CC can be classified into three types on the basis of gross morphological features: mass-forming (the most common), periductal infiltrating and intraductal growth. This categorisation correlates with prognosis. Extrahepatic CC includes tumours involving the confluence of the left and right intrahepatic ducts (All Bismuth classes). The anatomic margin for differentiating intra- and extrahepatic CC is the second-order bile ducts. Hilar CC such as Klatskin tumours are often miscategorised as intrahepatic CC. CC treatments include liver resection, extrahepatic bile duct resection, liver transplant, local therapy, radiation, systemic and targeted chemotherapy.

Learning Objectives:
1. To illustrate classification of cholangiocellular carcinoma.
2. To become familiar with available therapeutic options according to the type of cholangiocarcinoma.
3. To become familiar with prognostic implication according to the type of cholangiocarcinoma.

A-537 08:50

Imaging in mass-forming intrahepatic (IH) type

F. Caseiro-Alves; *Coimbra/PT (caseiroalves@gmail.com)*

Cholangiocarcinoma is a tumour that carries a dismal prognosis being frequently unresectable. Histologically it corresponds to an adenocarcinoma originating from the epithelium of the intra- or extra-hepatic bile ducts. Classification in these two sub-types is important since it has implications not only in diagnostic findings but also for patient management. From the pathological point of view intra-hepatic cholangiocarcinoma (IH-CCK) can mimic metastatic liver disease and immunohistochemical techniques may be necessary to establish the diagnosis. Imaging findings normally display a

dominant intra-hepatic mass often with satellite nodules. The tumour has an important fibrotic component, responsible for upstream segmental dilatation of biliary ducts, late enhancement pattern on dynamic imaging, and capsular retraction. Although macroscopic vascular invasion is frequent, the tumour is generally hypovascular, a distinctive feature from the more common HCC. However, recent studies do report mixed forms of HCC/CCK that seem to develop from a pluripotential cell line sharing imaging features of both primary liver tumours. Recent MR and CT developments like DWI or spectral imaging may be helpful for better location and characterisation with high-resolution imaging assisting in better treatment planning. Lymph node metastases along the porta hepatis are frequent as well as other signs of metastatic spread including to the lungs. Prognosis is related to tumour size, number of nodules and presence or absence of positive resection margins at surgery.

Learning Objectives:
1. To illustrate diagnostic imaging findings of mass forming cholangiocarcinoma.
2. To learn about diagnostic imaging findings useful for the differential diagnosis of cholangiocarcinoma.
3. To learn the surgical landmarks helpful in treatment planning.

A-538 09:05

Diagnostic assessment of periductal/infiltrating and intraductal-growing types: the view of the diagnostic radiologist

R. Kloeckner; *Mainz/DE (roman.kloeckner@googlemail.com)*

Cholangiocellular carcinomas (CCC) can be categorised according to its location (intrahepatic, perihilar, and distal-extrahepatic) or according to its growth pattern: mass-forming (MF), periductal-infiltrating (PI), or intraductal growing (IG). Although any growth type can occur in any location, perihilar carcinomas are mostly periductal-infiltrating. The intraductal growth type is rare and is often located distal/extrahepatic. As the only curative treatment for each subtype remains R0-resection, exact quantification of tumour extension is essential for treatment determination. Ultrasound is usually the first imaging modality performed. However, in most patients with PI or IG type cancers the only finding may be dilated bile ducts; contrast-enhanced CT also fails to precisely depict tumour extension. However, it is the modality of choice for assessment of lymph nodes and vessels as well as to rule out extrahepatic spread. The modality of choice to depict tumour extension and assess resectability is MRI. A typical imaging protocol consists of MR-cholangiopancreaticography, T1- and T2-weighted sequences (transversal/coronal), and diffusion-weighted imaging. After contrast administration, 3D-dynamic contrast-enhanced sequences are acquired, followed by conventional T1-weighted sequences (transversal/coronal). Typical imaging features of PI cancers include narrowed perihilar biliary ducts with significant thickening of the irregularly shaped bile duct wall. Typically, this leads to intrahepatic bile duct dilatation. Contrast enhancement is delayed with a peak after 2-5 minutes. Lymphadenopathy is common in perihilar cancers, mostly in the porta hepatis or portocaval. Typical presentation of the IG type includes a polypoid mass inside the bile duct with proximal duct dilatation secondary to occlusion of mucin production.

Learning Objectives:
1. To illustrate diagnostic imaging findings of periductal/infiltrating and intraductal-growing types of cholangiocarcinoma.
2. To learn about diagnostic imaging findings useful for the differential diagnosis of cholangiocarcinoma.
3. To learn the surgical landmarks helpful in treatment planning.

A-539 09:20

Diagnostic assessment of periductal/infiltrating and intraductal-growing types: the view of the interventional radiologist

S. Terraz; *Geneva/CH (sylvain.terraz@hcuge.ch)*

Cholangiocellular carcinoma (CCC) is the second most common primary liver cancer. In the past, direct cholangiography combined with angiography was used to assess tumour extension. More recently, the advent of multidetector computed tomography and magnetic resonance cholangiopancreatography has dramatically changed the imaging evaluation of patients with hilar CCC. In clinical practice, the diagnosis remains challenging and often requires invasive approaches. Endoscopic retrograde and percutaneous transhepatic cholangiography are the first-line procedures for the evaluation of indeterminate bile duct strictures. The role of cholangiography in the evaluation of hilar CCC is twofold: to assess tumour level and extension to identify potentially resectable patients and to help in planning palliative biliary drainage in non-resectable patients. Tissue acquisition via brush cytology and forceps biopsies allows the cytological and/or histological confirmation of the disease. Due to the low sensitivity of these techniques, repetitive examinations and/or alternative approaches are required. Cholangioscopy, endoscopic and intraductal ultrasound and confocal laser endomicroscopy are additional methods, which can be applied for the diagnosis of CCC. Preoperative staging should focus on biliary, vascular, hepatic, lymph node and extrahepatic extension. Unresectability criteria generally include liver metastasis, distant lymph node metastasis, bilateral arterial or portal invasion, unilateral vascular invasion and contralateral lobar atrophy and distant metastases. Parenchymal invasion is not considered an unresectability criterion because a right or left hepatectomy can be performed. Bismuth stage IV is also not always considered an unresectability criterion. In some cases, digital subtracted angiography should be performed to assess the intrahepatic arterial invasion.

Learning Objectives:
1. To illustrate diagnostic imaging findings of periductal/infiltrating and intraductal-growing types of cholangiocarcinoma.
2. To learn about diagnostic imaging findings useful for the differential diagnosis of cholangiocarcinoma.
3. To illustrate criteria useful for planning a radiological interventional procedure.

A-540 09:35

Therapeutic role of interventional radiology in unresectable patients

G. Carrafiello; *Varese/IT (gcarraf@gmail.com)*

Surgery is the only potentially curative option for intrahepatic cholangiocarcinoma ICC). The median survival of patients with unresectable disease is reported to be 6-12 months. Interventional radiology in the recent years has established itself in the treatment. The goals of interventional therapy are to control local tumour growth, relieve symptoms, improve and preserve quality of life. The treatment options available now are percutaneous tumour ablation and intraarterial therapies. These include transarterial chemoinfusion (TACI), yttrium 90- radioembolisation (RE) and conventional transarterial chemoembolisation (cTACE) or drug-eluting bead TACE (DEB-TACE). Unfortunately, the TACE procedure is not standardised yet, various chemotherapeutic drugs in various concentrations are used. The summarised median overall survival after treatment in the recent studies ranged from 10 to 15 months for cTACE and from 11.7 to 13.7 months for DEB TACE. ICC has recently accumulated a small body of studies regarding yttrium-90 RE as showed in a recent review of 11 studies. The overall median survival of patients with unresectable ICC was 15.5 months. A conclusion on which of the reported embolisation techniques provides the highest efficacy cannot unfortunately be reached based on the available data. Percutaneous image-guided ablation therapy has not been widely used for the treatment of ICC due to poor prognosis in the preliminary case series. Interstitial high-dose-rate brachytherapy (HDR-BT) and isolated hepatic perfusion of chemotherapies are the new frontiers. The data suggest that the specific role of the interventional radiology procedures should be investigated further in future large, randomised and prospective studies.

Learning Objectives:
1. To illustrate diagnostic imaging findings of periductal/infiltrating and intraductal-growing types of cholangiocarcinoma.
2. To learn about diagnostic imaging findings useful for the differential diagnosis of cholangiocarcinoma.
3. To illustrate criteria useful for planning a radiological interventional procedure.

09:50
Panel discussion: Can we improve diagnosis and treatment of cholangiocarcinoma?

08:30 - 10:00 **Room E2**

Special Focus Session

SF 13c
Non-alcoholic fatty liver disease (NAFLD)

A-541 08:30

Chairman's introduction: Defining the clinical problem

C. Bartolozzi; *Pisa/IT (carlo.bartolozzi@med.unipi.it)*

Non-alcoholic fatty liver disease (NAFLD) is the most common liver disease in the western world, with a prevalence of 20%. In a subgroup of patients, varying degree of fibrosis may develop, a condition named non-alcoholic steatohepatitis. Advanced liver fibrosis and cirrhosis may increase the risk of development of hepatocellular carcinoma (HCC). In fact, in the Mediterranean area up to 20% of HCCs occur in dysmetabolic patients, without any previous viral infection. Patients with advanced fibrosis or cirrhosis should, therefore, be recognised and included in surveillance programs. Several non-invasive imaging techniques are under investigation for the early identification and quantification of liver steatosis and fibrosis, to promptly identify patients in need for closer surveillance and adequate treatment management.

Session Objectives:
1. To learn about the clinical relevance of NAFLD and potential evolution towards NASH.
2. To become familiar with the role of imaging modalities in the detection and quantification of the different pathological elements.
3. To understand the incidence/risk of HCC development and its early detection.

A-542 08:35

Imaging in diagnosing and quantifying liver fat

V. Vilgrain, M. Ronot, A. Faccinato, B. Leporcq, B.E. Van Beers; *Clichy/FR (valerie.vilgrain@bjn.aphp.fr)*

Liver steatosis is a common disorder. Although there are several causes, the most common by far is the nonalcoholic fatty liver disease (NAFLD), which comprises a spectrum of clinical and histopathological changes including "simple" steatosis, steatosis with inflammation, steatohepatitis, cirrhosis, and hepatocellular carcinoma. The diagnosis of steatosis is easily obtained on imaging. Among imaging modalities, ultrasound and MR imaging are the most useful. The classical finding on ultrasound is the increased echogenicity compared to vessels and kidney. Ultrasound can also semi-quantitatively evaluate liver steatosis but precise quantification is not possible. MR is the modality of choice enabling both diagnosis and accurate quantification. The classical finding on MR imaging is the drop on opposed-phase T1-weighted sequence compared to in-phase. The reference technique for quantification is MR spectroscopy. Recent multiecho sequences allow now quantification of fat and iron and have been shown as accurate as MR spectroscopy. These methods quantify the proton density fat-fraction which reflects the concentration of triglycerides in tissue. Imaging could be also interesting in distinguishing simple steatosis from steatohepatitis, the latter containing inflammation and fibrosis. There is growing interest for this issue and multiple approaches are currently evaluated: elastographic techniques, diffusion-weighted MR, hepato-specific contrast MR agents, MR qualification of fat, etc.

Learning Objectives:
1. To understand the respective value of imaging modalities in diagnosing liver steatosis.
2. To become familiar with the most recent MR sequences for quantifying liver steatosis.
3. To learn the results and limitations of detecting NASH through imaging.

A-543 09:00

Imaging in diagnosing and staging liver fibrosis

L. Martí-Bonmatí; *Valencia/ES (marti_lui@gva.es)*

In this presentation, we will focus on the clinical importance and therapeutic implications of early detection of liver fibrosis, and the current status and future prospects for novel imaging tools for the qualitative and quantitative evaluation of liver fibrosis. Liver fibrosis represents the final common pathological outcome for most chronic liver diseases, with accumulation of collagen, proteoglycans and other macromolecules within the extracellular matrix. Diagnosis of liver fibrosis is made by liver biopsy. It is limited by sample size (1/50.000); possible morbidity (1%); interobserver variability (> 30%); and sampling errors (30-40%). As patients remain asymptomatic or have only mild, non-specific symptoms until the development of cirrhosis, non-invasive early detection of liver fibrosis and inflammation in patients with chronic viral hepatitis has a real clinical implication. Therefore, reproducible and reliable non-invasive methods are needed to evaluate disease progression, monitor treatment, and for epidemiological research. Different circulating and imaging biomarkers of live fibrosis will be discussed (from elastic imaging, perfusion imaging, diffusion imaging and relaxation times parametric imaging). Radiological structured reporting should approach the pathological grading of fibrosis and the confounding variables (steatosis, necrosis, inflammation, iron) for the whole liver in a quantitative manner to fulfill clinical trials.

Learning Objectives:
1. To understand the biological background, clinical importance and therapeutic implications of early detection of liver fibrosis.
2. To discuss the current status of quantitative imaging evaluation of liver fibrosis.
3. To summarise new and future prospects for novel imaging tools for the qualitative assessment of fibrosis.

Author Disclosure:
L. Martí-Bonmatí: Founder; QUIBIM SL.

A-544 09:25

Early detection of HCC

T. Denecke; *Berlin/DE (timm.denecke@charite.de)*

Early detection of hepatocellular carcinoma (HCC) is of great importance for patients, as early treatment may offer complete tumour eradication via local ablation, resection, or transplant. Multiple modalities are available for liver imaging in search of HCC in patients at risk. These include contrast enhanced ultrasound, multiphasic computed tomography (CT) and magnetic resonance imaging (MRI). In the latter two, adequate imaging protocols are crucial to catch the typical enhancement characteristics of HCC. Exact knowledge of these signs as well as additional features such as diffusion weighted imaging and liver specific contrast agents in MRI along with the limitations of diagnostic imaging is essential for abdominal radiologists, who play the key role in planning the optimal management of HCC patients.

Learning Objectives:
1. To learn about the potential and technical prerequisites of the available imaging techniques for early detection of HCC.
2. To become familiar with the appearance of HCC and its precursors in diagnostic imaging.
3. To get an overview of the current recommendations and guidelines for early detection of HCC.

Author Disclosure:
T. Denecke: Speaker; Bayer, Siemens, Toshiba, Novartis, IPSEN.

09:50
Panel discussion: How to manage the surveillance of the population at risk

08:30 - 10:00 **Room F1**

E³ - European Diploma Prep Sessions

E³ 1323
Cardiac and vascular

A-545 08:30

Chairman's introduction

R. Vliegenthart; *Groningen/NL (r.vliegenthart@umcg.nl)*

This European Diploma Prep session covers essential knowledge regarding radiological techniques in cardiovascular imaging, cardiovascular anatomy and highlights of cardiovascular pathology. Radiologists have an increasingly important role in the evaluation of cardiac and vascular diseases, due to the fact that CT/MRI can provide a diagnosis in a non-invasive, more detailed, more reproducible and/or more tissue-specific way than other modalities. In this session, a general basis is provided regarding the technique of cardiovascular imaging with CT and MRI, anatomical depiction in CT/MRI, and main disorders of the myocardium, pericardium, valves and aorta.

Session Objectives:
1. To understand the basic principles and techniques of cardiovascular imaging including CT and MRI of the heart and great vessels.
2. To become familiar with the imaging presentations of disorders of the endocardium, the pericardium and the cardiac valves.
3. To understand the MR imaging presentation of disorders of the myocardium.

A-546 08:33

A. Cardiovascular imaging: the basics

M. Gutberlet; *Leipzig/DE (matthias.gutberlet@helios-kliniken.de)*

Cross-sectional cardiovascular imaging has become more and more important in the last years. But due to the technical improvements especially with regard to spatial and temporal resolution already in standard thorax CT and MR examinations for non-cardiac indications the anatomy, normal variants and abnormalities of the heart and great vessels can be assessed. Therefore, a basic knowledge of these structures, variants and common pathologies is mandatory for a general radiologist. Furthermore, the basic technical aspects and requirements for a state of the art cardiovascular CT and MRI examinations will be discussed, especially with regard to radiation dose saving aspects.

Learning Objectives:
1. To understand the anatomy, normal variants and abnormalities of the heart and great vessels.
2. To describe the technical aspects and methodology of cardiac and vascular CT.
3. To describe the technical aspects and methodology of cardiac and vascular MRI.

A-547 09:02

B. Cardiovascular imaging: valves, endocardium and aorta

C. Loewe; *Vienna/AT (christian.loewe@meduniwien.ac.at)*

Within this presentation, anatomical areas are summarised in which common and potentially life-threatening disorders can occur and in which modern non-invasive means have gained more and more importance during the last years. Despite the outstanding role of echocardiography in the diagnosis and follow-up of valvular diseases in clinical routine, cardiac MR plays an important

and CT an increasing role in the management of patients suffering from valvular diseases. The most common valvular diseases including aortic regurgitation and stenosis will be introduced as well as possible congenital disorders. The role of imaging to establish the diagnosis and to plan the treatment will be discussed as well. After valvular repair CT evolved as the method of choice to assess possible infectious complications providing exact informations about local and systemic manifestations of endocarditis. The importance of early diagnosis of endocarditis will be clarified and the value of modern imaging will be underlined. In the third part of the representation an overview about anatomical variations of the aortic arch vessels as well as about the classification of acute and chronic aortic diseases will be provided, focusing on aortic dissection and aneurysm. Within this presentation, a short overview about the most important diseases of valves, endocardium and aorta will be provided while defining the most important questions to be answered by imaging. Based on this, current and possible future role of CT and MR in these fields will be explained and basic tips for optimised imaging will be contributed.

Learning Objectives:

1. To recognise the imaging presentation of the different forms of valvular disease.
2. To understand the causes and imaging presentations of endocarditis.
3. To describe the diagnostic evaluation and imaging presentation of common diseases of the great vessels, including aortic dissection and aneurysms.

Author Disclosure:

C. Loewe: Speaker; Speaker Honorarium from: Siemens, Bracco, Guerbet, GE Healthcare, Medtronic.

A-548 09:31

C. Cardiovascular imaging: myocardium and pericardium

J. Bogaert; *Leuven/BE (Jan.Bogaert@uz.kuleuven.ac.be)*

Myocardial and pericardial diseases include a heterogeneous group of diseases with a widely variable clinical presentation. Although echocardiography is the first in-line imaging modality to study this group of cardiovascular diseases, CT and MR imaging provide important information with regard to the diagnosis, differential diagnosis, treatment planning and prognosis. The aim of this presentation is to provide a scheme of imaging patterns on CT/MR imaging useful in the daily clinical routine. This scheme is based on morphologic, tissue characteristics, function and perfusion patterns.

Learning Objectives:

1. To describe the diagnostic evaluation and imaging presentation of ischaemic heart disease.
2. To understand the diagnostic evaluation and imaging presentation of myocarditis.
3. To become familiar with the causes and imaging presentations of pericardial effusion.

08:30 - 10:00 **Room F2**

Breast

RC 1302

Tailoring breast cancer screening to risk level

Moderator:
R. Pijnappel; Utrecht/NL

A-549 08:30

A. Calculating, using and improving individual risk estimates

S.W. Duffy; *London/UK (s.w.duffy@qmul.ac.uk)*

Breast cancer is one malignancy for which there is a considerable knowledge base of aetiology and risk factors. As a result, there are a number of risk prediction tools for breast cancer available. In this presentation, we review the development, validation and current status of these tools. We consider major gaps, in particular the identification of a substantial population at very low risk, and the issue of prediction of breast cancer by oestrogen receptor status. We discuss how mammographic density and genomic factors might contribute to filling the gaps.

Learning Objectives:

1. To know the different models for risk evaluation.
2. To understand the limitations of risk modelling for predicting the individual risk.
3. To appreciate the potential applications of risk modelling for tailoring breast cancer screening.

A-550 09:00

B. Intermediate risk: the grey zone

S.H. Heywang-Köbrunner;
Munich/DE (Sylvia.Heywang@referenzzentrum-muenchen.de)

Any type of breast cancer screening using a sensitive method is associated with chances (early detection, mortality reduction, less aggressive treatment), and potential side effects (fpos recalls, additional biopsies, overdiagnosis). Intensified screening helps save resources and adapt screening efforts and side effects to a level acceptable for the individual risk. The international definition varies and includes a lifetime risk between 15% and 20% (USA) to 30% including: familial risk, individual risk due to previous breast cancer or borderline lesions (B3, ADH, LCIS, ALH). Breast density is the most important further independent risk factor. While the risk factor ranges up to 5, the risk with ACR4 density is only doubled compared to normal tissue (ACR2-3). However, it is also associated with a lower sensitivity of mammography. Thus, risk-adapted screening may imply screening at shorter intervals and/or with additional methods. Promising concepts apply ultrasound or MRI as additional methods. Available data are presented. They show improved sensitivity with the addition of ultrasound or MRI, but more side effects. The most important deficit is the lack of data proving an effect on mortality reduction. To introduce risk-adapted screening schemes, further studies addressing these questions are needed.

Learning Objectives:

1. To become familiar with the concept of increased breast cancer risk.
2. To discuss the role of breast density in relation to cancer risk.
3. To evaluate the evidence in favour of intensive screening protocols in women at intermediate risk.

A-551 09:30

C. High risk: MRI alone?

F. Sardanelli; *San Donato Milanese/IT (f.sardanelli@grupposandonato.it)*

Evidence exists for breast MRI as the best modality for screening women at genetic-familiar high risk for breast cancer (BC). Data from 9 prospective studies (5,500 women, > 15,000 rounds, 392 BCs) show a 71-100% MRI sensitivity (6/9 studies > 85%) and a 63-98% specificity (6/8 studies ≥90%): 77% of BCs were invasive; 52% of invasive BCs were grade 3 and 77% were node negative; 45% of overall BCs were ≤10 mm in size. In recent studies, the adjunct of mammography and/or ultrasound to MRI did not significantly increase the overall diagnostic performance, posing the rational for using MRI alone, a choice reinforced by the higher sensitivity of BRCA mutation carriers to ionising radiation. Data on patients outcome were recently reported, showing a benefit of MRI including screening versus no screening under 50 and biennial mammographic screening over 50 in terms of disease-free survival adjusted for lead time bias (hazard ratio [HR] 0.40) and overall survival (HR 0.51). However, also MRI-including screening strategies should be evaluated versus risk reduction strategies, such as prophylactic mastectomy. A smart combination of the two approaches could be MRI screening up to the first BC diagnosis and bilateral mastectomy as a therapy for one breast and prophylaxis for the contralateral one, highly reducing the risk of repeated breast surgeries, especially in BRCA1 mutation carriers. Conversely, when screening women previously treated with thoracic radiation therapy, MRI sensitivity is only 63-80%. Thus, mammography should be added for detecting DCIS (microcalcifications) which are > 50% of BCs in these high-risk women.

Learning Objectives:

1. To appreciate the evidence in favour of MRI for screening high-risk women in terms of diagnostic performance and patient outcome.
2. To become aware of the value of MRI alone for screening women with high-risk genes.
3. To become aware of the need for using mammography as an adjunct to MRI when screening women who have had previous thoracic radiation therapy.

Author Disclosure:

F. Sardanelli: Consultant; Bracco Imaging. Grant Recipient; Bracco Imaging, Bayer Pharma.

08:30 - 10:00 **Room D1**

Special Focus Session

SF 13d

Severe trauma patients: myths, realities and future

A-552 08:30

Chairman's introduction

M. Stajgis; *Poznan/PL (stajgis@gmail.com)*

The rationale of the very first emergency procedures in severe trauma patients is based on time factor as one of the most important in saving life and satisfactory recovery of the patients. Therefore, fast and still evolving diagnostic imaging modalities play invaluable role in management of these patients. All 4 lectures in this session are dedicated to requirements for advanced and effective imaging in emergent different clinical scenarios, management priorities and practical approach. The use of emergent ultrasound, update in polytrauma CT imaging, often easily missed lesions in trauma victims and problems encountered in geriatric trauma population are the subjects to be thoroughly discussed.

Session Objectives:

1. To understand the impact of modern diagnostic imaging on management of trauma patients.
2. To become familiar with limitations in emergency imaging in different clinical settings.
3. To recognise the position of the radiologist in the polytrauma emergency team.

A-553 08:35

'When time is gold': whole-body CT in polytrauma patients

S. Wirth; *Munich/DE (swirth@med.uni-muenchen.de)*

Polytrauma remains a leading cause of death and disability worldwide, especially in the age group below 40 years. As time is particular related to outcome, diagnoses have to be provided clearly within the golden hour and also important interventions or surgical treatment should at least have been begun within this time span. Wide availability, fast and exact diagnosis as well as increased survival have established whole body CT as the key modality for initial diagnostic polytrauma service. However, the large amount of whole body CT images requires solutions to ensure efficient and timely interpretation as well as immediate distribution of the report and the images. Trained staff, optimised and standardised processes as well as fundamental knowledge of key injuries that require urgent treatment are indisputable prerequisites. Important, typical image findings of very high acute relevance are: active haemorrhage, non-stable fractures of the spine, sternum and pelvis, pneumothorax, heart, aortic and major vessel injuries, bronchial ruptures, laceration of lung, liver, spleen or kidneys, pancreatic injury with ductal involvement, diaphragmatic or intestinal rupture. The important case of mass-casualty incidents at least multiplies all these challenges. Due to its rare and sudden occurrence there is almost no clinical routine and only few guidelines, particularly concerning trauma room workflow and possibly more dedicated CT protocols with even more focussed time issues.

Learning Objectives:

1. To understand the impact of imaging findings on patient management.
2. To learn the accepted protocols in polytrauma CT imaging.
3. To become familiar with the most common typical and atypical imaging findings.

Author Disclosure:

S. Wirth: Board Member; Incoming President of the European Society of Emergency Radiology.

A-554 08:54

Where is the proper place for fast FAST (focused assessment with sonography for trauma)?

H. Alkadhi; *Zurich/CH (hatem.alkadhi@usz.ch)*

Focused assessment with sonography for trauma (commonly abbreviated as FAST) represents a rapid bedside ultrasound examination performed as an early imaging test for detecting blood around the heart and abdominal organs after trauma. This lecture will summarise current evidence about the role of FAST in patients with trauma, and will try to elucidate potential advantages and disadvantages of the modality for early trauma care.

Learning Objectives:

1. To understand the role of emergency ultrasound.
2. To become familiar with indications and protocol of FAST examination.
3. To learn about typical, alert findings.

A-555 09:13

Missed lesions in trauma patients: the Damocles' sword

R. Basilico; *Chieti/IT (rbasilic@unich.it)*

Missed injuries represent an important issue in trauma patients, for they may increase morbidity, mortality and costs. They are more commonly seen in patients with multiple injuries: in fact, one of the main reason of a high rate of missed lesions in severe trauma patients is the presence of co-existing injuries that were more serious or life threatening. Missed lesions in diagnostic imaging of trauma patients can be divided into three groups: minor injuries (hand, wrist, foot, ankle, forearm, uncomplex soft tissue injuries and fractures, rupture of ligaments and muscle tendons); major injuries (skull injuries, neurological and arterial lesions, liver, spleen, kidneys,urinary tract, pancreas and intestinal lacerations, femoral, humeral, pelvic and spine fractures and dislocations); life-threatening injuries (injuries of main vessels in thorax, hemothorax and pneumothorax). Moreover, it is very important to differentiate between missed lesions of no clinical relevance (no need for specific treatment) and of clinical relevance. A systematic radiological as well as interdisciplinary re-evaluation of diagnostic results is recommended to increase awareness of common and subtle findings to avoid delayed diagnosis.

Learning Objectives:

1. To become familiar with limitations in emergency imaging.
2. To learn about the most common fatal missed injuries in polytrauma patients.
3. To understand the methods for avoiding misdiagnosis in polytrauma imaging.

A-556 09:32

Geriatric trauma: what is different?

E. Dick; *London/UK (elizabeth.dick@imperial.nhs.uk)*

Our population is living longer, bringing new challenges in imaging. Both the behaviour and the physiology of older people result in a different injury pattern to that seen in young adults when trauma happens. During this session, we will 1. Consider the normal physiology of ageing. 2. Address common pathological problems in ageing such as osteopaenia - discuss how they affect severity of traumatic injuries. 3. Describe how trauma protocols should be changed when imaging an older patient.

Learning Objectives:

1. To become familiar with limitations in emergency imaging.
2. To learn about the most common fatal missed injuries in polytrauma patients.
3. To understand the methods for avoiding misdiagnosis in polytrauma imaging.

Author Disclosure:

E. Dick: Board Member; British Society of Emergency Radiology, European Society of Emergency Radiology.

09:51

Panel discussion: How is the role of the radiologist changing in the management of trauma patients?

08:30 - 10:00 **Room D2**

Radiographers

RC 1314

Enhancing research in radiography: a change of culture

A-557/A-558 08:30

Chairmen's introduction

C. Vandulek; *Kaposvár/HU (cvandulek@gmail.com)*

I.M. Björkman-Burtscher; *Lund/SE (isabella.bjorkman-burtscher@med.lu.se)*

Radiographers are responsible for performing imaging procedures in the range of all imaging modalities. Recently, the importance of research in the radiography profession has grown justified by the importance of evidence-based practice within the profession. This session will provide an overview of recent initiatives and developments in the scope of radiographer research at a European level. It will explain the context of radiographer research and examine ways of translating the results of research into best practice.

Session Objectives:
1. To offer recent updates on radiography research initiatives on a European level.
2. To discuss the use of a formal mentoring scheme in improving radiography research capacity.
3. To propose methods for improving evidence-based practice in radiography.

A-559 08:35

A. Radiography research updates: new collaborations and initiatives in Europe

J. McNulty; *Dublin/IE (jonathan.mcnulty@ucd.ie)*

Evidence-based practice (EBP) is a driving force underpinning modern healthcare which will lead to enhanced patient safety, improved patient outcomes, and efficiencies in service delivery. It is equally important that educational institutions work towards implementing EBP and research-informed teaching and learning throughout undergraduate and postgraduate curricula and that such content and related activities are vertically integrated through the curriculum so that graduates are better equipped to source, evaluate and practically implement (where appropriate) the latest research. The contribution of radiographers, academic and clinical, to this evidence through undertaking quality research, on any scale, and subsequent dissemination is essential and will also serve to raise the profile and standing of the radiography beyond our profession. Collaboration forms a key part of gaining wider recognition for our research. Such collaboration can start with local, small-scale, interprofessional studies before building progressively to large-scale international funded projects. Many examples exist of how progress can be made in this way. The European Federation of Radiographer Societies aims to continue and grow its support of radiographer-led research at the European level through fostering relationships between individuals and institutions independent of national borders. The development of a unified culture of research and EBP over the next decade would represent a significant milestone for our profession.

Learning Objectives:
1. To appreciate the importance and necessity of evidence-based practice.
2. To outline the potential for research collaborations between radiographers both nationally and at European level to broaden the evidence base and enhance the reputation of the profession.
3. To identify practical measures for developing new collaborations and initiatives, using current examples from Europe and beyond.

A-560 08:58

B. FoRRM: a Formal Radiography Research Mentorship scheme as an instrument for change

C. Malamateniou; *London/UK (christina.malamateniou@kcl.ac.uk)*

Radiography is a young, emerging profession, which admittedly lags behind other health care professions in the research arena. Evidence-based practice is not only the way forward for improving practice and keeping up-to-date with recent technological developments but also a necessary tool to make imaging examinations safer and more efficient. Mentoring in research can help build the necessary research capacity for radiographers and create the critical mass of research active radiographers that holds promise for increasing research outputs, research grant income and achieve a change of culture towards research in clinical practice. There are currently many informal mentoring schemes in radiography, including peer mentoring for undergraduate, but also different mentoring schemes for healthcare professionals, where radiographers may participate. This talk will describe the design of a formal radiography research mentoring scheme in the UK, customised to the needs of novice research radiographers, and suggested implementation using an action research methodology. Low-risk ethics and informed written consent were obtained prior to data collection. A focus group, individual semi-structured interviews and surveys were used to inform the final design. This scheme will be launched in the UK as a pilot study between 10 mentor-mentee partnerships. The aims and objectives, mentor and mentee selection and pairing criteria, format of communication between key-stakeholders, co-ordination, mentoring training, networking and feedback and evaluation schemes will also be discussed. The expected impact on career development, personal satisfaction and research awareness will be analysed.

Learning Objectives:
1. To understand the importance of research in developing the radiography profession.
2. To become familiar with research mentorship schemes as a method of disseminating knowledge, enhancing research capacity and quality and informing evidence based practice.
3. To discuss the practicalities, challenges and opportunities emerging from a dedicated national formal radiography research mentorship scheme in the UK and its feasibility and potential in a European perspective.

A-561 09:21

C. Translating research evidence into clinical practice

G. Paulo; *Coimbra/PT (graciano@estescoimbra.pt)*

Translating research evidence into clinical practice is essential to assure the development of the quality of the healthcare delivered to the patients. Despite the substantial human and financial resources allocated to the development of science and the field of knowledge of healthcare professions, with many peer-review publications, evidence-based practice guidelines and white papers, with proven benefit for patient-oriented outcomes, there are persistent challenges and also barriers in assimilating new research evidence into clinical practice. It is known that the translation of new knowledge into practice occurs through 3 stages: a) awareness; b) acceptance; c) adoption. The major challenge for the next decade is to build solid bridges between clinical and academic environments, with the objective to develop the radiographers' field of knowledge through evidenced-based research, as a process to guarantee that the 3 mentioned stages are fulfilled. The research in radiography is essential for the radiographer professional role development and advance practice, as a tool to increase professional satisfaction. The commitment and involvement of senior and chief radiographers, in the process of translating research evidence into clinical practice, is the key for success of awareness, acceptance and adoption, contributing to the development of best practice. The EFRS Radiography Research Network (www.efrs-rrn.eu) is a powerful tool to promote and share the research that is being developed by radiographers, to exchange experiences, to discuss new professional practices, with the objective to meet the patients' needs and expectations.

Learning Objectives:
1. To learn about the barriers and enablers to translating research evidence into clinical practice.
2. To provide guidance on how radiographers can lead change and ensure best practices are in place.
3. To be aware of useful tools for collaboration and dissemination of research evidence (e.g. EFRS Radiography Research Network).

09:44

Panel discussion: Research: the key to advancing the profession of radiography?

08:30 - 10:00 **Room K**

E³ - Rising Stars Programme

Basic Session 4: Musculoskeletal: trauma

A-562 08:30

Shoulder

M. Zanetti; *Zurich/CH (marco.zanetti@hirslanden.ch)*

Standard radiographs, ultrasound, CT and MR imaging are essential in the evaluation of shoulder pain. Standard radiographs (ap, axial, and Neer view) are necessary for the evaluation of acute shoulder trauma, calcific tendinitis, arthritis, and in patients with shoulder impingement. Ultrasound is useful in the evaluation of the rotator cuff and calcific deposits. Ultrasound has limitations in the evaluation of fatty degeneration of the rotator cuff muscles. CT is useful for evaluation of fractures, bony defects (bone loss) associated with chronic shoulder instability after initial trauma. CT provides better detail of cortical and trabecular bone structures than MR imaging at cost of higher radiation exposure. CT arthrography is used in chronic shoulder instability to assess cartilage, labrum, and bone loss for shoulder instability surgery (e.g. Latarjet, prosthesis). MR imaging is the procedure of choice for evaluation of soft tissue injury such as rotator cuff tear. MRI can also detect occult fractures. However, MRI is often not the initial imaging modality for evaluation of acute shoulder trauma. MR arthrography is recommended to assess cartilage, labrum defects, partial thickness tears, and ligament lesions (e.g. pulley lesions).

A-563 09:00

Knee

K. Verstraete; *Ghent/BE (koenraad.verstraete@ugent.be)*

Imaging knee trauma is one of the most frequently performed radiological investigations. For fractures, plain radiography is the best initial imaging study. CT with 2D and 3D reformatting is useful in complex fractures and to detect small avulsion and osteochondral fractures. Ultrasound is a fast and cheap imaging method for detection of intra-articular fluid, collateral ligament lesions, and muscle and tendon injuries. MR imaging is the imaging method of choice for meniscal, cartilage, tendon, cruciate and collateral ligament injury, but is also very sensitive to detect stress fractures and bone bruise. This lecture will review the different types of knee injury and show the best imaging techniques for detection and evaluation of these lesions. Common pitfalls will be shown.

A-564 09:30

Ankle

J. Kramer; *Linz/AT (kramer@ctmri.at)*

The ankle joint is a hinge joint, whose function is central to locomotion and responsible for weight bearing of the whole body. It is composed of several bones and ligaments, which can be injured independently or in varying combinations. Tibia, fibula and talus are held together by three main sets of ligaments (the medial collateral ligament or deltoid ligament, the lateral collateral ligaments and the ligaments comprising the syndesmosis or fibrous joint between the distal tibia and fibula). Hind-, mid-, and forefoot are mostly involved in overloading or stress syndromes. The knowledge of the complex nature of the mechanisms of injury together with the patients history and recognition of the importance of the ligaments has to be taken into account for making an accurate diagnosis. Normally plain films are still or should be still the first step in the imaging evaluation of the ankle-foot joints. Degenerative changes as well as bony injuries can so be confirmed or ruled out easily with low costs only. Also for the detection or/and especially in a preoperative situation, x-rays are mandatory in the evaluation of foot deformities (e.g. flat foot, Haglund's heel, coalitions, etc). and tumours. High-resolution CT with the capability of two- or three-dimensional reconstructions are recommended in the preoperative setting especially when multiple bony fragments are suspected. MR imaging is the examination of choice for the assessment of soft tissue injuries and lesions in the osteochondral area.

08:30 - 10:00 **Room G**

Neuro

RC 1311

Reporting the degenerative lumbar spine

Moderator:
D. Zlatareva; Plovdiv/BG

A-565 08:30

A. Disc nomenclature: how I make my report

J. Rankine; *Leeds/UK*

"no abstract submitted"
Learning Objectives:
1. To become familiar with the different nomenclatures in degenerative disc disease and their anatomic substrates.
2. To learn how to differentiate between the different types of disc disease.
3. To appreciate how the different types of degenerative disc diseases determine the therapeutic approach.

A-566 09:00

B. Don't forget the facet joints and posterior elements

L. van den Hauwe, J.W. Van Goethem, M. Faure, T. Van Den Wyngaert, J. Huyskens, F. De Belder, C. Venstermans, P.M. Parizel; *Antwerp/BE (lucvdhauwe@mac.com)*

Many radiologists reading imaging studies of the spine performed in patients with low back pain (LBP), neck pain, and radicular symptoms tend to focus on the anterior part of the spine, and more specifically on the intervertebral disc. They are often unaware that the posterior elements (facet joints, pedicles, spinal ligaments, spinous processes, etc). may also be a source of pain. Moreover, radiologists are faced with the low specificity of the morphological abnormalities found on plain film radiography, computed tomography (CT), and magnetic resonance (MR) imaging which are also a frequent finding in the general - often asymptomatic - population. Conversely, the source of LBP (and neck pain) may remain unrecognised unless more dedicated MR imaging sequences such as fat-suppressed (FS) T2-weighted images (e.g. short-tau inversion recovery (STIR)) and FS contrast-enhanced (CE) T1-weighted images are added to the standard spinal MR imaging protocol. These FS-sequences are more sensitive in demonstrating bone marrow oedema, soft tissue inflammation, and hypervascularity that are often associated with degenerative changes of the posterior elements, e.g. facet joint osteoarthritis, synovitis, neural arch intervertebral or spinous process neoarthrosis, etc. Also nuclear medicine techniques such as single-photon emission computed tomography (SPECT), SPECT/CT, etc. are additional imaging techniques that may correctly identify the source of the pain.
Learning Objectives:
1. To become familiar with the anatomy of the facet joints and the posterior elements.
2. To understand the pathophysiological principle underlying the degenerative changes of these structures.
3. To appreciate the effect of these changes on the therapeutic approach.

A-567 09:30

C. What to say and not to say in your report

M.M. Thurnher; *Vienna/AT (majda.thurnher@meduniwien.ac.at)*

Variability in radiologists' reporting styles and recommendations for spinal studies can lead to confusion among clinicians and may contribute to inconsistent patient care. Reporting spine studies requires a systematic approach. The report on MRI of the spine should have following elements: perispinal tissue, bones, disks, spinal canal, facet joints, spinal cord and cauda equina. Adequate techniques and sequences are mandatory for optimal evaluation of spinal structures. In this lecture, the recommendations to improve documentation and reporting of spine MRI will be discussed.
Learning Objectives:
1. To understand the legal value of a report.
2. To demonstrate how detailed a report should be.
3. To understand the importance of a clinical information and the relevance of assessing previous examinations.

10:30 - 12:00 **Room A**

E³ - ECR Academies: Interactive Teaching Sessions

E³ 1421

Skull base lesions

A-568 10:30

A. Imaging of the cavernous sinus and the anterior skull base

D. Farina; *Brescia/IT (nappaje@yahoo.it)*

The anterior skull base and cavernous sinus may be affected by a list of diverse disease entities, reflecting their "gateway" position between neuro and splanchnocranium as well as the variety of tissues around them. Both have a complex anatomy: the anterior skull base because of its irregular shape and thickness in the different segments; the cavernous of sinus because of the many neurovascular tissues that travel through it. Knowledge of the anatomy is, therefore, pivotal to correct interpretation of imaging findings. The continuity of the anterior skull base may be interrupted by either congenital (generally midline) or traumatic lesions which require careful scrutiny, particularly to avoid useless and dangerous biopsies. Both the subsites can be involved by inflammatory/infectious or neoplastic diseases arising below, above or from the skull base.
Learning Objectives:
1. To understand the anatomy.
2. To understand the most common lesions and their differential diagnosis.

A-569 11:15

B. Imaging of the central skull base

D.-A. Varoquaux; *Marseille/FR (arthur@varoquaux.com)*

Central skull base has a complex anatomy and can be involved in various pathologies. Both MRI and CT provide complementary information for non-invasive lesion assessment. The radiologist needs to know normal anatomy and the pathologic spectrum of this region to determine the nature and extent of pathologic conditions which will help to plan the therapeutic approach. The field of skull base surgery and radiotherapy still progresses, with many controversies regarding what procedures are reasonable and appropriate. The central skull base is an anatomically complex region where sphenoid bone is the cornerstone. The basiocciput, articulating with the posterior inferior aspect of the sphenoid bone, also plays an important contribution to the central skull base. Central skull base surrounded by soft tissues such as the cavernous sinuses and nasopharynx. The central skull base may be affected by pathologies intrinsic to the sphenoid bone or by processes that arise in adjacent soft tissue and extend centrally to affect the central skull base. We will discuss a variety of pathologies such as neoplasms, infections, trauma, congenital malformations, and a variety of miscellaneous pathologies.
Learning Objectives:
1. To understand the anatomy.
2. To understand the most common lesions and their differential diagnosis.

10:30 - 12:00 **Room B**

ESR meets Japan

EM 2

State-of-the-art radiology

Welcome by the ESR President:
L. Donoso; Barcelona/ES
Presiding:
K. Riklund; Umeå/SE
H. Honda; Fukuoka/JP

A-570 10:30

Introduction: Radiology today in Japan

H. Honda; *Fukuoka/JP (honda@radiol.med.kyushu-u.ac.jp)*

The Japan Radiological Society (JRS) was first established in 1923 as Japan Roentgen Society and in 1940 changed the name as Japan Radiological Society. Currently JRS is a large society with nine thousand members and provides the scientific experience to members by two Society Congresses every year in spring and autumn. Japan boasts a dense distribution of imaging units that provide good accessibility to advanced imaging technologies with relatively short waiting lists for CT, MRI and PET examination. Although the radiologists' workload is high, Japanese radiologists' investigate strenuously. JRS members are submitting 300-400 abstracts to ECR every year and the acceptance rate is more than 70%. Radiologists are playing important roles in every clinical process, the detection and diagnosis of the disease, staging and treatment decision and follow-up of patients.

Session Objectives:

1. To learn about the organisation of radiology in Japan.
2. To review the up-to-date radiology in neuro, chest, and abdomen.
3. To learn about Japanese radiology and culture through photographs.
4. To express appreciation to the ESR for inviting Japan to meet the ESR.

A-571 10:35

State-of-the-art of neuroimaging

S. Aoki; *Tokyo/JP*

Recent advances of neuroimaging include non-Gaussian diffusion analysis, arterial spin labeling, 4D MRA/CTA, perfusion, SWI and phase images, etc. In this session, I will present these techniques, mainly about advanced diffusion MR metrics. Conventional diffusion-weighted image (DWI) is extremely useful to detect a hyperacute infarction, but also useful in other diseases such as an abscess, an epidermoid, CJD, encephalitis/encephalopathy, PML, HDLS. Causes of high signal on DWI are not only cytotoxic oedema but also other pathologies such as hypercellularity and high viscosity. Recently, neurite beading has been highlighted for microstructural changes of the white matter in acute stroke using advanced diffusion MR metrics. Diffusion tensor imaging (DTI) uniquely presents direction and integrity of water diffusion within the imaging voxel. One tensor per one voxel model of DTI was very successful, such as diffusion tensor tractography, but DTI has some limitations. Non-Gaussian diffusion analyses, such as diffusional kurtosis imaging (DKI) and neurite orientation dispersion and density imaging (NODDI), are newly developed techniques to analyse microstructural changes more precisely. Advanced diffusion MR may play an important role in elucidating brain networks and microstructures in neuroscience.

Learning Objectives:

1. To have an overview of recent techniques of neuroimaging.
2. To learn about differential diagnoses of DWI abnormalities.
3. To learn fundamentals of advanced diffusion analysis beyond DTI.

A-572 10:55

Interlude: Radiologists' intermission: refreshing photo-stream on our beautiful country (I)

Y. Miki; *Osaka/JP (Yukio.miki@med.osaka-cu.ac.jp)*

Radiologists in Japan, as well as in other countries, are now struggling with pile of daily images to go through, which took place due to fast imaging technology in this century. To overcome this stressful situation, some radiologists play sports and others may enjoy music. Some radiologists treat themselves by "photo-therapy". No, we are not suffering from jaundice! "Photo-therapy" is a simple activity, in which we bring our camera and go for taking beautiful scenery or vivid people. Concentrating on taking photographs takes us away from stressful days, and in addition, brings us a sense of accomplishment. We radiologists love images, no matter if they are medical images or not. Facing the images by visible rays of light is a fantastic business for us as well as that by x-ray or radio frequency wave. The presenters in this photo session are a team of two radiologists. Yukio Miki's photos (I) mainly focus on Kyoto and Hokkaido, and Toshiaki Taoka's photos (II) are mostly wondering in Nara. We would be very happy if we can share the scenery of our beautiful country with our audience, and our goal in this presentation is to make some of our audience feel like treating themselves by "photo-therapy" or feel like visiting Japan.

A-573 11:00

Advanced liver imaging: improving treatment decisions

T. Murakami; *Osaka/JP*

Dynamic MDCT and MRI with high temporal and spatial resolution are essential for diagnosis of liver disease, because these can improve the detection, characterisation and staging of liver tumour. They also enable us to perform 4D imaging and liver functional imaging. MIP/VR images reconstructed from each phase data of shuttle helical CT imaging, which can rapidly move back-and-forth continuously, can reveal not only morphologic 3D information of vessel but also flow direction as 4D-CT angiography. Perfusion CT study with cine scanning of the liver can reveal haemodynamics of hepatic organ quantitatively and may reveal regional liver function. T1 mapping imaging of Gd-EOB-DTPA-enhanced MRI also may reveal regional liver function. Dual-energy CT (DECT) imaging has the ability to make not only material density images but also monochromatic images. Optimal KeV monochromatic CT image can improve tumour to liver contrast of hypervascular HCC at arterial phase CT image. DECT with multiple material decomposition (MMD) technique can measure percentage of contained material quantitatively. Now, MMD technique can estimate amount of fat deposition quantitatively. Multimodality fusion imaging using the complementary imaging examinations, such as US, MDCT and MRI, are very useful for detection and treatment of liver tumour. At the time of RFA and TACE, US or angiographic imaging is sometimes inadequate to detect HCC. In such a case, multimodality fusion imaging, such as fusion images of US and Gd-EOB-DTPA-enhanced MRI or MDCT, is very useful for adequate treatment and precise evaluation of treatment effect.

Learning Objectives:

1. To learn about the advanced liver imaging techniques.
2. To understand how to use multimodality fusion imaging of US, CT and MRI for treatment of liver tumour.
3. To become familiar with advanced liver imaging of US, CT and MRI.

A-574 11:20

Interlude: Radiologists' intermission: refreshing photo-stream on our beautiful country (II)

T. Taoka; *Nagoya/JP (ttaoka@naramed-u.ac.jp)*

Radiologists in Japan, as well as in other countries, are now struggling with pile of daily images to go through, which took place due to fast imaging technology in this century. To overcome this stressful situation, some radiologists play sports and others may enjoy music. Some radiologists treat themselves by "photo-therapy". No, we are not suffering from jaundice! "Photo-therapy" is a simple activity, in which we bring our camera and go for taking beautiful scenery or vivid people. Concentrating on taking photographs takes us away from stressful days, and in addition, brings us a sense of accomplishment. We radiologists love images, no matter if they are medical images or not. Facing the images by visible rays of light is a fantastic business for us as well as that by x-ray or radio frequency wave. The presenters in this photo session are a team of two radiologists. Yukio Miki's photos (I) mainly focus on Kyoto and Hokkaido, and Toshiaki Taoka's photos (II) are mostly wondering in Nara. We would be very happy if we can share the scenery of our beautiful country with our audience, and our goal in this presentation is to make some of our audience feel like treating themselves by "photo-therapy" or feel like visiting Japan.

A-575 11:25

Diagnostic imaging of thymic tumours

N. Tomiyama; *Osaka/JP (tomiyama@radiol.med.osaka-u.ac.jp)*

Representative anterior mediastinal tumours are thymic tumours which include thymoma (non-invasive and invasive), thymic carcinoma, thymic neuroendocrine tumours, thymic lymphoma and thymic cyst. Thymoma is the most common tumour of the thymus, and is divided into 5 histological subtypes (Type A, AB, B1, B2, and B3) base on WHO classification. Clinical staging of thymoma (Masaoka stage) and WHO classification correlates with prognosis very well. Thymic carcinoma is completely different from thymoma histologically, and is more aggressive than thymoma. Thymic neuroendocrine tumours are divided into well-differentiated neuroendocrine carcinomas (carcinoid tumour) and poorly differentiated neuroendocrine carcinomas which consist of large cell neuroendocrine carcinoma and small cell carcinoma. Many studies have described the CT and MRI findings of thymic tumours. CT is equal or superior to MRI in the diagnosis of thymic tumours except for thymic cyst. CT is usually sufficient to differentiate thymic tumours; however, in certain circumstances, such as thymic cyst with haemorrhage or inflammation which mimic solid tumour despite low enhancement, MRI may be better in

distinguishing anterior mediastinal tumours. There are some studies to predict the degree of malignancy of thymic tumours using PET. The ^{18}F-FDG PET findings suggest that PET reflected the grade of malignancy in thymic tumours and may be helpful in differential diagnosis according to the WHO classification.

Learning Objectives:
1. To become familiar with major types of thymic tumours and WHO histological classification of thymoma.
2. To learn about imaging findings of thymic tumours including CT, MRI, and PET.
3. To understand how to use CT, MRI, and PET in the diagnosis of thymic tumours.

11:45
Panel discussion: Always be a pioneer: state-of-the-art technologies from Japan

10:30 - 12:00 **Room N**

Computer Applications

RC 1405
Will the good old PACS disappear?

A-579 10:30
Chairman's introduction
D. Regge; *Turin/IT (daniele.regge@ircc.it)*

Picture Archiving Communication Systems (PACS) have originally been conceived as local archives of medical images originating from different modalities. The universal format for image storage and transfer is DICOM. This course will approach the changing world of PACS pragmatically, by providing helpful information and tips on when and how to implement a new PACS system and how to perform data migration safely even in complex environmental conditions. Off-site data storage is now a viable and cost-saving solution. The course will also include an overview of different cloud healthcare solutions and on how to improve interconnectivity by the implementation of vendor-neutral archiving systems.

Session Objectives:
1. To explain when and how to replace PACS.
2. To provide insight on how to improve interconnectivity and information sharing in medicine.
3. To envisage the role of off-site archiving solutions in radiology.

Author Disclosure:
D. Regge: Speaker; GE Medical Systems. Other; Springer.

A-580 10:35
A. It's time for PACS replacement: how-to guide, recommendations and pitfalls
S. Morozov; *Moscow/RU (smorozov@emcmos.ru)*

PACS has made a great progress from a pure storage and a radiologist's tool to a platform for interdisciplinary collaboration and big data analysis. It has allowed transition from analog to digital workflow and further in the direction of decentralized enterprise clinical imaging. Major drivers for PACS development are expansion of imaging into clinical areas, EHR integration, and radiological practices consolidation on regional and international levels. The major trends of PACS development are the following: cross-functionality, cross-integration, patient-centric solutions, analytic tools development. Any PACS with a lack of standardization, workflow optimisation and comprehensive viewing tools limits interoperability and efficiency of a radiology practice. The required features are the following: reading, reporting, feedback, collaboration, second opinion, report interpretation, clinical integration, report dispersal to patients, tracking of outcomes. New PACS enables reading, reporting, communication, feedback, collaboration, second opinion, report interpretation, clinical integration, tumour board applications, reports dispersal to patients, and tracking of outcomes. It should be affordable, faster, integrated with voice recognition, EMR and prior studies. The typical lifetime of a PACS is 7-10 years. New PACS selection process considers in-house or cloud-based solutions, VNA, modular approach, division of storage/diagnostics functionality. Capital costs for a new PACS purchase should be justified in terms of productivity increase and return of investment. New PACS adoption includes resource, workflow and cut-over planning, risk assessment, test version installation, integration, implementation, data migration, and changeover. Major pre-requisites for a successful PACS installation are planning, documentation, standardization, wide team involvement, iterative testing, over-communication, feedback analysis, and correction.

Learning Objectives:
1. To explain why and when PACS should be replaced.
2. To provide recommendations for PACS replacement and risk assessment analysis including image migration issues.
3. To give a practical example of how PACS is replaced in a large health facility or region.

A-581 10:58
B. Enterprise-based vendor-neutral archiving: is this the future of PACS?
J. Fernandez-Bayó; *Sabadell/ES (jFernandezB@cspt.es)*

VNA stands for vendor neutral archiving; it is a system that stores medical images in standard format with a standard interface. Two main factors led to the development of VNA. First, the need to separate PACS services (image management) from physical storage (standard file systems hardware). Classical PACS solutions combined image management and image storage in a single product, and they usually used nonstandard tricks to improve overall performance. However, this approach is difficult to scale when more storage demand is required and in particular it presents serious problems when one wants to migrate from one PACS solution to another. Second, classical PACS have failed to satisfy the demand for incorporating images from other medical specialties, mainly because those specialties often have different needs. Thus, VNA has become a common storage solution for hospitals with many departmental PACS. Going one step further, a single VNA system can be shared by different hospitals in a health region where each hospital may have a different PACS solution. This approach allows each hospital or department to keep and choose their own PACS solution, and they have some freedom to choose the kind of viewer they use. Other advantages include the benefits of economies of scale in the central storage system and potentially greater ease of future migrations to a new PACS. However, the drawbacks are that the local PACS may not support the remote storage in a completely transparent way and no specific performance improvements can be applied.

Learning Objectives:
1. To provide a definition of vendor-neutral archiving and describe its key features.
2. To discuss the role of vendor-neutral archiving in archiving and sharing information from different medical specialties.
3. To describe hurdles along the path to fully implementing enterprise bases' vendor-neutral archiving systems.

A-582 11:21
C. Does PACS into the cloud means PACS evaporates?
J. Schillebeeckx; *Knokke/BE (jan@schillebeeckx.com)*

Cloud computing is a model for enabling ubiquitous on-demand network access to a shared pool of computing resources that can be rapidly provisioned with minimal management effort or service provider interaction. This cloud model is composed of five essential characteristics, three service models, and four deployment models. Service models are provision models of applications, hardware, software, data, operation systems, telecom, etc. managed by external parties in the cloud. The three types of service models are, Software as a Service (SaaS), Platform as a Service (PaaS) and Infrastructure as a Service (IaaS). Deployment models means different environments (clouds) where different service models are located. The characteristics of those four types of environment are the private cloud, the community cloud, the public cloud and as a combination, the hybrid cloud. PACS in the cloud has several advantages and weaknesses. Clear advantages are less upfront costs, access to on-demand capacity, reliable back-up and recovery, easier management of IT staff and better financial planning. Weaknesses are performance, data migration and portability of data. Security and privacy issues might be a subjective weakness for some people but in reality it can also be an objective strength if delivered by trusted parties. Opportunities are the ability for Healthcare Information Exchange and the ubiquitous availability of patient healthcare records. The biggest threat is without any doubt the risk of misuse of confidential data. Most likely PACS will not evaporate but become a game player in the enterprise imaging model.

Learning Objectives:
1. To explain the concept of cloud archiving and its advantages.
2. To address limitations and risks of cloud PACS solutions.
3. To give insight on future developments of cloud technology.

Author Disclosure:
J. Schillebeeckx: Consultant; Agfa Healthcare NV; Qaelum NV.

11:44
Panel discussion: How will increased interconnection affect radiologists' day-to-day life?

10:30 - 12:00 **Room L8**

ESR Patient Advisory Group (ESR-PAG)

ESR-PAG 2

Mind the gap - data-sharing for better patient outcomes - the key issues for patients and the radiology community

A-583/A-584 10:30

Chairmen's introduction

N. Bedlington; *Vienna/AT (nicola.bedlington@eu-patient.eu)*

B. Brkljačić; *Zagreb/HR (boris@brkljacic.com)*

In light of the discussions around the proposed EU General Data Protection Regulation and its potential affects on health research in future, this session should provide on the one hand an overview on the importance of health data for research as well as eHealth and interoperability, particularly in the era of big data and on the other hand it should highlight the legal challenges and issues with regard to data protection and the patient's perspective.

Session Objectives:

1. To understand the importance of eHealth and interoperability, particularly in the era of big data, etc.
2. To understand the legal challenges and issues with regards to data protection and the patient's perspective.
3. To learn how the proposed data protection legislation potentially affects health research.

Author Disclosure:

N. Bedlington: Board Member; Chair of the ESR Patient Advisory Group.

A-585 10:40

eHealth, EHR and data protection: friend or foe?

P. Mildenberger; *Mainz/DE (peter.mildenberger@unimedizin-mainz.de)*

Communication in medicine is one of the key issues today, especially in radiology the expectations are very high in timely delivery of reports. This can be fulfilled with electronic systems much better than in conventional paper-based workflows. Data protection and privacy have to be considered in such solutions, examples therefore will be presented and discussed. There are some specific situations, which can benefit from eHealth or EPR especially, e.g. follow-up of findings, if priors are available in full diagnostic quality for comparison and even more for management of unexpected findings. Future developments with analytics may improve quality of image interpretation and knowledge in general. Of course, clear rules for patient consent and potential misuse have to been implemented.

Learning Objectives:

1. To learn about different concepts and implementations of eHealth-Solutions throughout Europe.
2. To appreciate advantages and opportunities of data-sharing.
3. To understand risks of EHR & eHealth and learn how IT and legislation could help.

Author Disclosure:

P. Mildenberger: Board Member; IHE-Europe. Speaker; Fédération des Hôpitaux Luxembourgeois, Bracco.

A-586 10:55

View of a patient representative from the Pelvic Pain Support Network

J. Birch; *Poole/UK (judy_b@dsl.pipex.com)*

Patients should have the right to obtain their own medical information without obstacles. It is the patient's responsibility to decide how to store this information and who they share it with. Patients should be able to request that their data be transferred from one provider to another. Patient organisations are encouraged to gather information about patients' and caregivers' experiences, preferences and unmet needs in the management and treatment of diseases. Usually it will involve engaging with people and collecting personal information. Guidance on ethical issues for patient groups to consider when collecting and reporting information is in development. In principle, the vast majority of patients would support the use of health information/data for the benefit of improvements in care. However, some patients may not want certain information to be disclosed. This right should be respected. The length of time that data are retained is important as much that is relevant in the health field may be long term. Greater cooperation is needed to facilitate the establishment of patient registries. There should be an explicit requirement for informed consent to use of health data for research including further studies and research. We need to ensure that the balance between patient's rights and the processing of data for healthcare services and research is right for patients. For this to happen patient organisations should be involved in the development of guidelines for informed consent related to the sharing of health data and the drafting of consent forms.

Learning Objectives:

1. To understand the key concerns for patients.
2. To explore whether the needs of patients can be reconciled with those of radiologists and researchers.

Author Disclosure:

J. Birch: Research/Grant Support; NIHR HTA co-applicant: MRI and laparoscopy for diagnosis of chronic pelvic pain.

A-587 11:10

View of a patient with prostate cancer

E. Briers; *Hasselt/BE (erikbriers@telenet.be)*

Disease can be seen as a journey that begins with discomfort and symptoms. These lead to a diagnostic path that may or may not end in a diagnosis and be followed by a treatment or a sequence of treatments and in cancer in a condition that today is called chronic as cancer never really goes away. During this journey and before, data are collected on the patient's life, on his biological data, images, tissue analysis, the history of his disease and much more by all the medical professionals who accompany the person during this journey. It is not the reality but a "dream" that these data should be pooled together in an electronic file that is owned by the patient but that can be used (with the patients permission) by the patient's caretakers. Whereas these data are the basis of personalised care, genetic data are the basis for precision medicine but the genetic data are part of the medical records of a patient. If we then can augment the data of the one specific patient with information on the family, ancestry, we open a new window of understanding on the sensitivity for a given disease not only in the genetic understanding but also more psychological which can contribute to the care of the holistic patient. For obvious reasons, pooling data streams from many patients gives an incredible view on populations and diseases, this is the principle of biobanks.

Learning Objectives:

1. To understand that the outcome for a patient depends on the collaboration and data sharing between all the medical professionals that are taking care of the patient.
2. To explore that diagnostic data become more relevant and important both for patients (future patients) and clinicians if diagnostic data are linked to the outcome data to allow clinicians to improve the diagnostic questions in relation to a given disease-pathology.
3. To understand that patients are willing to share their data and images to improve the fate of future patients, especially for patients suffering from serious life threatening diseases like cancer.

A-588 11:25

Big data in radiology: how will it enhance personalised medicine?

H.-U. Kauczor; *Heidelberg/DE (Hans-Ulrich.Kauczor@med.uni-heidelberg.de)*

Personalised medicine is based on diagnosis and stratification of the disease and respective dedicated treatment. Medical imaging per se provides many fundamental data for personalised medicine such as location and extent of a disease (staging) as well as functional and molecular characterisation of the pathology. Currently, this information is transferred via the radiological report, which contains some quantitative data, for supporting the selection of an appropriate treatment. To increase and standardise quality and impact of medical imaging with regard to personalised medicine, the whole process needs to be scaled up. The radiological knowledge lies in the images, which needs to be extracted, quantified and validated to obtain standardised imaging biomarkers. There are a number of studies demonstrating the feasibility of this approach. Although we are all convinced that imaging biomarkers are important and promising, the added value is still to be demonstrated (evidence). To do this we need to exploit the data in our image repositories (PACS), which represent the big data in radiology. However, the data structure in the PACS is neither ready for straightforward analysis nor interoperable with other big data, such as clinical data, lab data, as well as biobanking data. Overcoming these obstacles will pave the way to fully exploit big data from radiology for personalised medicine, e.g. characterisation of hepatic lesions as benign, low- and high-grade dysplastic (premalignant) as well as invasive (malignant). The ESR actively promotes the role of radiology in this field to the benefit of patients.

Learning Objectives:

1. To understand the main features of personalised medicine.
2. To appreciate the value of imaging biomarkers for personalised medicine.
3. To learn how to exploit big data in radiology.

Author Disclosure:

H. Kauczor: Research/Grant Support; Siemens, Bayer. Speaker; Siemens, Boehringer Ingelheim, Novartis, Almirall, GSK.

11:40

Panel discussion: Big data = big issues?

10:30 - 12:00 **Room F1**

E³ - European Diploma Prep Sessions

E³ 1423
Head and neck

A-589 10:30
Chairman's introduction
M.G. Mack; *Munich/DE (m.mack@radiologie-muenchen.de)*

This session will cover the most common pathologies of all areas of the neck from the skull base to the lower neck. You will learn to examine the different regions with the proper imaging technique and improve your knowledge in analysing head and neck imaging studies for improved differential diagnosis. Furthermore, you will learn that the detailed analysis of the infiltration pattern of malignant lesions is affecting the therapy. You will furthermore learn to differentiate malignant lesions from benign lesions and most common variations.
Session Objectives:
1. To become familiar with the anatomy and imaging presentation of the most common disorders of the temporal bone and skull base.
2. To understand the imaging presentation of common inflammatory and neoplastic disorders of the nose, paranasal sinuses and nasopharynx.
3. To describe the typical imaging features of the most common neoplastic disorders of the oral cavity, oropharynx, hypopharynx and larynx.

A-590 10:33
A. Temporal bone and skull base
A. Trojanowska; *Lublin/PL (agnieszka30@yahoo.com)*

During the lecture we will first discuss the complex anatomy of the temporal bone with special regards to conductive and sensorineural hearing loss. Next, we will go through most common causes of conductive hearing loss, with emphasis on middle ear tumours including cholesteatoma, and chronic inflammation. Afterwards we will focus on sensorineural hearing loss, including acquired inner ear pathology and developmental anomalies. During second part of this lecture we will go through most important tumours of anterior, middle and posterior skull base. We will discuss the features of different malignancies on CT and MRI images, focusing on providing an informative report for the clinician.
Learning Objectives:
1. To differentiate the anatomy, normal variants and congenital disorders of the temporal bone.
2. To understand the causes and imaging features of hearing and vestibular disorders.
3. To describe the imaging presentation of the most common tumours of the skull base.

A-591 11:02
B. Nose, paranasal sinuses and nasopharynx
C. Czerny; *Vienna/AT (christian.czerny@meduniwien.ac.at)*

Radiological imaging of the nose, paranasal sinuses and the nasopharynx is applied in patients with inflammatory or suspected benign or malign tumours. The knowledge of normal anatomy and variants is necessary to understand the pathways of inflammatory and tumourous pathologies and to establish the correct diagnosis. Multidetector-spiral CT (MDCT) and MRI are the methods of choice for the radiological imaging. Additionally, positron emission computed tomography (PET-CT) is an extremely valuable imaging tool in patients with malignant disease. It is a combination of MDCT and PET. A contrast-enhanced CT is performed - in most cases for staging covering the whole body - and a PET scan after the intravenous application of a tracer (in most cases fluorodeoxyglucose). Malignant tissues take up the tracer and with the CT scan the pathology can be exactly anatomically localised. In recent times, positron emission magnetic resonance tomography (PET-MR) has been introduced. The normal anatomy and variants as well as the importance of closely neighboured anatomical structures, which can be involved in inflammatory and tumourous disease, will be described. Pathology consists of inflammation and tumours. Inflammation can be differentiated into acute and chronic inflammation. Tumours can be either benign or malignant. It is important to describe the exact localisation and extension of the different pathologies. Imaging characteristics and involvement of surrounding structures may help to differentiate between benign and malignant disease. Uptake of contrast material and tracer - especially when using PET-CT or PET-MR - may well differentiate benign from malignant disease and additionally enables a whole body scanning with exact radiological staging.
Learning Objectives:
1. To describe the anatomy and normal variants of the nose, paranasal sinuses and nasopharynx.
2. To differentiate the imaging features of acute and chronic inflammatory changes of the nose and paranasal sinuses.
3. To understand the imaging features of benign and malignant tumours of the nose, paranasal sinuses and nasopharynx.

A-592 11:31
C. Oral cavity, oro- and hypopharynx and larynx
M. Becker; *Geneva/CH*

The purpose of this lecture is to familiarize the radiologist with common pathologic conditions of the oral cavity, pharynx and larynx; to describe the key anatomic structures relevant to tumour spread and to discuss the clinical implications of CT and MRI in the pre-therapeutic workup of squamous cell carcinoma of the head and neck. A systematic review will include key radiologic features and characteristic patterns of submucosal tumour spread and implications of cross-sectional imaging for staging and treatment. The lecture will also review the characteristic aspect of less common tumours and tumour-like conditions affecting this area. Typical radiologic findings will be discussed with an emphasis on potential pitfalls and on how to avoid them. Emphasis will be put on what the clinician needs to know and how to report the findings in a systematic way.
Learning Objectives:
1. To describe the normal imaging anatomy of the oral cavity, oropharynx, hypopharynx and larynx.
2. To understand the imaging features of tumours of the oral cavity and oropharynx.
3. To describe the imaging features of tumours of the hypopharynx.
4. To understand the imaging features of tumours of the larynx.

10:30 - 12:00 **Room K**

E³ - Rising Stars Programme

Basic Session 5: Neuroradiology: spine

A-593 10:30
Anatomy and congenital disorders
A. Rossi; *Genoa/IT (andrearossi@ospedale-gaslini.ge.it)*

Familiarity with the normal anatomy of the spine and spinal cord is of paramount importance for radiologists. Identification of the three compartments of the spine, i.e. extradural, intradural-extramedullary, and intramedullary, is crucial for interpretation of radiological findings and treatment planning. The anatomic and functional peculiarities of the cranio-cervical junction, cervical, thoracic, lumbar and sacrococcygeal spine should also be borne in mind. Normal features such as the normal position of the conus medullaris are important to evaluate patients suspected of harboring congenital malformations. Knowledge of the main embryological events during gastrulation and neurulation is also important to correctly interpret and classify cases of spine and spinal cord malformations. Finally, the correct use of CT and MRI and the preparation of study protocols shall be highlighted during this presentation.

A-594 11:00
Tumours
M.M. Thurnher; *Vienna/AT (majda.thurnher@meduniwien.ac.at)*

Myelopathy simply means "something is wrong with the spinal cord". The list of diseases affecting the spinal cord is long (includes demyelinating, vascular, metabolic, neoplastic and degenerative conditions) and imaging findings are overlapping. Most common imaging finding is enlargement of the cord with T2 high signal intensity in the cord. Magnetic resonance imaging (MRI) is the method of choice in detection of myelopathy. However, imaging findings are often unspecific and overlapping. Knowledge of coexisting brain lesions is crucial for narrowing the differential diagnosis. Finally clinical information (onset of symptoms, history of travels, immune status, etc). will be helpful to confirm or exclude specific diagnoses. In this lecture, a simplified approach to myelopathy with a "question cascade" will be presented.

A-595 11:30
Degenerative disease of the spine
M. Sasiadek; *Wroclaw/PL (marek.sasiadek@umed.wroc.pl)*

Degenerative disease of the spine (DDS) is one of the most common disorders in humans. The most important definitions as well as short descriptions of DDS's aetiopathology and clinical symptoms will be provided first in this lecture, followed by overview of the conventional and advanced imaging methods, which are used in DDS. The imaging method of choice in DDS is

magnetic resonance (MR), which is indicated in patients with significant clinical symptoms, like persistent pain, radicular signs or neurological deficits. The other imaging methods (plain radiography, computed tomography, vascular studies, scintigraphy, positron emission tomography, discography) play a supplementary role. The optimal MR protocol for DDS imaging will be presented. In the next part of the lecture the imaging patterns of the particular types of the degenerative changes (degeneration of the intervertebral disks, vertebral bodies, facet joints and ligaments, as well as spinal stenosis and degenerative spondylolisthesis) will be presented in detail. The clinical relevance of the particular imaging findings will be emphasized. The differential diagnosis of DDS, which includes infectious, inflammatory and neoplastic processes, will be also mentioned. Finally the potential role of advanced MR techniques in DDS, especially diffusion tensor imaging (DTI), will be discussed.

12:15 - 12:45 **Room A**

Plenary Session

HL 3

Sven-Ivar Seldinger Honorary Lecture

Presiding:
K. Riklund; Umeå/SE

A-596 12:15

Imaging and micronavigation: time to redraw the map?
S. Holmin; *Stockholm/SE (staffan.holmin@ki.se)*

Background: Development of new imaging tools and protocols could help in determining the biological state of brain tissue, which is important in, e.g. modern stroke treatment, but clinically relevant stroke models with preserved collateral circulation are lacking. In addition, the potential of micro-endovascular principles for superselective delivery of cells and substances and sampling in various pathological conditions needs further exploration. **Methods and Materials:** Using microendovascular technique we developed models for ischaemic stroke by endovascular temporary occlusion of MCA branches with preserved collateral circulation and with a possibility to control blood flow while scanning with multimodal imaging. The imaging results were correlated to histochemistry. Other models were developed for studying the safety and efficiency of superselective intra-luminal delivery of cells and substances upstream to target organs and for selective endovascular sampling. In addition, we explored an inverted Seldinger principle with trans-vessel wall passage from inside small vessels to the extravascular tissue for delivery and sampling. Prototypes were designed, manufactured and tested ex vivo and in vivo. Results and **Conclusion:** The minimally invasive endovascular stroke models produced small infarctions with a large penumbra and enabled studies on infarction/penumbra development, flow dynamics, metabolism and inflammation during the hyperacute and later phases. Selective intra-luminal delivery of cells and substances was safe and increased engraftment in various models. The trans-vessel wall technique, using the designed and manufactured Extroducer prototype created a micro-working channel to any organ via the microendovascular route. The technique was safe and made it possible to deliver cells and substances to different "hard-to-reach" organs.
Author Disclosure:
S. Holmin: Other; The author has financial interest in Smartwise Sweden AB.

12:30 - 13:30 **Room B**

E³ - The Beauty of Basic Knowledge: Breast Imaging

E³ 24D

Ductal carcinoma in situ (DCIS): small tumour but big problem

Moderator:
J. Camps Herrero; Valencia/ES

A-597 12:30

Ductal carcinoma in situ (DCIS): small tumour but big problem
G. Forrai; *Budapest/HU (forrai.gabor@t-online.hu)*

One of the main targets of breast screening is DCIS, which is mostly revealed by mammography as microcalcifications. Detection rate is continuously improving; the most important reason is the introduction of digital mammography. Special attention is paid to multifocality and lesion extension. Problems as distant foci, extensive intraductal component and characterisation of microcalcifications are discussed in this course. Less frequent forms of DCIS are detected by clinical examination as nipple discharge, Paget disease or palpable lesion. Ultrasound provides diagnostic help by demonstrating ductal pathologies, nodular or cystic forms and also by guiding biopsies. MRI is the considered to be the best imaging method for evaluating the extension of DCIS, as well as diagnosing the non-calcifying forms of this disease. Stereotactic vacuum-assisted biopsy is the state-of-the-art sampling method of microcalcifications. Some technical and practical issues are important to keep in mind to achieve biopsy result standards. Marker clip dislocation occurs quite frequently; therefore, the use of original images is mandatory during preoperative localisation. Detection of recurrent DCIS is a complicated task, which needs a lot of experience while evaluating newly appeared, subtle calcifications. The algorithm of correct preoperative management of DCIS is explained during the talk.
Learning Objectives:
1. To understand the differences between DCIS and invasive ductal carcinoma (IDC) in terms of pathology and imaging and the clinical implications thereof.
2. To learn the semiologic gamut of DCIS in the different techniques.
3. To know how to stage DCIS.

12:30 - 13:30 **Room D1**

E³ - The Beauty of Basic Knowledge: Chest Imaging

E³ 25D

Measurements in chest radiology

Moderator:
N. Howarth; Chêne-Bougeries/CH

A-598 12:30

A. Heart and great vessels: how, why, when?
G. Fassa-Ashrafpoor; *Chêne-Bougeries/CH (golmehr.fassa@grangettes.ch)*

Cross-sectional imaging techniques such as computed tomography (CT) and magnetic resonance imaging (MRI) are increasingly being performed, allowing unrestricted assessment of the heart and great vessels. ECG-gated acquisition protocols are crucial in reducing motion artefacts. Measurement of the thoracic aorta is performed at different anatomic levels using a multi-plane double-oblique reconstruction perpendicular to the lumen, allowing for identification of patients requiring surgical management. Assessment of the heart includes measurement of right and left atrial areas, end-systolic and end-diastolic right and left ventricular volumes (allowing determination of ejection fraction) and left ventricular end-diastolic wall thickness, which are relevant for the diagnosis of cardiomyopathies. Moreover, structural analysis of the heart should also be performed. The anatomy, connections and dimensions of the pulmonary veins can be easily analysed. The presence of thrombosis in cardiac cavities, mainly in the left atrial appendage and the left ventricular apex should also be sought, most importantly in patients with a history of systemic embolism. Other structures, such as the coronary arteries and cardiac valves can also be accurately assessed by CT and MRI. Finally, cross-sectional techniques are indicated for follow-up of patients after surgical intervention of the heart and great vessels.
Learning Objectives:
1. To review the most useful measurements on cross-sectional imaging of the heart and great vessels.
2. To learn how to accurately perform these measurements.
3. To know when the measurements are of clinical importance.

A-599 13:00

B. Lung nodules: is volume better than size?
M. Prokop; *Nijmegen/NL*

"no abstract submitted"
Learning Objectives:
1. To review the management of pulmonary nodules seen on CT.
2. To learn how to accurately perform the measurement of nodule volume and size.
3. To know the limitations of the lung nodule measurement.

13:30 - 15:30 **Room Z**

EIBIR Session

EIBIR 4

The VPH-DARE@IT Project: delivering a clinical decision support platform for earlier dementia diagnosis

Moderator:
A. Frangi; Barcelona/ES

A-600 13:30

VPH-DARE@IT: towards early, differential diagnosis of dementia
A. Frangi; *Barcelona/ES*

"no abstract submitted"
Learning Objectives:
1. To learn about the objectives of this major European collaborative project.
2. To understand how this project will enable earlier diagnosis of dementia and improve our understanding of it.

A-601 13:40

Clinical platform for data-driven differential diagnostics of cognitive disorders
M. van Gils, J. Mattila, J. Lötjönen, T. Urhemaa, A. Umer, A. Tolonen, J. Koikkalainen; *Tampere/FI (Mark.vanGils@vtt.fi)*

A common reason for delays in diagnosis of complex diseases is uncertainty of the underlying pathology causing the symptoms. This is also true in dementia, where brain scans, neuropsychological tests and other procedures are performed to determine whether the patient suffers from Alzheimer's disease, frontotemporal dementia, vascular dementia, or some other dementing disease. In this field, a new clinical decision support platform has been developed to assist clinicians make more accurate and objective decisions, and also at earlier phases of the diseases. The decision support provided by this platform is brought forth by two main components: automatic segmentation and quantification of brain images and a supervised machine learning method for comprehensively assessing the state of a disease in the patient. First, fully automated image processing methods derive volumetric measures from brain MR images. Second, the quantified imaging data are combined with all other available data, including demographic information, neuropsychological test results, blood test analysis, CSF analysis and the patient's genetic profile. A classifier called disease state fingerprint is able to take all heterogeneous patient data and compare it to previously diagnosed patients, providing an index of similarity with each disease profile. These methods have been shown to reach classification accuracy of 78 % when discriminating patient's between five different states of memory problems, ranging from mild cognitive impairment to Alzheimer's disease. The clinical decision support tool using these methods is being validated with prospective patients, to see how it performs with real users at four memory clinics across Europe.
Learning Objectives:
1. To appreciate the challenge of developing a clinical support platform for cognitive disorders.
2. To learn about the clinical decision support platform being developed by the VPH-DARE@IT project.
3. To understand how this platform will work in practice.
Author Disclosure:
J. Mattila: Shareholder; Combinostics. **J. Lötjönen:** Shareholder; Combinostics. **J. Koikkalainen:** Shareholder; Combinostics.

A-602 14:00

Shared research as a service platform for translating research into clinical practice for dementia
S. Varma; *Sheffield/UK (susheel.varma@sheffield.ac.uk)*

This presentation will inform the audience about the VPH-DARE@IT project that will deliver the first patient-specific predictive models for early differential diagnosis of dementias and their evolution using an integrative and validated multi-scale modelling platform for biomedical research and clinical decision support, underpinned by a set of unique databases and modelling paradigms. This platform will tackle the early and differential diagnosis of dementias using a combination of mechanistic and phenomenological models of the ageing brain, taking into account the environmental context. The objectives of the project are: To deliver a systematic, multi-factorial and multi-scale modelling approach to understanding dementia; To explore the lifestyle and environmental factors that predispose individuals to the development of dementia; To deliver more objective and accurate differential diagnoses than those currently available in Europe; To shorten the current average time-lapse between the onset of cognitive and memory deficits and its specific clinical diagnosis. We will present the VPH-DARE@IT research platform that will integrate existing tools that focus on dementia research, providing a single framework where new generation workflows will be created focusing on multi-scale patient specific treatment for dementia. By means of this platform novel modelling strategies will be developed and disseminated to unravel the brain ageing processes and progression of dementia through high-throughput analysis of clinical, biological and environmental data.
Learning Objectives:
1. To understand the implications of workflow for underlying infrastructure.
2. To learn how the VPH-DARE@IT will enable workflows to utilise distributed date stores for scientific analysis.
3. To learn about the emerging scientific workflows and understand the infrastructure in the context of VPH-DARE@IT use cases.

A-603 14:20

In silico characterisation of white matter microstructure using diffusion MRI
L. Beltrachini; *Sheffield/UK (susheel.varma@sheffield.ac.uk)*

Nuclear magnetic resonance (NMR) has proven of enormous value in the investigation of porous media. Its use allows studying pore-size distributions, tortuosity, and permeability as a function of the NMR sequence parameters. This information plays an important role for characterising white matter (WM) tissue in vivo and non-invasively. A complete NMR analysis in silico involves the solution of the Bloch-Torrey (BT) equation over realistic domains. However, analytically solving this equation becomes intractable for all but the simplest geometries. In this talk I will present a numerical framework for performing accurate simulations of dMRI over realistic domains. This consists in an efficient numerical solver of the generalised BT equation by means of the finite element method, as well as the construction of statistical computational models of tissue blocks of WM microstructure based on histomorphometric data.
Learning Objectives:
1. To learn how NMR is used to characterise white matter tissue.
2. To understand the numerical framework used in VPH-DARE@IT for dMRI simulations.
3. To learn about the construction of statistical computational models of white matter microstructure.

A-604 14:40

Fluid transport in the ageing brain: an integrative modelling approach
Y. Ventikos; *London/UK (y.ventikos@ucl.ac.uk)*

The function of the brain depends on the transport of a multitude of fluids, namely blood, cerebrospinal fluid, interstitial fluid and intracellular fluid. The ability to model these intertwined fluid transport processes within brain tissue in an anatomically accurate and patient-specific manner is of ever-increasing significance, especially since integrative systems possess numerous interactions with the external world which either directly or indirectly affect brain function and homeostasis. Within the VPH-DARE@IT project, we have developed a multicompartmental poroelasticity model for brain tissue based on a hybrid finite element method-finite volume formulation. This ultimately gives rise to a multi-scale, multi-factorial and multi-paradigm modelling framework that is capable of capturing the dynamic changes of brain tissue associated with normal ageing and in diseased states. In addition to discussing the methodology, we also outline novel results in incorporating lifestyle factors and the capacity of this framework to incorporate a variety of physiologically derived sub-systems and processes, such as the newly confirmed "glymphatic" pathway. The latter may prove to be pivotal in improving our understanding of how the brain flushes out its waste, and in doing so may go a long way in deciphering some of the root causes of dementia.
Learning Objectives:
1. To learn what longitudinal population neuroimaging can bring to the study of the brain.
2. To learn about the models being developed in the VPH-DARE@IT project.
3. To appreciate the possible applications of the models in early and differential diagnosis of dementia.

A-605 15:00

Phenomenological modelling and the RSS
W.J. Niessen; *Rotterdam/NL (w.niessen@erasmusmc.nl)*

Longitudinal population neuroimaging studies, especially when complemented with other biomedical and genetic data, provide a unique resource to study the brain, both in normal ageing and disease. In the VPH-dare@IT project, methods are developed to model the ageing brain from MRI brain data collected in the Rotterdam Scan Study. Models include population statistics of quantitative imaging biomarkers, providing insight into changes in brain anatomy, vascular pathology and connectivity with age. Additionally, utilising group-wise image registration, full four-dimensional models describing the

ageing brain are constructed. In this presentation, next to presenting the methodology for model construction, possible application of the models in early and differential diagnosis of dementia are shown. Also, the link between genetic & environmental factors and the brain model will be discussed.
Learning Objectives:
1. To understand how VPH-DARE@IT develops models of the ageing brain.
2. To learn about the possible application of the models in early and differential diagnosis of dementia.
3. To appreciate the link between genetic and environmental factors and the brain model.
Author Disclosure:
W.J. Niessen: CEO; Chief Scientific Officer of Quantib BV. Founder; Co-founder of Quantib BV. Shareholder; Shareholder of Quantib BV.

15:20
Discussion

14:00 - 15:30 **Room A**

E³ - ECR Academies: Interactive Teaching Sessions

E³ 1521
Genitourinary and gastrointestinal radiology

A-606 14:00
A. Prostate MRI using PI-RADS
H.C. Thoeny; *Berne/CH (harriet.thoeny@insel.ch)*

Prostate imaging is based on the so-called PI-RADS (Prostate Imaging and Reporting Data System) system that provides clinical guidelines for performing and interpreting multiparametric MRI (mpMRI) of the prostate. To perform correct mpMRI all sequences should be acquired with the same angle, slice thickness and location. PI-RADS is an objective tool based on a 5-point scoring system to define the probability of the presence of a significant prostate cancer and to exclude significant prostate cancer with a high likelihood. Furthermore, inter-reader variability should be decreased. PIRADS allows to improve and standardise communication between radiologists and urologists. In PIRADS vs 2 an overall score based on all mpMR techniques (high-resolution T2, DW-MRI and DCE-MRI) is provided for each detected lesion. PIRADS 1 and 2 mean that clinical significant cancer is unlikely to be present, PIRADS 3 means indeterminate lesion and PIRADS 4 and 5 suggest that clinically significant cancer is highly likely to be present, in PIRADS 4 the size of the lesion is smaller than 1.5 cm, whereas PIRADS 5 means that the tumour is larger than 1.5 cm. Most of the prostate cancers are located in the peripheral zone and DW-MRI is the dominant sequence to detect a significant cancer in this location, whereas T2 is the dominant sequence to detect significant prostate cancer in the transition zone. If a sequence is technically inadequate, this should be assigned assessment category "X".
Learning Objectives:
1. To learn the clinical indications for prostate MRI.
2. To assess technical considerations for performance of multi-parametric prostate MRI.

A-607 14:45
B. New aspects of renal tumours
N. Grenier; *Bordeaux/FR (nicolas.grenier@chu-bordeaux.fr)*

Renal tumours can be solid or cystic or mixed. Clear cell, papillary and chromophobe are the three most frequent types of carcinomas but many other types are possible. Angiomyolipomas, oncocytomas and leiomyomas remain the three most frequent types of benign tumours. New aspects of renal tumours include integrated MR and contrast-enhanced US criteria within Bosniak's classification for cystic masses and multiparametric MR patterns for solid tumours. These new imaging criteria should provide reliable criteria for patient management and decrease the number of inadequate follow-up and tumour biopsies. Separating atypical cystic masses and low- or non-enhancing solid tumours often requires contrast-enhanced US or MRI. One of these two techniques is now mandatory in CT-based type IIF cystic lesions for reclassification. In solid tumours, multiparametric MR imaging must include chemical shift gradient echo (GRE) sequences, signal intensity on T2-weighted images, dynamic contrast-enhanced sequences, diffusion-weighted sequences and late contrast-enhanced images. Using different combinations of two or several parameters, now makes it possible to clearly distinguish certain renal tumours. A larger validation of all these combinations is still necessary to define those having a clinical significance for routine practice.
Learning Objectives:
1. To become familiar with the different types and classifications of renal tumours.
2. To understand the key imaging findings of the different tumours.
Author Disclosure:
N. Grenier: Advisory Board; Supersonic Imagine.

14:00 - 15:30 **Room B**

Special Focus Session

SF 15
Head and neck radiology: from symptoms to diagnosis

A-608 14:00
Chairman's introduction
B. Verbist; *Leiden/NL (b.m.verbist@lumc.nl)*

To make appropriate choices about imaging modalities and protocols and to be able to produce a meaningful report for the patient and the referring physicist, a good cooperation with your clinical colleagues is indispensable. Good background information on the patient's medical history and current problems will guide which imaging study should be chosen and how it should be performed. A thorough knowledge of the strengths and limitations of clinical examination and of (surgical) diagnostic or treatment procedures will be extremely helpful in analysing and interpreting the images and will improve the accuracy of the differential diagnoses list. This will be illustrated for 4 common symptoms or findings in the head and neck area: a ringing or buzzing ear, a stuffy or running nose, sore throat and bumps and lumps in the neck.
Session Objectives:
1. To learn how to guide imaging approach and interpretation based on symptoms.
2. To discuss clinical vs radiological differential diagnoses in common ENT problems.

A-609 14:03
Tinnitus
M. Lemmerling; *Ghent/BE*

Patients with tinnitus perceive sound in the ear in the absence of a corresponding external sound. Tinnitus can be classified as pulsatile (synchronous with the heartbeat) or non-pulsatile (continuous), or as objective or subjective. Non-pulsatile and subjective tinnitus are the more frequent variants. In case of pulsatile tinnitus, CT is the imaging method of choice. MRI should be performed in case of non-pulsatile tinnitus. In the majority of patients with tinnitus, no imaging anomalies are found. In case of pulsatile tinnitus, one must exclude vascular neoplasms, other vascular anomalies, and otosclerosis. Glomus tumour (paraganglioma) is the most frequent vascular mass that can cause tinnitus. A wide variety of vascular malformations can cause tinnitus, such as AVMs and AVFs, aberrant carotid artery, persistent stapedial artery, dehiscent jugular vein, atherosclerotic disease, and rarely aneurysm, fibromuscular dysplasia, and carotid artery dissection. Some believe that vascular loops contacting the eight cranial nerves at the brain stem root entry zone cause pulsatile tinnitus. In patients with non-pulsatile tinnitus, vestibular schwannoma is the most important pathologic condition to consider. Other conditions that rarely cause tinnitus are MS, Chiari 1 malformation and endolymphatic sac tumours.
Learning Objectives:
1. To learn about the clinical presentation of tinnitus.
2. To discuss the imaging algorithm for evaluation of tinnitus.
3. To get an overview of the differential diagnoses of tinnitus.

A-610 14:23
Stuffy and runny nose
S. Colley; *Birmingham/UK (Steve.Colley@uhb.nhs.uk)*

Sinus imaging (CT) is indicated for: 1. Investigatiuon of sinus or nasal symptoms not responding to conventional medical treatment, or for recurrent infections. 2. Investigation of rhinorrhea - specifically for clear rhinorrhea and exclusion of potential skull base defects or CSF leak. 3. Investigation of sino nasal tumours - where imaging should be combined with MRI. 4. To provide an anatomical 'road map' for endoscopic sinus surgery. This talk will cover: CT scanning techniques (Standard MDCT vs MDCT with Dose Reduction Techniques vs Cone Beam CT), CT for CSF rhinorrhea, Imaging of sinonasal infections, CT and MR imaging for sinonasal tumours.

Learning Objectives:
1. To understand imaging indications in case of rhinorrhea or nasal obstruction.
2. To learn about sinonasal infections.
3. To appreciate the role of imaging in sinonasal tumours.

A-611 14:43

Sore throat

D. Farina; *Brescia/IT (nappaje@yahoo.it)*

Sore throat can be the presenting or main sign of a vast number of clinical entities, the majority of which are benign and self-limiting and, as such, do not require imaging. Clinical and physical assessment is, therefore, an essential triage to identify the conditions in which further testing is mandated. Helpful hints may be obtained asking the patient to better define his/her complaints: is the symptom localised or diffuse? new or long lasting? continuous or triggered by external factors? isolated or combined with other signs or symptoms? In particular, sore throat may be accompanied by fever, odynophagia, voice change or airway compromise; this presentation suggests a complication of an acute infection, such as a peritonsillar abscess. "Hot potato" voice may also herald para- or retropharyngeal abscess. US and frequently cross-sectional imaging (CT or MRI) are essential to confirm the diagnosis and even more to plan surgery or guide percutaneous evacuation of pus collections. Sore throat and neck lump warrant physical examination and imaging (US is the first step) to differentiate infectious causes (bacterial or viral) from neoplastic disease. On the other hand, most inflammatory conditions of non-infectious origin (such as laryngopharyngeal reflux or allergic rhinitis with postnasal drip) generally do not require imaging.

Learning Objectives:
1. To learn about the causes of sore throat.
2. To get acquainted with pattern of spread of infections.
3. To understand the risk of tumour.

A-612 15:03

Lumps of the infrahyoid neck

M.G. Mack; *Munich/DE (m.mack@radiologie-muenchen.de)*

The infrahyoid neck is extending from the hyoid bone to the thoracic inlet. Several spaces from the suprahyoid neck are extending into the infrahyoid neck. Imaging can differentiate the visceral space, the carotid space, the retropharyngeal space, the posterior cervical space and the perivertebral space. The detailed knowledge of the location of the spaces, the normal content of the spaces and the different pathologies, which can arise from the different spaces together with detailed clinical information, is essential for a systematic approach. Both, CT and MRI play an important role in the evaluation of infrahyoid neck lesions. During this lecture you will learn the characteristic imaging findings of the different lesions of the spaces of the infrahyoid neck, including malignant lesions, benign lesions, congenital lesions, inflammatory lesions as well as degenerative disease and variations.

Learning Objectives:
1. To choose the most appropriate imaging modality for neck lumps.
2. To review congenital neck masses.
3. To become familiar with acquired causes of neck swelling.

15:23

Panel discussion: To what extent do symptoms guide your imaging approach and interpretation?

14:00 - 15:30 **Room C**

E³ - ECR Academies: Modern Imaging in Colorectal Cancer

E³ 1518

Colorectal cancer: synchronous and metachronous metastases

Moderator:
T.K. Helmberger; Munich/DE

A-613 14:00

A. Clinical management: what needs to be improved?

T. Holm; *Stockholm/SE (Torbjorn.holm@karolinska.se)*

The management of patients with colorectal cancer has improved gradually and dramatically during the recent 20 years. Advances in radiology, including optimised CT protocols, MRI and PET-CT has improved preoperative local and distant staging. Surgical techniques have developed significantly with so called specimen orientated surgery, implying precise dissection in defined anatomical planes leading to high quality specimen, which has led to a larger proportion of curative resections. Oncological treatments with neoadjuvant radio- and radio-chemotherapy regimens in rectal cancer and adjuvant chemotherapy in colorectal cancer patients with a high risk of distant disease have been widely used. Optimised histopathological assessments of resected specimen have provided better prognostic information in addition to quality control of the surgical procedure. All these developments have led to significantly better local tumour control and cancer specific survival. Although local tumour control and prognosis have improved, distant metastases are still a major problem. Synchronous distant disease, diagnosed at primary staging, is present in 15-20% of the patients. In addition, another 15-25% will develop metachronous metastases during follow-up. Even though the treatment of distant disease has also improved with more aggressive regimens including chemotherapy, different types of local ablation and surgery, a large proportion of patients with metastases cannot be cured. Thus, today distant disease is the main problem in colorectal cancer. Improvements must be made mainly in neoadjuvant treatments, early detection of distant disease and in individualised treatment of metastases, based on better genetic characterisation of the individual tumour.

Learning Objectives:
1. To understand how common distant metastases are in CRC.
2. To learn about current clinical management of metastatic disease.
3. To learn about approaches aiming at improving outcome.

A-614 14:30

B. Optimal diagnostic algorithm

A. Ba-Ssalamah; *Vienna/AT (ahmed.ba-ssalamah@meduniwien.ac.at)*

Today, colorectal cancer (CRC) is the third most common malignancy worldwide and fourth among leading causes of cancer mortality. Overall, approximately 50% of patients with CRC develop liver metastases (CRLM) during the course of their illness. Liver metastases are detected in nearly 25% of patients with CRC at the time of diagnosis, i.e. 25% of CRC patients present with stage IV disease. The 5-year cumulative rate of metachronous CRLMs is reported to be 15 to 25 %. Fortunately, CRC is one of the few malignancies in which synchronous or metachronous liver metastases may be treated with surgery. Evenso, CRLMs are resectable in only 20%-30% of cases, improving the 5-year survival rate tenfold as compared with that in those with non-resectable CRLMs (i.e. from < 5% to 50%-60%). In patients diagnosed with CRC, imaging of the liver is the standard of care. Using contrast-enhanced ultrasound, multidetector CT (MDCT), or contrast-enhanced MRI with either extracellular gadolinium chelates or hepatobiliary agents, the decision to give neoadjuvant chemotherapy or palliative care, such as RFA or TACE, is made. Post-treatment liver imaging determines if the patient has been a responder or non-responder, i.e. is or is not resectable, respectively. The advantages and limitations of these modalities and various contrast agents will be explained, including their ability to detect chemotherapy-associated complications and assess liver function prior to major liver resection.

Learning Objectives:
1. To understand the pre-treatment imaging algorithm for liver metastases.
2. To learn about the role of MRI for detection of liver metastases.
3. To learn about alternative approaches and challenges.

Author Disclosure:
A. Ba-Ssalamah: Consultant; Bayer HealthCare. Speaker; Siemens and Bayer HealthCare.

A-615 15:00

C. PET/CT vs MR/PET: which and when?

P. Veit-Haibach; *Zürich/CH (patrick.veit-haibach@usz.ch)*

PET/CT is one standard imaging modality in oncological imaging and in colorectal cancer especially. It has the advantage of providing the anatomy together with metabolic information. PET/CT has made it already into several clinical guidelines for staging, re-staging and therapy follow-up for various tumours. However, both components have limitations. In CT, small metastases can be partly insufficiently visualised based on only small contrast differences. In PET, small metastases might be below the in-plane resolution of the PET system. Additionally, PET imaging might not pick up small lesions based on low tracer avidity or based on smearing artefacts due to physiological movement. Since very few years, PET/MR (simultaneous or sequential) is now available in large institutions mostly for research but also partly gaining interest in clinical routine imaging, too. PET/MR offers the standard advantages known from MR (e.g. better soft tissue contrast) in conjunction with PET. However, the method has also significant drawbacks - e.g. concerning workflow - when applied clinically. This talk will give an overview on the role of FDG PET/CT in staging and re-staging of CRC as well as on the potential advantages and disadvantages of this hybrid method compared to the stand-alone imaging modalities. Furthermore, the possible role of PET/MR vs. PET/CT in imaging of colorectal cancer and liver metastases especially will be discussed and demonstrated.

Learning Objectives:
1. To learn about the role of FDG PET/CT for staging of CRC.
2. To learn about the role of FDG PET/CT for restaging of CRC.
3. To become familiar with the possible role of MR/PET vs PET/CT.

Author Disclosure:
P. Veit-Haibach: Grant Recipient; IIS Grants GE Heathlcare, IIS Grants Siemens Healthcare, IIS Grants Bayer Healthcare, IIS Grants Roche Pharmaceutical. Research/Grant Support; Grant Support from GE Healthcare. Speaker; Speakers fees from GE Healthcare, Speakers fees from Siemens Healthcare.

14:00 - 15:30 **Room O**

E³ - ECR Master Classes (Interventional Radiology)

E³ 1526
Fire and ice outside the liver

A-616 14:00
Chairman's introduction
M. Bezzi; *Rome/IT (mario.bezzi@uniroma1.it)*

Ablation has become an increasingly adopted treatment option for primary and metastatic lung tumours, for renal carcinoma and for benign and malignant musculoskeletal lesions. For lung tumours, ablation is mainly performed in patients with unresectable or medically inoperable neoplasms. The immediate technical success rate is high, with a low periprocedural mortality rate and sustained complete tumour response has been reported in 85-90% of target lesions. Small renal masses in adults are common and usually found incidentally and pose a challenge because the treatment paradigm has to strike the balance between competing comorbidities and a lethal cancer. Cryoablation and thermal ablation are the most common treatment options as compared to partial nephrectomy, in patients who desire treatment but either are not suitable surgical candidates or prefer not to have a surgical intervention. Bone and soft tissue tumour ablation has reached widespread acceptance in the locoregional treatment of various benign and malignant musculoskeletal lesions. Percutaneous ablation of osteoid osteomas has been evaluated the most and is considered a first-line treatment choice for many lesions. Palliation of painful metastatic bone disease with thermal ablation is also considered safe and has been shown to reduce pain and analgesic use while improving quality of life for cancer patients. Patient selection for percutaneous ablation should always be carried out by a cancer management multidisciplinary team. Procedure-related complications are rare and are typically easily managed.
Session Objectives:
1. To learn about patient selection and evidence for ablation techniques outside the liver.
2. To understand how to increase the safety of ablation outside the liver.
3. To learn about recent and ongoing trials of ablation outside the liver.

A-617 14:05
A. Lung ablation: update and level of evidence
W. Prevoo; *Amsterdam/NL (w.prevoo@nki.nl)*

The standard curative therapy of malignant lung tumours (primary and metastatic) is a surgical resection. However, in early-stage NSCLC only 30% of the patients is eligible for surgical resection, due to advanced age, medical comorbidities like limited cardiopulmonary function and prior pulmonary surgery. In the last decades, minimal invasive image-guided thermal ablation (radiofrequency ablation (RFA), microwave ablation (MWA) and cryoablation) has emerged as a safe and effective therapeutic option for unresectable malignancies in a selected population of patients, with low morbidity and mortality. Minimal invasive image-guided ablative procedures are easy to repeat. The procedures are operated with CT guidance and CT monitoring. Ice ball formation during cryo is very accurately monitored by CT compared to heat-ablative procedures. The most common complication in RFA, MWA and cryoablation is pneumothorax. Every system has its limitations and advantages; high electric impedance limiting current flow and tissue heating because of the insulating effect of air may lead to poor clinical results in RFA. Even in aerated lung, MWA has the advantage of predictable and large ablation zones with fast and deep distribution of energy. In central lesions, however, there is a risk of damage to the tracheobronchial tree leading to bronchopleural fistula. Cryoablation is relative resistant to cold-sink effects of ventilation. Location may be a decisive factor choosing the right ablative method which is to be discussed in this presentation, followed by sharing data of recent prospective and retrospective trials.
Learning Objectives:
1. To understand the advantages and limitations of thermal ablation in the lung.
2. To understand the advantages and limitations of cryoablation in the lung.
3. To learn about recent and ongoing trials and the level of evidence.
Author Disclosure:
W. Prevoo: Other; proctor Medtronic ablation systems.

A-618 14:30
B. Renal ablation: update and level of evidence
C.M. Sommer; *Heidelberg/DE (christof.sommer@med.uni-heidelberg.de)*

Percutaneous tumour ablation (TA) is established for the treatment of localised renal tumours. Attemps were being made to describe the role of TA, surgery, and surveillance in the interdisciplinary management of clinical stage I renal cell carcinoma under consideration of so-called quality indicators. Now, long-term data are available for image-guided TA, and the considerable increase of its use and acceptance is not only justified by the convincing oncologic outcomes but also by demography and the zeitgeist: older patients having comorbidity and metachronous tumours, strong evidence and growing awareness of renal insufficiency, diabetes mellitus and hypertension as major predictors for cardiovascular morbidity and mortality, interdisciplinary tumour boards, cost-effectiveness, informed patients and patient laws. In selected patients, TA can be performed with a very low complication rate, preservation of the renal function, and very high technical and oncologic success. Under consideration of controlled trials, TA can show 3-, 5- and 10-year disease-free, cancer-specific and overall survival rates comparable with partial and/or radical nephrectomy. A recently performed meta-analysis describes the type, frequency and pattern of recurrence after percutaneous TA. From the three different types of recurrence, (I) residual disease in the ablation zone, (II) de-novo tumours in a kidney, and (III) extra-renal metastases, the local control of the primary renal tumour is of highest clinical relevance. The aim of this course is to understand the advantages and limitations of thermal ablation and cryoablation in the kidney as well as to learn about recent and ongoing trials and the level of evidence.
Learning Objectives:
1. To understand the advantages and limitations of thermal ablation in the kidney.
2. To understand the advantages and limitations of cryoablation in the kidney.
3. To learn about recent and ongoing trials and the level of evidence.
Author Disclosure:
C.M. Sommer: Equipment Support Recipient; CeloNova BioSciences/BostonScientific, PharmaCept, QMedical. Investigator; PharmaCept, CeloNova BioSciences/BostonScientificAngioDynamics, Covidien. Research/Grant Support; AngioDynamics, Covidien, PharmaCept.

A-619 14:55
C. Bone and soft tissues ablation: update and level of evidence
A. Gangi; *Strasbourg/FR (gangi@unistra.fr)*

The percutaneous management of bone and soft tissue tumours requires consideration of many factors: histology of the tumour with differentiation of benign and malignant tumours, careful evaluation of the patient's general condition, an understanding of the disease process, an appreciation of the degree of bone destruction, and a working knowledge of available treatment options are required. A multidisciplinary approach is essential to determine the course of treatment that best alleviates pain, preserves function, and optimises the quality of life remaining in the patient with malignant and metastatic disease.
Learning Objectives:
1. To understand the advantages and limitations of thermal ablation in the bone and soft tissues.
2. To understand the advantages and limitations of cryoablation in the bone and soft tissues.
3. To learn about recent and ongoing trials and the level of evidence.
Author Disclosure:
A. Gangi: Other; Proctoring Galil medical.

15:20
Panel discussion: How to strengthen the role of ablation beyond the liver in everyday clinical practice and how to prove the value of what we do

14:00 - 15:30 **Room N**

E³ - ECR Academies: Modern Cardiac Imaging

E³ 1520

Myocardial characterisation: established modalities vs new ones

Moderator:
J. Bremerich; Basle/CH

A-620 14:00

A. Hybrid systems in the assessment of myocardial perfusion and viability

D.V. Ryzhkova; *St. Petersburg/RU (d_ryjkova@mail.ru)*

Myocardial perfusion imaging is a highly valuable tool to identify ischaemia and stratify patients with the high-risk of cardiac events for subsequent medical treatment, for coronary intervention, including coronary angiography and possible PTCI or revascularisation. The improvement of left ventricular function, and prognosis in patient with severe heart failure after coronary revascularisation depend on both the existence and extension of viable dysfunctional myocardium. There is a clear demand for procedures of cardiac imaging that can help to detect the coronary perfusion abnormalities and the myocardial viability. SPECT and PET still remains as the mainstay for diagnosis, risk stratification and optimal treatment choice in patients with coronary artery disease and heart failure. PET is a noninvasive imaging technique that can be used to measure myocardial blood flow in relative and absolute units. PET allows for evaluation of myocardial metabolism and viability. Despite PET having a high sensitivity to estimate the physiological processes, the anatomical image resolution of radionuclide modality is limited. These limitations have been overcome in the hybrid imaging systems of PET/CT and PET/MRI. The integration of PET with MDCT provides an opportunity to obtain the information concerning coronary artery anatomy and myocardial perfusion. Hybrid PET/MRI allows to evaluate cardiac function, perfusion and scarring at the same time. A simultaneous acquisition of PET/MRI data has the potential opportunity of a direct comparison between the two modalities in perfusion and viability imaging. Nevertheless, more research is needed to understand the application of hybrid imaging.

Learning Objectives:
1. To appreciate the clinical need for assessment of myocardial perfusion and viability.
2. To know more about imaging modalities used for these indications.
3. To comparatively evaluate hybrid imaging vs single-modality modalities (CT, MRI).

A-621 14:30

B. T1 and T2-mapping: new items in the radiology toolbox

P. Croisille; *Saint-Etienne/FR (croisille@creatis.insa-lyon.fr)*

In the field of cardiac magnetic resonance imaging (CMR), there is an increased interest for tissue characterisation. It includes quantification of lesion size, and especially myocardial infarct (MI) size, in the addition of lesions depiction, that can be related to fibrosis or inflammation. Mapping techniques undoubtedly alleviate most ambiguities. Mapping techniques are increasingly being used not only as a clinical research tool to characterise tissue contents in a wide range of infiltrative and ischaemic disease but also are improving confidence in diagnosis.

Learning Objectives:
1. To learn about technical basics of myocardial mapping in cardiac MR.
2. To learn what types of diagnostic information could be obtained with mapping.
3. To become familiar with results of clinical application of this technique.

A-622 15:00

C. Cardiac spectroscopy: is it ready for clinical practice?

M. Beer; *Ulm/DE (meinrad.beer@uniklinik-ulm.de)*

Basis of cardiac spectroscopy is the chemical shift phenomenon. It allows the separation of different metabolites. Thus, important metabolites such as lipids (1H-MRS) or energetic phosphates (31P-MRS) can be non-invasively quantified. Fit algorithms are applied to calculate spectra. 1H-MRS is simple to perform. CMR standard body coils can be used, a measurement time of 5 min is sufficient, followed by another 5 min for semi-automatic post-processing. 1H-MRS spectra allow to calculate the fat/water ratio. 31P-MRS affords longer measurement times up to 45 min due to the lower natural abundance of 31P and its lower MR sensitivity. For post-processing corrections for B1-field, flip-angle, blood contamination (contains no PCr) and T1-times (no fully relaxed spectra) must be applied. Cardiac spectroscopy has enormous advantages, but also limitations. First its non-invasiveness, second the chance to analyse metabolism in distinct compartments. However, measurement and post-processing is time consuming. Technical advances such as higher field strengths (3 T and more), new coil designs (quadruple) and the use of hyperpolarisation give the chance for a breakthrough. Integrity of cardiac metabolism is essential for cardiac function, this explains the importance of MRS techniques. MRS allows insights into basic pathophysiologic alterations in various cardiac diseases such as CAD or diabetes. Dynamic analysis of metabolite fluxes or the determination of energetic consequences of innovative therapeutic regimes such as multidrug therapy in HIV is feasible, reaching out for molecular study of different biochemical cycles (e.g. Krebs cycle) in the near future.

Learning Objectives:
1. To learn the essential basics of cardiac spectroscopy.
2. To understand advantages and limitations of cardiac spectroscopy.
3. To appreciate the importance of spectroscopy for myocardial characterisation.

14:00 - 15:30 **Studio 2016**

Joint Session of the ESR and ERS

Imaging of airways: what the respirologist needs to know

Moderators:
N. Karabulut; Denizli/TR
S. Ley; Munich/DE

A-623 14:00

Classification and impact of bronchiectasis

S. Aliberti; *Milan/IT (stefano.aliberti@unimib.it)*

Bronchiectasis has been formerly regarded as a rare disease but now has been increasingly recognised worldwide. A renewed interest in the condition is also stimulating drug development and clinical research. Bronchiectasis represents the final common pathway of several infectious, genetic, autoimmune, or allergic disease and is highly heterogeneous in terms of aetiology, impact and prognosis. The major objectives of bronchiectasis treatment are aimed to improve airway clearance (physiotherapy); to suppress, eradicate or even prevent chronic infection of the airways; to reduce airway inflammation; and to reduce exacerbations and to improve physical functioning and quality of life. Recent evidence-based guidelines have been developed in some European countries and randomised controlled trials have now demonstrated the benefit of long-term macrolide therapy, with accumulating evidence for inhaled therapies, physiotherapy and pulmonary rehabilitation.

Learning Objectives:
1. To appreciate the difference between cystic fibrosis and non-cystic fibrosis bronchiectasis.
2. To understand the difference between chronic bronchitis and bronchiectasis.
3. To learn about the treatment options of bronchiectasis.

Author Disclosure:
S. Aliberti: Advisory Board; Bayer Healthcare, Griffols, Aradigm Corporation.

A-624 14:23

How to image and report airway disease?

P. Grenier; *Paris/FR (philippe.grenier@aphp.fr)*

Thin collimation MDCT is the gold standard imaging technique for the diagnosis and extent of assessment of bronchiectasis. Multiplanar reformations increase the detection rate of bronchiectasis, the readers' confidence as to the distribution of bronchiectasis and improve agreement between observers as to the diagnosis of bronchiectasis. Reformations of images along the long axis of the airways on which minimum intensity projection is applied help assess the extent of bronchiectasis at the segmental level and the number of generations of bronchial divisions involved. The extent of decreased lung attenuation due to decreased lung perfusion reflects the extent of obliterative bronchiolitis associated with bronchiectasis, and remains the strongest determinant of airflow obstruction in these patients. Bronchial wall thickening is also a determinant of severity of obstructive lung disease. Complementary expiratory CT using low dose may increase the perception of gas trapping extent. The use of maximum intensity projection is recommended to improve the detection of foci of inflammatory or infectious bronchiolitis. CT quantitative analysis of airways disease has been developed for phenotyping obstructive lung disease, particularly COPD and asthma, and assessing progression of disease overtime. Specific softwares may provide bronchial wall and lumen dimensions at a segmental or subsegmental level. Gas trapping extent may be quantified on expiratory CT as the expiratory to inspiratory ratio of mean lung density, or the percentage of lung voxels with CT attenuation less than -856 HU. Most recently, non-rigid registration of inspiratory and expiratory scans has allowed for an assessment of voxel-by-voxel density change.

Learning Objectives:
1. To appreciate CT acquisition and visualisation protocols in airway disease.
2. To consolidate knowledge on how to measure airway lumen and wall.
3. To learn how to report what the clinician needs to know.
Author Disclosure:
P. Grenier: Speaker; Novartis Pharma for symposium.

A-625 14:46

Role of airway obstruction and remodeling in the progression of COPD
I. Adcock; *London/UK*

"no abstract submitted"
Learning Objectives:
1. To understand the pathophysiology of chronic bronchitis and airway obstruction.
2. To consolidate knowledge about the effects of smoking on airway remodelling.
3. To learn about different treatment options.

A-626 15:08

Imaging of mucus, inflammation and remodeling in COPD and CF
H.-U. Kauczor; *Heidelberg/DE (Hans-Ulrich.Kauczor@med.uni-heidelberg.de)*

COPD is the acquired and CF the congenital form of airway disease both mainly defined by the severity of airflow obstruction as measured by pulmonary function tests. Emphysematous destruction is a hallmark of the advanced stages of COPD with well-known radiological patterns and quantification tools for CT. Bronchiectasis is the hallmark of advanced stages of CF. In the early stages of COPD and CF, however, airway disease prevails with chronic bronchitis and bronchiolitis. Imaging shows airway wall thickening due to oedema, inflammation and muscular hypertrophy as well as mucus within the lumen. CT with high resolution nicely demonstrates the morphological changes of airway remodelling even in smokers without airway obstruction. MRI has clear advantages over CT to differentiate between wall thickening and mucus. A tool for quantification of mucus load is still an unmet need. Imaging might even initiate treatment early. Beyond morphological remodelling the assessment of the functional changes is pivotal in patients suffering from COPD or CF. Airway obstruction leads to air trapping, which is best visualised on expiratory CT or dynamic MRI. Air trapping leads to decreased gas exchange and hypoxia, which subsequently results in hypoxic vasoconstriction (Euler-Liljestrand reflex). This leads to mosaic perfusion at inspiratory CT as well as delayed or lacking perfusion at dynamic contrast-enhanced perfusion MRI. Air trapping and hypoperfusion can be signs of both, early and reversible findings amenable to treatment, e.g. physiotherapy, antibiotics, bronchodilators, as well as late and irreversible findings in end-stage lung disease with emphysematous or bronchiectatic destruction.
Learning Objectives:
1. To understand the concept of the COPD airway phenotype at imaging.
2. To learn about airway obstruction, air trapping and hypoxic vasoconstriction.
3. To appreciate the potential of MRI to differentiate mucus and inflammation.
Author Disclosure:
H. Kauczor: Research/Grant Support; Siemens, Bayer. Speaker; Siemens, Boehringer Ingelheim, Novartis, Almirall, GSK.

14:00 - 15:30 **Room E1**

Musculoskeletal

RC 1510

Shoulder MRI: mastering technique and making my report relevant

A-627 14:00

Chairman's introduction
M. Maas; *Amsterdam/NL (m.maas@amc.nl)*

Shoulder MR imaging is a highly frequent routine in clinical departments of radiology. Since time efficiency is frequently encountered as major driving force in management, the potential conflict between an optimal and a minimal MR protocol may reflect on patient outcome. In literature many protocols are suggested, intra-articular contrast is frequently used, yet I am reluctant to perform MR arthrography in an older patient. I want clinically relevant outcome, clinically relevant answers to be the results of my practice. This sessions enables discussions on protocol choice and clinical relevance.

Session Objectives:
1. To understand the level of expertise that patients expect for adequate performance and reading of shoulder MRI.
2. To gain insight into differentiating normal age-related changes from clinical relevant MR features.

A-628 14:05

A. The normal MRI: techniques and anatomy
E. Llopis; *Valencia/ES (evallopis@gmail.com)*

MR is the primary diagnostic imaging modality when of the shoulder joint is suspected. For an accurate evaluation it is essential to know the normal anatomy, complex biomechanics with a wide range of motions and variant, to avoid misdiagnosis and to understand which ones are clinically relevant. We will divide shoulder anatomy into static and dynamic structures. Bone structures, labrum and ligament as static structures and rotator cuff muscles as dynamic ones.
Learning Objectives:
1. To become familiar with MRI techniques for imaging the shoulder.
2. To understand normal MRI shoulder anatomy, and normal variants seen.

A-629 14:28

B. Rotator cuff tears: what are they and what do they look like?
K.-F. Kreitner; *Mainz/DE (Karl-Friedrich.Kreitner@unimedizin-mainz.de)*

Rotator cuff disease is common and may be a significant cause of shoulder pain. Thorough assessment of the rotator cuff by MR imaging may enable accurate diagnosis and facilitate appropriate management by the orthopaedic surgeon. The tendons of the rotator muscles are highly organized structures where five distinct histologic layers have been described. Over the last decade, the rotator cable has received increasing attention as it acts as a supporting limb of the cuff. The cable is adjacent to the crescent zone of the rotator cuff and can be seen on most MR imaging studies. Pathologically, tendinosis/tendinopathy can be differentiated from partial- and full-thickness tears of the cuff. Whereas tears at the rotator crescent are often due to ischaemia and degeneration, tears of the footprint have obtained increased attention as they affect younger patients more. Partial-thickness tears can be described as articular, bursal or intrasubstance partial tears and should be further characterised with regard to the degree of tendon involvement. Full-thickness tears allow communication between the glenohumeral joint and the subacromial-subdeltoid bursa and can be pinhole in size or involve an entire tendon. When diagnosing cuff tears, it is essential to assess the respective muscle as fatty infiltration or atrophy may be the sequelae of the tear. The latter findings may have great influence on therapy and outcome of the patient. Analysis of the rotator cuff postoperatively should be done very carefully, as signal alterations of the tendon do not necessarily indicate a relevant pathology.
Learning Objectives:
1. To become familiar with the anatomical basis of rotator cuff tears.
2. To learn about the MRI findings of rotator cuff pathology.

A-630 14:51

C. Patterns of instability: what does the MRI show?
A.J. Grainger; *Leeds/UK (andrewgrainger@nhs.net)*

Two patterns of injury are seen in patients dislocating their shoulder. Younger patients will tend to disrupt the labroligamentous complex, whereas the older population tends to disrupt the integrity of the rotator cuff. In this latter group, tears of supraspinatus are seen along with tears of subscapularis and avulsion fractures of the greater tuberosity. Rotator cuff disruption forms the subject of other talks so will not be discussed further here. Anterior dislocation leading to avulsion of the anteroinferior labral-ligamentous complex from the glenoid is termed the Bankart lesion, or bony Bankart if accompanied by a fracture. Avulsion occurs due to the pull of the anterior band of the inferior glenohumeral ligament (AIGHL) at its attachment to the anteroinferior labrum. The AIGHL is the primary restraint to movement when the arm is abducted and externally rotated. Avulsion of the labrum is well shown at MR arthrography and a number of variants exist which will be discussed. Posterior dislocation will produce a reverse pattern of shoulder injury which will also be discussed.
Learning Objectives:
1. To become familiar with patterns of abnormality seen in shoulder instability.
2. To learn about the MRI findings of shoulder instability.
Author Disclosure:
A.J. Grainger: Equipment Support Recipient; Siemens Medical. Grant Recipient; Arthritis Research UK, National Institute of Health Research. Speaker; GE Medical.

15:14
Panel discussion: How are the indications for MR arthrography in the shoulder changing?

14:00 - 15:30 **Room E2**

State of the Art Symposium

SA 15

Endovascular abdominal aneurysm repair (EVAR): where do we stand now?

A-631 14:00

Chairman's introduction

T. Rand; *Vienna/AT (thomas.rand@wienkav.at)*

Within two decades EVAR has developed to an established method and state-of-the-art intervention. Using EVAR, aortic aneurysms can be excluded via a minimal incision at the groin, in mostly not much more than 1 hour. From the beginning radiologists have been pioneers in all EVAR-related procedures and have pushed the clinical and scientific horizons in this field. Technically a tremendous progress has been performed over the years: when EVAR started with the simple and rather rigid stent grafts in the 80s and still 90s, dislocations and endoleaks played a major role. Nowadays, with the development of ultimate flexible and low-profile stent grafts, this situation has completely changed. In the meanwhile, a total new generation of stent grafts have been developed: fenestrated stent grafts can exclude complex aortoabdominal aneurysms, with the use of supportive side branches. Nevertheless, diagnosis and subtle preinvestigations need sophisticated skills and knowledge in diagnostic radiology. CT has become the standard procedure in diagnosis and follow-up. Both, diagnostic and interventional radiological excellence, are the basis for successful treatment of aortic aneurysms. For this session I am proud to announce top experts in both diagnostic and interventional radiology, who will provide best knowledge about state-of-the-art procedures as well as advanced techniques.

Session Objectives:

1. To introduce the basic concepts of EVAR.
2. To underline the major role of radiology in EVAR.

A-632 14:03

Endovascular versus open surgical repair: what do we know so far?

D.K. Tsetis; *Iraklion/GR (tsetis@med.uoc.gr)*

The treatment of aneurysms has evolved during the last 20 years, from complex and lengthy open surgical repair to minimally invasive endovascular aneurysm repair (EVAR). The constant evolution of devices along with the accumulated experience of physicians are gradually expanding indications of EVAR to include more subjects with complex and challenging anatomies that would otherwise have had to undergo major open surgery accompanied by serious mortality and morbidity. Certain geometrical factors, such as neck angulation, iliac bifurcation, endograft curvature, neck-to-iliac diameter and length ratios, as well as iliac limbs configuration can exert significant influence on the haemodynamic behavior of the endovascular stent grafts. Endoleak is the most common complication of EVAR. Type I and Type III endoleaks demand correction (proximal cuff or extension), while Type II endoleak may seal spontaneously in about 50% of cases. Totally percutaneous EVAR with the use of suture-mediated closure devices is safe and feasible and currently may be routinely used in clinical practice. This technique compared with surgical cut-down seems advantageous in terms of local complication rate and patients comfort. The additional use of local anaesthesia in selected patients can potentially further reduce procedural times, total length of hospitalisation and overall cost of the procedure.

Learning Objectives:

1. To learn about the basic concepts of the treatment of abdominal aortic aneurysms.
2. To understand the principles of endovascular repair.
3. To appreciate innovative endovascular treatment options.
4. To become familiar with the latest research in the field.

A-633 14:21

The role of imaging in preoperative planning and follow-up

F. Rengier; *Heidelberg/DE (fabian.rengier@web.de)*

Pre- and postoperative imaging is crucial for endovascular abdominal aneurysm repair. CTA including chest, abdomen and pelvis constitutes the preferred method for EVAR planning. MRA is an alternative if iodinated contrast is contraindicated. The first step in the preoperative workup of the CTA or MRA is the precise characterisation of the aneurysm itself including its diameter, thrombus, relation to renal arteries and other branches, and iliac artery involvement. For evaluation of proximal fixation, the proximal neck needs to be analysed regarding length, diameter, angle, calcification and thrombus. For evaluation of distal fixation and vascular access, both common and external iliac arteries are assessed for length, diameter, occlusive disease, tortuosity and calcification. Finally, internal iliac artery patency has to be noted. Most of the measurements are most accurately performed using dedicated software and center line analysis. For first postoperative assessment, CTA is recommended to determine treatment success, visualise stent graft position and exclude early complications. Depending on the findings, further postoperative follow-up can be performed by contrast-enhanced ultrasound (CEUS) or MRA in combination with x-ray. Nitinol stents cause relatively few artefacts on MRA compared to stainless steel or elgiloy stents. PET-CT may be indicated if graft infection is suspected. Innovative imaging and computational methods such as 4D flow MRI, finite element analysis and computational fluid dynamics might play a role in the future.

Learning Objectives:

1. To learn about the concepts of preoperative planning.
2. To understand key figures and definitions.
3. To appreciate the use of innovative imaging methods.
4. To become familiar with the meaning of diagnostic preoperative workup.

A-634 14:39

Implantation techniques and long-term results

R. Uberoi; *Oxford/UK (raman.uberoi@orh.nhs.uk)*

Endovascular stent grafting has become a well-established effective technique in the treatment of both elective and now ruptured abdominal aortic aneurysms. Randomised studies have demonstrated lower immediately mortality 1.6% V 4.7% for endovascular repair as well as reduction in major complications. Up to 70% of aneurysms have been considered suitable for treatment with a technical success of 93-100%. However, patient as well as device selection remains important factors in ensuring good outcomes. Immediate conversion is reported in 1.7% with major risk factors cited being adverse iliac anatomy and unfavourable necks. Device migration is seen in around 4% of patient and endoleaks reported in 10-50% of patients. secondary intervention rates are required in 16.2% of patients with the risk of re-intervention much higher when using devices outside IFU, in the presence of short necks and steep neck angulation $>$ 45 degrees. Risk of endoleak and reintervention also increases with high BMI $>$ 25, hypertension, larger aortic diameters and length of aneurysm. Aortouniiliac devices have a less favorable outcome compared to bifurcated devices, most likely the result of the complex patients selected for treatment with these devices. Iliac limb occlusion may also occur often as the result of iliac artery tortuosity or sac shrinkage over time. Outcomes, however, are improving with the newer generation of devices and technologies and increasingly minimally invasive techniques such as PEVAR and avoiding cut downs in patients undergoing eVAR as well as helping to speed up the whole procedure.

Learning Objectives:

1. To learn about the basic concepts of endovascular techniques.
2. To understand basic mechanical and anatomic considerations.
3. To appreciate the use of innovative endovascular tools.
4. To become familiar with the latest research in the field.

A-635 14:57

Imaging and treatment of endoleaks

M. Gschwendtner; *Linz/AT (Manfred.Gschwendtner@elisabethinen.or.at)*

Patients who have had EVAR undergo lifelong surveillance to evaluate for the presence of aneurysm expansion and endoleaks. Detection of endoleaks is essential, as endoleaks are associated with expansion and even rupture. Triphasic computed tomographic angiography (CTA) is the most commonly utilised imaging modality to evaluate postoperative EVAR and is highly sensitive and specific at detecting endoleaks. Other techniques commonly utilised for detection of endoleaks are magnetic resonance and duplex ultrasonography. Digital subtraction angiography (DSA) is more accurate than CTA in classifying endoleaks because the direction of blood flow can be seen during DSA. In general, high-pressure leaks (type I and type III) require urgent management because of the relatively high short-term risk of sac rupture. Low-pressure lesions (types II and IV or endotension) are considered less urgent but may warrant continued endovascular evaluation if there is impending growth of the aneurysm sac or if the patient presents with symptoms.

Learning Objectives:

1. To learn about the nomenclature and pathophysiological backup of endoleaks.
2. To understand the basic concepts in treatment und surveillance of endoleaks.
3. To appreciate the use of innovative tools for treatment and surveillance.
4. To become familiar with the key facts and figures regarding the scientific workup.

Author Disclosure:

M. Gschwendtner: Consultant; Cook, Medtronic, Cardinal Health.

15:15
Panel discussion: The key role of the radiologist in endovascular abdominal aortic aneurysm repair
1. To discuss where the further development of aortic endovascular treatment will go.
2. To discuss the role of the radiologist in this concept.
3. To conclude where we stand now.

14:00 - 15:30 **Room F1**

E³ - European Diploma Prep Sessions

E³ 1523
Gynaecological and obstetrics

A-636 14:00
Chairman's introduction
C.D. Alt; *Düsseldorf/DE*

This level I session gives important information about how to perform imaging of the female reproductive organs and presents fundamentals of foetal imaging. "The imaging of the uterus" includes the basic knowledge about the anatomy and the physiological changes of the uterus and cervix and gives an overview about common indications for cross-sectional images. There will be a special emphasis on MRI, including an imaging protocol and the presentation of MR imaging characteristics of common uterine diseases. "Disorders of the adnexa" discusses the role of various imaging modalities for the characterisation of adnexal masses, helps to differentiate benign from malignant adnexal findings and presents pearls and pitfalls. "Fundamentals of foetal imaging" provides basic knowledge of the methodology and technical principles of foetal MRI and presents common pathological findings.
Session Objectives:
1. To understand the imaging presentation of the most common benign and malignant disorders of the uterus.
2. To become familiar with inflammatory and neoplastic disorders of the adnexa.
3. To understand the principles of foetal images and the imaging presentation of the most common foetal disorders.

A-637 14:03
A. Imaging of the uterus
R.A. Kubik-Huch; *Baden/CH (rahel.kubik@ksb.ch)*

In this lecture, the current approach to uterine imaging and the advantages and limits of the various imaging modalities will be discussed. Ultrasound, usually using the high-resolution transvaginal approach, is the imaging modality of choice for the uterus. It is widely available and relatively inexpensive. Shortcomings with this imaging test are the limited field of view, obscuration of pelvic organs by the presence of bowel gas, inherent limitations dependent, and its dependence on the experience of the operator. The role of hysterosalpingography has become very limited in recent years. CT has an inferior soft tissue contrast compared to MRI and the disadvantage of ionising irradiation, its role is thus mainly limited to the emergency setting as well as oncologic staging of disease. With its high-contrast resolution, its ability to provide good tissue characterisation, and its multiplanar imaging capabilities, MRI is increasingly used to evaluate pathologies of the uterus. In this lecture, indications and contraindications of MRI will be reviewed. Patient's preparation for pelvic MRI and the imaging sequences, tailored to the specific clinical questions will be discussed.The audience will learn about the normal zonal anatomy of the uterus, congenital anomalies as well as variations of the uterus during the menstrual cycle and in the postmenopausal phase. The spectrum of normal and pathologic findings and the most important benign and malignant pathologies of the uterus will be reviewed and the role of MRI for staging cervical and endometrial cancer will be discussed.
Learning Objectives:
1. To understand the advantages and limits of ultrasound, hysterosalpingography, CT and MRI in imaging the uterus.
2. To become familiar with the normal anatomy of the uterus and to know the variations of the uterus during genital life and during the menstrual cycle.
3. To learn about congenital anomalies as well as the most relevant benign and malignant uterine pathologies.
4. To be able to explain the technique of a pelvic MRI and to know the contra-indications of MRI, the required preparation of the patient and the choice of technical parameters depending on indications.

A-638 14:32
B. Disorders of the adnexa
E. Sala; *New York, NY/US (salae@mskcc.org)*

The differential diagnosis for adnexal masses is wide, encompassing a range of benign, borderline and malignant entities. The majority of adnexal masses are benign, but identification of malignant lesions is of paramount importance. Stratification of risk is made on age, menopausal status, imaging features and tumour markers. Imaging evaluation should be used in combination with patient's age, menopausal status, history, clinical examination and tumour markers, to derive an appropriate differential diagnosis. However, ultimately diagnosis may depend on histological confirmation. In general, a cystic mass in a young adult female is most likely to represent a functional cyst, endometrioma, tubo-ovarian abscess, dermoid cyst, or cystadenoma. Only a small percentage of these patients will have borderline or frank malignancy. If imaging suggests a frankly malignant tumour the most likely differential in this age group would be a malignant germ cell or sex cord stromal tumours rather than a surface epithelial tumour. An incidental unilocular ovarian cyst found in pre-menopausal patient requires no further management unless it is symptomatic or, due to its size, there is a risk of torsion. In post-menopausal patients, unilocular cysts can be managed conservatively with repeat TVUS, if there is no increase in cyst diameter or complexity and the serum CA 125 is normal. If there is a complex cystic or solid lesion on US, further assessment by MRI is recommended. If ovarian carcinoma is suspected on US, staging is performed with CT.
Learning Objectives:
1. To describe the imaging features of benign tumours of the ovaries.
2. To understand the diagnostic evaluation and imaging features of malignant tumours of the ovaries.
3. To explain the imaging features of inflammatory disorders of the Fallopian tubes.

A-639 15:01
C. Fundamentals of foetal imaging
D. Prayer; *Vienna/AT (daniela.prayer@meduniwien.ac.at)*

Foetal MRI imaging is optimally done at a field strength of 1.5 or 3 T. Coil positioning as close to the foetal regions of interest as possible is mandatory to achieve good image quality. Ultrashort sequences are used with T2-contrast as the "working horse", but other sequences, such as T1-weighted, echoplanar- and diffusion-weighted sequences as providers of important tissue information. MRI is usually not applied as a screening method but as an adjunct to previous ultrasound. With MRI, the clinical question should be answered first. However, not to miss complex syndromes, the whole foetus and the extrafoetal structures should be imaged too, if possible. Foetal MRI is in most cases performed from gestational week 18 onwards. Not all pathologies may be visualised already in the second trimester. Indications for foetal MRI may vary widely in the respective perinatal centres. As a general rule, a foetal MRI should be performed whenever additional information to the ultrasound study can be expected. Pathologies of the central nervous system (CNS) where MRI has been proved to be helpful comprise malformations, especially in the early diagnosis of lissencephalies, commissural agenesis, and posterior fossa malformations. Haemorrhagic lesions can be picked up with great sensitivity. In case of infection ultrasound seems to be superior in detecting associated calcifications, but MRI shows tissue damage more sensitively. Extra CNS indications are related to thoracoabdominal malformations, such as, for instance, the congenital diaphragmatic hernia, lung malformations, stenosis and atresias of the bowel, complex malformations involving multiple organ systems.
Learning Objectives:
1. To describe the methodology and technical principles of foetal MR imaging.
2. To understand the imaging presentation of common pathologies of the foetal central nervous system.
3. To understand the imaging presentation of common pathologies of the foetal body.

14:00 - 15:30 **Room F2**

Breast

RC 1502

Update on BI-RADS

Moderator:
G. Esen; Istanbul/TR

A-640 14:00

A. Mammography
U. Bick; *Berlin/DE (Ulrich.Bick@charite.de)*

The breast imaging reporting and data system (BI-RADS®) for mammography of the American College of Radiology (ACR®) consists of several components, a standardised lexicon of terms to be used during reporting, a 4-step coding system for the mammographic density as a surrogate parameter for the mammographic sensitivity, and a group of assessment categories ranging from 0 to 6 for structured communication regarding the recommended further management. The goal of BI-RADS® is to improve the quality of breast imaging reporting and communication. In addition, by providing structured reports it facilitates regular quality assurance measures. The 5th edition of the BI-RADS® atlas for mammography was published in 2013. The main changes in this new edition concern the reorganisation of the description of breast composition, the elimination of the subdivision of suspicious calcifications into intermediate concern and higher probability of malignancy, and the possibility to separate assessment categories and management recommendations.
Learning Objectives:
1. To learn about the recently updated BI-RADS® lexicon.
2. To become familiar with the mammography descriptors.
3. To understand the usefulness of the BI-RADS® categories and their clinical application.

A-641 14:30

B. Ultrasound
A. Evans; *Dundee/UK (a.z.evans@dundee.ac.uk)*

The BIRADS ultrasound (US) lexicon was revised in 2013. The presentation will go through the components of a breast US report and the descriptors that should be used describing masses and other features. Integration of the mammographic and US findings to arrive at a BIRADS classification will be discussed. The consequent management of breast lesions will then be discussed highlighting pitfalls and new additions to the lexicon such as elastography.
Learning Objectives:
1. To learn about the recently updated BI-RADS® lexicon.
2. To become familiar with the ultrasound descriptors.
3. To understand the usefulness of the BI-RADS® categories and their clinical application.
Author Disclosure:
A. Evans: Research/Grant Support; Supersonic imagine, Siemens. Speaker; Supersonic imagine, BARD, Siemens.

A-642 15:00

C. MRI
M.H. Fuchsjäger; *Graz/AT (michael.fuchsjaeger@medunigraz.at)*

To standardise breast MRI and to minimise false-positive results without compromising sensitivity, the American College of Radiology (ACR) introduced the Breast Imaging-Reporting and Data System (BI-RADS®) MRI lexicon in 2003, with its second edition published in late 2013. BI-RADS® relies on the combined analysis of morphological appearance and lesion enhancement kinetics. It is widely used for reporting breast MRI acquired at any given field strength. The current status and the appropriate use of the BI-RADS® MRI lexicon will be presented. Any breast MRI report should not only follow the guidelines, but also follow a red thread, be consistent, express confidence and be comprehensible for clinicians. Adequate nonclinical information (i.e. patient name, date and type of examination) is indispensable. Any breast imaging report has to follow a stringent structure including indication, clinical history, clinical findings, brief description of technology used, assessment of parenchymal density and background enhancement, detailed description of significant findings, comparison with previous imaging studies and final assessment according to BI-RADS®. This overall final BI-RADS® assessment is based on the most worrisome finding, taking into account both breasts and all imaging methods (mammography, ultrasound, MRI) evaluated. Furthermore, adequate communication of the result, as well as dos and don'ts of reporting according to BI-RADS® will be discussed.

Learning Objectives:
1. To learn about the recently updated BI-RADS® lexicon.
2. To become familiar with the MRI descriptors.
3. To understand the usefulness of the BI-RADS® categories and their clinical application.

14:00 - 15:30 **Room D1**

Chest

RC 1504

Mediastinal disease revisited

Moderator:
A. Persson; Linköping/SE

A-643 14:00

A. The crucial role of chest x-ray: mediastinal lines and stripes
E.E.J.G. Coche; *Brussels/BE (emmanuel.coche@uclouvain.be)*

The mediastinum is a complex area of the chest that contains vital structures such as the heart, the great vessels, trachea and main bronchi, oesophagus, thymus, venous and lymphatic structures, and nerve tissue. In the past, the mediastinum has been considered as the so-called "black-box" of thoracic radiology. Its analysis is notoriously difficult with many pitfalls due to superimposition of many adjacent tissues. Knowledge of the normal appearance of mediastinum on chest radiography is the first crucial step for localising and identifying a potential abnormality. The mediastinal lines and stripes can be defined as linear structures (reflections) visible on the conventional x-ray, formed by points of contact of the mediastinal soft tissues and the adjacent aerated lung or contact of lung parenchyma by interposed soft tissue. The alteration of normal anatomy and the accompanying displacement of the mediastinal lines and stripes may alert the radiologist to the presence of a mediastinal mass. Modern imaging techniques such as CT and MRI nicely depict and explain the nature and the modifications of the mediastinal lines and stripes in physiological as well in pathological conditions. The aim of this presentation is to emphasize on the important role of basic radiological findings in standard diagnostic chest x-ray interpretation and to correlate the radiological anatomy with cross-sectional imaging. A side-by-side correlation between chest radiography and reformatted CT or MR images will be performed systematically.
Learning Objectives:
1. To become familiar with the signs that indicate mediastinal pathology.
2. To confidently identify and localise a mediastinal mass on chest x-ray.

A-644 14:30

B. Mediastinal masses: role of CT
M. Occhipinti; *Rome/IT (mariaelena.occhipinti@gmail.com)*

The mediastinum contains several structures that can produce a wide variety of pathologic conditions. Thymus, thoracic aorta, oesophagus, azygos and hemiazygos veins, thoracic duct, lymph nodes, adipose tissue, and nerves are all located in this anatomical region and can produce diverse lesions. Although chest radiograph may detect many of these pathological conditions, computed tomography (CT) and magnetic resonance are the imaging modalities of choice for a precise characterisation of all lesions. In particular, CT allows to evaluate the characteristics of the mass, its content and its margins, the presence of calcifications, erosion or scalloping of ribs or vertebrae, the relationship to neighboring structures, and the presence of distant metastases for a complete staging of neoplastic disease. Classifications of mediastinal compartments can also help in characterising mediastinal masses. The latest classification systems are based on CT anatomy and provide a more detailed classification of mediastinum than the previous systems based on chest radiograph. Finally, CT can guide biopsy of mediastinal masses allowing to obtain the definitive diagnosis.
Learning Objectives:
1. To learn the most common causes of mediastinal masses.
2. To recognise signs which allow us to characterise mediastinal lesions.

A-645 15:00

C. A new look at the mediastinum: role of MRI and PET/CT
F.L. Giesel; *Heidelberg/DE (f.giesel@dkfz.de)*

In the area of multi-modal imaging MRI and PET CT enables to improve patient stratification in mediastinal involvement of particular cancer diseases. High-resolution and improved tissue contrast using 1.5 and 3 Tesla MRI scanners allows the improved tumour assessment in regard to vascular and pleural infiltration. Furthermore, DW-MRI also improves the depiction of solid tumour changes during therapeutic intervention. In contrast, PET-CT allows the improved N- and M-Staging in tumour cancer spread, which is particularly a

necessity in initial patient stratification (N2 vs N3) and follow-up during therapeutic procedures. Furthermore, new molecular probes enable further molecular assessment of disease involvement of tumour spread.
Learning Objectives:
1. To learn when and how to apply MR for mediastinal disease.
2. To learn when and how to apply PET/CT for mediastinal masses.

14:00 - 15:30 **Room D2**

Radiographers

RC 1514
Innovative education in medical imaging

A-646 14:00
Chairmen's introduction (part 1)
P. Bezzina; *Msida/MT (Paul.bezzina@um.edu.mt)*

Educational programmes in health care should provide exposure to patients so that students and qualified staff acquire the necessary skills and competences. There is, however, the obligation to provide and ensure patients' safety and well-being. These two competing requirements may pose a dilemma in health care education. Health education is both a science and an art, and repeated exposures will enhance the teaching experience and help to develop skills and competences. Simulation-based and interactive learning may be the answers to developing health professionals' knowledge, skills and attitudes while protecting patients from unnecessary risks. Both simulation-based and interactive learning are not new methods and they offer the opportunity for dynamic, complex, and unanticipated situations to be practised and managed. The costs of simulation and interactive training, when first introduced were high, with few institutions maybe having the vision to realise that it is was a worthwhile investment in the long term. Some were also sceptical of these different approaches to teaching and learning. In this day and age, smartphones and tablets are an integral part of daily living activities. They also have a role in health care delivery. In this session, the use of interactive learning is also specifically being applied to its use in MRI. The aim of this session is to inform medical imaging professionals of some key developments and their use in health care education through simulation, interactive devices which include smartphones and tablets.

A-647 14:03
Chairmen's introduction (part 2)
M. Bachmann Nielsen; *Copenhagen/DK (mbn@dadlnet.dk)*

Simulation training is gaining momentum in medical specialities, but not so much in radiology. Some studies with ultrasound simulators have been published but few conclusive results have been obtained and the same applies to other part of our speciality. A problem has been the high investment cost but it could be a worthwhile investment. In addition, the number of smartphone users in the world will surpass 2 billion in 2016, the number of tablet users in Europe is over 100 million. Smartphone and tablets could well be the new revolution in radiology/radiography education.
Session Objectives:
1. To understand the role of handheld devices in medical imaging education.
2. To appraise the use of simulators as an innovative educational tool in radiology.
3. To discuss the use of interactive application to teaching and learning in medical imaging.

A-648 14:05
A. Is there a role for smartphones and tablets in medical imaging education?
F. Girard; *Pont de Roide/FR (franck.girard@opteamage.com)*

New mobile devices have entered our lifestyles, whether to keep contact on social networks, play or listen to music. Entering the radiology world is, therefore, a natural path. However, are the current screens fit for radiology reviews? What are the possible drawbacks of working on mobile devices? Can patients' anonymity be compromised? As we move further to higher screen resolution, speed of devices and network connectivity, we will try to discuss the place of these new ways of work, and see if this trend is due to last.
Learning Objectives:
1. To review the current educational uses of hand-held electronic devices in medical imaging.
2. To discuss the potential advantages and disadvantages of technology-enhanced learning in medical imaging.
3. To suggest potential future uses of smartphones and tablets in radiography education.

Author Disclosure:
F. Girard: CEO; Opteamage. Consultant; Bayer Healthcare, GE Healthcare, Merge.

A-649 14:28
B. Using simulators as an innovative teaching tool in medical imaging
P. Cosson; *Teeside/UK (p.cosson@tees.ac.uk)*

Effective and rewarding simulation use in education requires clear thinking. There are many types of simulator to select from, several stages of student preparedness to be aware of, tutors each have different experiences, and educational aims can range from assessment to introduction of new concepts. This talk aims to use one established planning framework for healthcare simulation education to discuss these issues. This discussion will be informed by eight years of experience in using simulation in radiography education. Suggestions for improvements in simulated educational practice will hopefully arise.
Learning Objectives:
1. To appraise the current methods used in healthcare simulation for education.
2. To explore the benefits and disadvantages of these methods in radiography education.
3. To suggest future uses and further improvements of simulators in radiography education.
Author Disclosure:
P. Cosson: Board Member; Shaderware Limited. Founder; Shaderware Limited.

A-650 14:51
C. Beyond eye candy: developing effective interactive animations to enhance MRI learning
D. Koumarianos; *Athens/GR (dikoum@eapeikonisi.gr)*

If a picture is worth a thousand words, a good animation is certain to be worth a thousand pictures when one is studying MRI. MRI involves many dynamic events that lend themselves to animation, and animations can be used to illustrate basic principles while minimising unnecessary detail, emphasize relevant information through narration, highlight through changes in speed, and even play on humour with cartoons. Nevertheless, animation is not a magic solution to educational problems. For an animation to be educationally valuable, both the graphical presentation of the animation and its structure need to go beyond that of being appealing "eye-candy". Instructional design has a tremendous influence on the educational value of an animation and educators must acknowledge that content alone will not carry the educational process; how it is delivered is quickly becoming as critical as what is delivered. By drawing upon the discoveries of cognitive science and exploring the potential of animation technologies, Richard E. Mayer provides us a learning theory with sufficient detail to guide practical decisions in multimedia design and offers a list of critical evidence-based principles that need to be considered for making multimedia environments effective. People learn better when multimedia messages are designed in ways that are consistent with how the human mind works and with research-based principles. Animations grounded in Mayer's research-based principles can decrease the "eye candy", raise the quality of the content and ensure that learners develop accurate mental models of complex concepts.
Learning Objectives:
1. To review the current educational uses of interactive animations in medical imaging.
2. To discuss the potential advantages and disadvantages of multimedia in medical imaging education.
3. To demonstrate the development of educationally effective interactive animations.

15:14
Panel discussion: What is the value of innovation in advancing clinical practice and education in radiography?

14:00 - 15:30 **Room K**

Physics in Radiology

RC 1513
IT tools for dose tracking and workflow optimisation

A-651 14:00
Chairman's introduction
A. Trianni; *Udine/IT*

Session Objectives:
1. To understand the pros and cons of dose tracking in modern day radiology imaging.
2. To review IT standards for dose tracking.
3. To learn about dose optimisation from using dose tracking tools.

A-652 14:05
A. Digital Imaging and Communications in Medicine (DICOM) standard and Integrating the Healthcare Enterprise (IHE)
D. Peck; *Detroit, MI/US (donaldp@rad.hfh.edu)*

The language of radiology equipment is done through the DICOM standard. The development of the DICOM standard is accomplished through working groups made up of industry personnel and medical equipment users. Using DICOM and other healthcare standards (e.g. HL7) the IHE seeks to establish methods wherein computer systems can communicate to achieve specific functional objectives. IHE is a collaboration of professional societies and industry that develop workflow profiles to allow the integration of different systems and accomplish specific tasks. There is an ongoing effort to enhance the current content of DICOM and IHE to optimise radiation dose tracking. In this presentation the procedures used to create the DICOM standard will be reviewed and some of the most recent changes relevant to dose will be discussed.
Learning Objectives:
1. To understand the current DICOM standard.
2. To learn about new DICOM efforts which will significantly impact imaging systems' operations.
3. To understand how IHE coordinates the integration and management of DICOM objects.

A-653 14:28
B. Patient dose index tracking: a must have?
F. Zanca; *Leuven/BE (federica.zanca@med.kuleuven.be)*

While dose tracking systems and their utilisation are an emerging topic of interest, before starting any discussion on "whether," "what," and "how" to track exposure, we should understand the tracking's purpose. In the author's view, four main reasons should be identified: procedures standardisation and optimisation, legislation compliance, individual risk assessment and research purposes. The primary rationale is indeed to avoid exposing patients to unnecessary radiation by engaging radiologists in a new practice of exams justification, protocols standardisation and optimisation. Such a system is also helpful for being compliant with the coming EU directive 2013/59/Euratom. A dose tracking system can also help in: identifying unusual high radiation dose and implementing patient follow-up process (patient safety); identifying studies with parameters outside pre-defined reference levels and optimise protocols (optimisation); identifying patient populations that receive a relatively large number of imaging studies and propose patient-specific protocol development; standardising the workflow and operator dependent protocols parameters; optimising dose level versus image quality. Similarly, it can act as a conduit of data to national benchmarking databases or as a tool to support the tracking the radiological procedures of individual patients and radiation dose. However, there are challenges to implement dose-tracking systems, like what actionable data to capture and how to report them. The next step is how to go form dose indices collected to patient dose estimates in order to assess risk. This presentation will end with some examples of dose tracking systems implementations in clinical practice.
Learning Objectives:
1. To identify informatics and tools for tracking patient radiation dose.
2. To learn about some possible uses in clinical practice.
3. To learn about some examples of patient radiation dose tracking.
Author Disclosure:
F. Zanca: Employee; GE Healthcare.

A-654 14:51
C. Optimising technique using patient dose index tracking software: tips and tricks
R.W.R. Loose; *Nuremberg/DE (Loose@klinikum-nuernberg.de)*

The European Basic Safety Standards "2013/59/Euratom" (EU-BSS) require dose recording and reporting from radiological procedures. The main source of medical exposure is CT. Before any attempt to optimise dose management one has to assure which dosimetric data are available from modalities via DICOM. Modalities provide dosimetric data as part of the DICOM header, as DICOM-SR structured dose report, as DICOM-MPPS modality performed procedure step, or as dosimetric data stored in DICOM-bitmap images. Only few modalities use all pathways for dose transmission. The quality of dose management software depends on how and how many DICOM sources are evaluated. In CT, DICOM-SR transmits only the average dose index CTDIvol of an examination whereas the dose distribution along the patient's z-axis (dose modulation) can be obtained only from the DICOM headers of all images. In fluoroscopy (RF and XA) the dose stored in DICOM images is not sufficient as exposures from fluoroscopy alone are not included in DSA- or cardio-series. CR images (storage plates) provide a DICOM exposure index (EXI) but no dosimetric data. In any case modalities store physical dose parameters (ESAK, DAP, CTDIvol, DLP). Recording of these parameters is an obligation in all European member states. Physical dose parameters can be used to compare dose management between same types of modalities like different CTs. The use of effective dose ED for reporting and tracking is questionable and not recommended by ICRP for individual patients but can be used to compare doses from different types of modalities.
Learning Objectives:
1. To learn how to use the DICOM header to improve technique and outcome for the patient.
2. To learn how to use the DICOM header to improve performance of the automatic exposure control system.
3. To take advantage of dose tracking information in order to compare technique among different CT scanners.

15:14
Panel discussion: Dose index tracking in clinical practice

14:00 - 15:30 **Room G**

Neuro

RC 1511
White spots in the brain
Moderator:
E.T. Tali; Ankara/TR

A-655 14:00
A. White spots and blots in the brain: what are they?
T.A. Yousry; *London/UK (t.yousry@ucl.ac.uk)*

White matter lesions (WMLs) often present a diagnostic challenge. They can be incidental, associated with ageing, or reflect an underlying disease. The differential diagnosis is, therefore, wide reaching from vascular, such as small vessel disease (SVD) to inflammatory causes, such as multiple sclerosis (MS). Although the clinical presentation often leads to the right diagnosis, overlap in the clinical presentation as well as in the MR findings is frequent. The correct interpretation of the corresponding imaging is, therefore, essential. To be able to put WMLs in the right context, they need to be categorised and related to their pathological substrate, which is the basis for the nomenclature that should be used. MRI criteria have been developed to support the differential diagnosis. They are based among other features on shape (oval in MS), distribution (subcortical in MS, basal ganglia in SVD), enhancement (MS), involvement of spinal cord (MS) and occurrence of other changes (lacunes and microhaemorrhages in SVD). New findings from 7T high-field MRI have contributed to the development of new criteria, such as the central vein in MS lesions, which can be also identified at 3 T. These findings determine the imaging strategy that needs to be adopted. This strategy also needs to take into account the MRI criteria to diagnose MS - the 2010 "McDonald criteria" - which are based on the demonstration of dissemination in space (DIS) and time (DIT) and after exclusion of alternative causes.
Learning Objectives:
1. To understand what white spots are.
2. To make differential diagnoses in brain white spots.
3. To demonstrate how to study patients with brain white spots.
Author Disclosure:
T.A. Yousry: Consultant; Biogen. Research/Grant Support; Biogen, Novartis, GSK.

A-656 14:30

B. How can I improve my reporting of T2-hyperintense lesions?

A. Rovira-Cañellas; *Barcelona/ES (alex.rovira@idi.gencat.cat)*

Focal white matter bright spots on T2-weighted images (BS) are commonly observed MRI abnormalities, not only in the elderly, but also in middle age subjects particularly those with migraine or chronic headache. In addition, a large list of different disorders should be considered in these patients as hypoxic-ischaemic vasculopathies, multiple sclerosis, primary and systemic vasculitis, and acquired metabolic and toxic conditions, among others. While it is recognised that a combination of findings from clinical history, physical examination, and laboratory tests is commonly required to correctly establish a firm and clear aetiological diagnosis, a detailed analysis of different MRI features should also be considered essential, e.g. lesions shape, size, and distribution; contrast-uptake; and associated structural lesions (microbleeds, infarctions, etc). Knowledge of these features, will assist the diagnostic workup of patients presenting with BS, and should be considered a first step to take full advantage of the potential of MRI, and in doing so should result in a reduced chance of misdiagnoses and facilitate the correct diagnosis of sometimes treatable disorders. Detailed description of these features and their interpretation must be translated into a written and structured radiological report, which should be accurate with inclusion of relevant positive and negative findings, and clinically focused, to properly assist with the further management of these patients. These standardised reports are more time-efficient than simply dictation, support analysis for research and decision support, and improve communication of radiology results, which has important clinical implications in the management of patients presenting with brain BS.

Learning Objectives:

1. To understand if it is possible to use a structured report with white brain abnormality.
2. To learn how to define a comprehensive imaging protocol for those patients.
3. To appreciate the role of modern imaging techniques for defining white brain hyperintense T2 lesions.

A-657 15:00

C. Is there a need for quantitative reporting of white matter lesions?

F. Barkhof; *London/UK, Amsterdam/NL (f.barkhof@vumc.nl)*

WM lesions are a coming ageing phenomenon and convey a bad prognosis. Patient with more than punctate WM lesions are at risk for decline in cognition, motor function and even mortality. The latter reflects a relationship to cardiovascular risk factors endangering other organs like the heart as well. In addition to a direct threat to the brain, WM lesions as a marker of cerebrovascular micro-angiopathy also accelerate other pathology, e.g. due to Alzheimer's disease. While visual rating of WM lesions has a value in clinical practice, rating scales underestimate the amount of damage, especially beyond the punctate state. Volumes of WM hyperintensities increase non-linearly with increasing pathology. Methods for quantification are evolving rapidly and becoming less computer intensive, though remained affected by choice of sequence. In addition to focal lesions, they can determine pre-lesional stages and lacunes and, therefore, better capture overall damage. Beyond focal WM lesions, quantitative analysis allows assessment of diffuse WM damage, for example using diffusion tensor imaging (DTI). Though related to focal WM lesions, the extent of WM damage revealed by DTI is much more extensive and correlates better with cognitive impairment and, therefore, should be a target for future clinical implementation, in combination with brain volume changes. Standardisation of DTI and brain volume changes remain an important issue to further development of comprehensive assessment of brain damage in the elderly.

Learning Objectives:

1. To understand the importance of quantitative analysis in white matter lesions.
2. To show how to perform the quantitative analysis.
3. To understand the importance of follow-up in in patients with white matter lesions.

Author Disclosure:

F. Barkhof: Advisory Board; Novartis, Biogen-IDEC, Roche, TEVA. Board Member; Radiology, Brain, Neurology. Consultant; Ixico. Research/Grant Support; Toshiba, Philips.

16:00 - 17:30 **Room A**

E³ - ECR Academies: Interactive Teaching Sessions

E³ 1621

Emergency radiology II

A-658 16:00

A. Brain trauma

M. Smits; *Rotterdam/NL (marion.smits@erasmusmc.nl)*

Neurotrauma is a major cause of death and disability and accounts for up to 10% of all emergency department visits. Most patients with head trauma are classified as having minor head injury, defined as no or brief loss of consciousness, amnaesia and a Glasgow Coma Score (GCS) of 13-15. Brain injury is, however, fatal in 10% of all head injury patients, while 5-10% suffer permanent serious neurological deficits. A further 20-40% of patients are left moderately disabled. CT is the modality of choice for assessment of brain injury in the acute setting, while MRI is more commonly used as a secondary modality in the subacute or chronic stage. Direct consequences of brain injury include fracture, contusion, haematoma and vascular injury, which are generally well known and easily appreciated. Findings of indirect consequences, however, such as herniation, brain swelling and vascular complications are sometimes subtle and easy to overlook. In this case-based presentation, I will outline the common findings of direct brain injury consequences and specifically focus on the less common findings of indirect consequences.

Learning Objectives:

1. To understand the different types of brain trauma.
2. To become familiar with the differential diagnosis.

A-659 16:45

B. Peripheral vascular injury

J. Ferda; *Plzen/CZ (ferda@fnplzen.cz)*

Penetrating vascular trauma is caused by direct vessel damage, exhibits the visible bleeding with an extensive blood loss. Blunt trauma injures vessels by crushing, distraction or shearing leads to dissection, thrombosis and consequent ischaemia and/or invisible bleeding. Unrecognised and uncontrolled haemorrhage can rapidly lead to the demise of the trauma patient. Unrecognised and untreated ischaemia can lead to limb loss, stroke and multiple organ failure. Proper imaging have to recognise the vascular injury and to decide if surgical or endovascular repair might be used. In injuries caused by high energy and/or high velocity, CT angiography is the method of choice to determine the site of active extravasation or the vessel occlusion even if the patient is in the condition of centralised circulation. Some bleedings are delayed after restoration of systemic blood pressure, especially in pelvic region. In low-energy low-velocity trauma, the development of the signs of vascular trauma could be hidden - ultrasound aims to detect the pseudoaneurysms as well as the intramural haematoma or thrombosis. The imaging of the bleeding artery or occluded vessel is crucial to consequent therapy. The injuries with tissue loss and destruction of the skeleton are preferably indicated to surgical treatment. Where it is possible to penetrate the injured segments by the wire, the endovascular approach is preferable, with the exception of the simple embolisation to stop bleeding. During the presentation will be shown the illustrative cases of penetrating injury, the blunt injury including the crossroads of imaging and treatment.

Learning Objectives:

1. To understand the different types of peripheral vascular injury.
2. To become familiar with the different imaging techniques.
3. To become familiar with interventional treatment options.

16:00 - 17:30 **Room B**

Abdominal Viscera

RC 1601

The spleen: the forgotten organ

A-660 16:00

Chairman's introduction

L.H. Ros Mendoza; *Zaragoza/ES (lhrosmendoza@gmail.com)*

The spleen has been considered as the forgotten organ of the abdominal cavity, nevertheless a wide range of diseases can affect the spleen. The finding of an incidental splenic mass is frequently encountered at imaging studies that are performed on patients for other reasons. Pathologic conditions

of the spleen can be classified into the following categories: congenital: accessory spleen, polysplenia and asplenia, true cyst; inflammatory: pyogenic abscess, fungal abscess, hydatid cyst, sarcoidosis; vascular: infarction, peliosis: haematologic: sickle cell disease, extramedullary haematopoiesis; posttraumatic: haematoma, false cyst; neoplastic: benign tumours: haemangioma, hamartoma, lymphangioma; malignant tumours: lymphoma, metastases, angiosarcoma. Other disease processes affect the spleen diffusely: Gaucher disease, portal hypertension, sickle cell disease. The findings in the different imaging techniques (ultrasound, computed tomography, and magnetic resonance imaging) of these splenic lesions are reviewed, considering three different scenarios: the incidental lesion, acute and chronic diseases, and malignant tumours, emphasizing the key differences that in many cases can help narrow the differential diagnosis. An imaging algorithm is proposed to ease the diagnostic workup in cases of incidental splenic lesions. In some cases these radiologic findings could have substantial overlap, which precludes the rendering of a specific diagnosis on the basis of imaging findings alone; in these instances correlation of radiologic features with clinical and histological findings is needed to confirm the diagnosis.
Session Objective:
1. To briefly introduce the diagnostic challenges imaging spleen.

A-661 16:05

A. Acute and chronic splenic disease
G. Zamboni; *Verona/IT (gzamboni@hotmail.com)*

The spleen can harbour different types of acute and chronic non-malignant disease. Congenital abnormalities include very common entities (e.g. accessory spleen) and rare conditions such as polysplenia and asplenia syndromes. Focal non-malignant diseases include cystic lesions, haemangioma, hamartoma, and abscess. Diffuse infiltrative non-malignant diseases include tuberculosis and siderosis. In addition, the spleen can undergo vascular diseases, with resulting infarction, and rupture, both traumatic or spontaneous.
Learning Objectives:
1. To describe the most common causes of acute and chronic splenic disease, excluding malignant lesions.
2. To define imaging protocols, including functional and metabolic techniques, to apply for the detection and characterisation.

A-662 16:28

B. The incidental splenic lesion
M. Laniado; *Dresden/DE (michael.laniado@uniklinikum-dresden.de)*

Incidental findings are defined as lesions detected by CT, MRI, or another imaging modality performed for an unrelated reason. The overall reported prevalence is around 30% for CT, and 25% if the initial diagnosis involves the genitourinary and gastrointestinal tract. About 20% of incidental findings are located in the abdomen. The frequency of either clinical follow-up or clinical confirmation accounts for approximately 65% and 45%, respectively. Compared to other abdominal viscera, incidental findings in the spleen have not been evaluated in great detail. Few available data in the literature report a low prevalence of less than 2% for splenic granulomas, haemangiomas, cysts, abscesses, etc. Unfortunately, both incidentally detected and other splenic lesions often show overlapping imaging features. Therefore, differentiation of benign lesions from indeterminate or malignant lesions may be a challenge. On the other hand, most isolated splenic lesions are benign and without clinical relevance. To further characterise incidentalomas of the spleen, clinical correlation (e.g. pain, fever, immunocompromised state, neoplasm, trauma) and other imaging findings (e.g. liver lesions, lymphadenopathy) are often the key to diagnosis. It is essential for the radiologist to know how to deal with splenic incidentalomas, namely what should be written in the report and when additional studies have to be recommended. This issue will also be addressed in the presentation.
Learning Objectives:
1. To describe the most common causes of splenic incidentaloma and their imaging appearance.
2. To define imaging protocols, including functional and metabolic techniques, for the differential diagnosis.
3. To propose an algorithm for the management of incidental splenic lesions.

A-663 16:51

C. Malignant lesions
S. Gourtsoyianni; *London/UK (sgty76@gmail.com)*

Malignant splenic lesions are quite rare; however, incidentally picked up splenic lesions on cross-sectional imaging performed in patients with suspected or known malignancy certainly pose a diagnostic challenge. Most common malignant lesion of the spleen is lymphoma, primary or secondary. In Hodgkin disease splenic involvement results in up-staging while in non-Hodgkin lymphoma if spleen is the predominant site of involvement therapeutic approach might change, thus degree of splenic involvement influences treatment and prognosis. Imaging appearances of malignant splenic lesions, including besides lymphoma, angiosarcoma, leiomyosarcoma and metastases can overlap and imaging alone is not adequate for accurate characterisation in all cases. Percutaneous image-guided biopsy of the spleen using 18 gauge needles or smaller has a reported high diagnostic accuracy and a complication rate similar to that reported for liver and kidney rendering it a better alternative to splenectomy.
Learning Objectives:
1. To describe the clinical presentation and imaging findings for focal and diffuse neoplastic malignant lesions.
2. To discuss the indication of splenic lesion biopsy and its diagnostic contribution.

17:14
Panel discussion: How to manage incidental findings in clinical routine practice

16:00 - 17:30 **Room C**

E³ - ECR Academies: Modern Imaging in Colorectal Cancer

E³ 1618

Rectal cancer: staging and restaging local disease

Moderator:
D.-M. Koh; Sutton/UK

A-664 16:00

A. Transrectal ultrasonography
J.E.R. Waage; *Hillerod/DK (dr.waage@gmail.com)*

Transrectal ultrasonography (TRUS) is, alongside MRI, the method of choice for local tumour staging (T-staging) of rectal cancer. Although MRI is able to identify the mesorectal fascia and thus more useful in addressing the need for neoadjuvant radiotherapy, TRUS is equally accurate in predicting advanced T-stages and superior at assessing early rectal cancer. In patients where MRI is contraindicated, TRUS is the only accurate staging modality. The two methods are supplementary, and both modalities should ideally be used in all rectal cancer patients to aid treatment decision in multidisciplinary teams (MDTs). TRUS can be obtained and saved as 2D images, as video-loops or as 3D volumes. The use of 3D TRUS alongside MRI can arguably improve MDT treatment decisions, but no prospective study has evaluated the added value of both modalities in this setting. TRUS elastography has been shown to further improve TRUS assessment of early rectal cancer, and in the future additional technological advances such as contrast-enhanced ultrasonography and image fusion of TRUS and MRI might further improve staging. Restaging after chemoradiotherapy is currently unreliable for any single imaging modality, but the combination of MRI and TRUS to assess overall tumour regression and total responders, respectively, might provide clinically useful information.
Learning Objectives:
1. To understand the role of TRUS for staging rectal tumours.
2. To become familiar with new TRUS techniques.
3. To learn about TRUS for restaging of rectal cancer.

A-665 16:30

B. Emerging MR-techniques
D.M. Lambregts; *Amsterdam/NL (doenja.lambregts@gmail.com)*

MRI is one of the main tools used for the staging of rectal cancer. Moreover, the use of MRI for restaging of tumour after neoadjuvant treatment is increasingly adopted in clinical practice. Aim of this lecture is to discuss current state of the art MR protocols, evaluate the main strengths and weaknesses of MRI in the (re-)staging of rectal cancer and highlight how functional imaging techniques such as diffusion-weighted MRI may be used in daily radiological practice.
Learning Objectives:
1. To understand which MR sequences are used in clinical practice.
2. To become familiar with new imaging techniques used in rectal cancer.
3. To learn about how to use DWI for restaging of rectal cancer.

A-666 17:00

C. Multiparametric assessment of treatment response
N. Papanikolaou; *Stockholm/SE (npapan@npapan.com)*

Magnetic resonance imaging is the primary imaging modality for (re)staging patients with rectal cancer. The main advantage of MRI is the rich soft tissue contrast that can provide with comprehensive information. Multi-parametric MRI (mpMRI) is the combination of techniques providing anatomical and

physiology-related information. Usually, anatomical information can be obtained by T2-weighted images, while diffusion imaging can probe tissue microarchitecture changes and perfusion imaging may quantify microvascular tumour properties. It has been shown that chemoradiation treatment response may be complete in up to 25%, moderate in about 50% and poor in 25% of the cases. Therefore, it is of paramount importance to develop predictive imaging biomarkers that could efficiently guide therapeutic strategies depending on tumour phenotype. mpMRI may have an important role on predicting therapeutic outcome and the incidence of local recurrence. Diffusion-related metrics have been utilised, with various degrees of success, including apparent diffusion coefficient (ADC) measurements. Pre-treatment, Post-treatment as well as the relative changes of tumoural ADC values have been investigated as potential biomarkers, however, with variable results. Tumour volume as identified on heavily diffusion images was also used to predict treatment response but in a limited number of studies. On the other hand, both qualitative and quantitative perfusion-related parameters like Wash-In, Wash-Out, AUC, Ktrans were investigated both with small size paramagnetic contrast agents, as well as blood-pool agents. Recently, magnetization transfer ratio was shown to be an accurate imaging biomarker to quantitatively assess the amount of fibrosis on post-chemoradiotherapy exams.

Learning Objectives:
1. To understand the rationale behind multiparametric imaging in rectal cancer.
2. To learn how to approach images in a multiparametric setting.
3. To get an overview of available software platforms.

Author Disclosure:
N. Papanikolaou: Owner; N. Papanikolaou & Associates LP.

16:00 - 17:30 **Room Z**

Joint Session of the ESR and ESTRO

MR and MR/PET in radiation treatment planning - challenges and opportunities

A-667/A-668 16:00

Chairmen's introduction
K. Riklund; *Umeå/SE (katrine.riklund.ahlstrom@umu.se)*

V. Valentini; *Rome/IT (vvalentini@rm.unicatt.it)*

The session will be focused on providing the audience about the contribution of multimodality/hybrid imaging and in-room imaging to define tumour extension to optimise radiation oncology treatment and to drive treatment strategies for the cure of the tumour and improving the quality of life of the patients.

Session Objectives:
1. To learn about the contribution of multimodality/hybrid imaging and in-room imaging to define tumour extension to favour optimisation in radiation oncology treatment.
2. To understand the feasibility of multimodality/hybrid imaging and in-room imaging to optimise radiation oncology treatment.
3. To appreciate the role of multimodality/hybrid imaging and in-room imaging to drive treatment strategies for the cure of the tumour and for the quality of life of the patients.
4. To become familiar with the clinical need of multidisciplinary specialists to position the role of imaging as pivotal in modern oncology.

A-669 16:03

The benefit of high tesla MRI for radiation oncology planning
U. van der Heide; *Amsterdam/NL (u.vd.heide@nki.nl)*

Radiotherapy sets itself apart from other treatment modalities by its capacity to modulate the treatment dose spatially. Complex dose distributions are feasible so that macroscopically visible tumour is irradiated to a high dose, subclinical disease to a lower dose, while sparing healthy structures. High-precision delivery of such dose distributions requires visualisation of the anatomy at the time of treatment. The high and versatile soft tissue contrast of MRI at 1.5 and 3.0 T is particularly useful to delineate the tumour and surrounding organs for treatment planning. Integration of MRI with the radiation device results in optimal precision in irradiation of the target volume. 'Beam-on imaging', i.e. imaging during irradiation, makes it possible to monitor changes in the anatomy due to organ motion. By treating only when the target volume is in the right position, or by tracking a moving tumour, the precision of dose delivery is further enhanced. With such MRI-guided radiotherapy systems we expect to improve treatment results particularly in those areas where high soft tissue contrast is required to visualise the tumour, and where internal organ motion makes beam-on imaging of the anatomy necessary.

Learning Objectives:
1. To learn about the contribution of MRI and in-room MRI to define tumour extension and organ-at-risk movements to favour optimisation in radiation oncology treatment.
2. To understand the benefit of MRI in-room to optimise radiation oncology treatment.
3. To appreciate the role of MRI and in-room MRI to drive treatment strategies for the cure of the tumour and for the quality of life of the patients.

Author Disclosure:
U. van der Heide: Research/Grant Support; Elekta AB, Sweden. Speaker; Philips Healthcare, the Netherlands.

A-670 16:23

The challenge of in room MRI for treatment delivery
N. Dinapoli; *Rome/IT (nicola.dinapoli@rm.unicatt.it)*

Image-guided radiotherapy has been developed in last two decades as a paradigm for increasing precision in treatment delivery and reducing margin to be applied to the target, so reducing the probability of sequelae after treatment. The adoption of MR is the last frontier for in-room monitoring process. Clinical use of MR in this setting has being introduced very recently with MR-cobalt machines and is being developed is association with LINAC devices. Technical issues have been solved due to the need to associate MR equipment and electronic needed for the delivery of radiation treatment. The expectations from clinical adoption of these devices are very high because of the possibility to monitor the anatomy of the patients (and relative position of tumour and organs at risk) with previously not conceivable accuracy levels. Furthermore, the use of such imaging devices will provide the possibility to achieve more data about tumour response and/or changes of organs at risk during treatment, that could allow to develop new models able to predict the treatment outcome with higher accuracy and reliability.

Learning Objectives:
1. To learn about the limitations to defining tumour extension and organ-at-risk movements to favour optimisation in radiation oncology treatment.
2. To understand the constraints of optimising radiation oncology treatment.
3. To appreciate the uncertainties of driving treatment strategies for the cure of the tumour and for the quality of life of the patients.

Author Disclosure:
N. Dinapoli: Research/Grant Support; Varian Medical System Inc. Speaker; ESTRO (European Society for Radiotherapy & Oncology).

A-671 16:43

The benefit of MR/PET in radiation oncology
U. Nestle; *Freiburg/DE (ursula.nestle@uniklinik-freiburg.de)*

The availability of MR/PET offers multiple chances for radiation oncology. Like in PET/CT, identical patient position contributes to high-precision treatment planning. This is of special value for targets with low visibility in CT, excellent diagnostic depiction by MRI and simultaneous benefit by PET imaging, like but not limited to tumours of the upper abdomen, prostate and brain. In addition, movement information can be derived from both methods supporting modern radiotherapy planning and application techniques. Moreover, highly interesting biological information can be expected from the simultaneous acquisition of various molecular imaging data by PET and molecular MRI. Extensive collection and thorough evaluation of the diagnostic literature from the point of view of radiation oncology will be needed to explore these chances for new target volume concepts, treatment planning and adaptation and follow-up, together with clinical trials and database analyses evaluating the benefit of the new technology for the future.

Learning Objectives:
1. To learn about the contribution of MR/PET to defining tumour extension and organ-at-risk movements to favour optimisation in radiation oncology treatment.
2. To understand the benefit of MR/PET for optimising radiation oncology treatment.
3. To appreciate the role of MR/PET in driving treatment strategies for the cure of the tumour and for the quality of life of the patients.

A-672 17:03

The challenge of using MR/PET in radiation oncology
E.-M.B. Larsson; *Uppsala/SE (elna-marie.larsson@radiol.uu.se)*

High-precision radiation therapy requires exact delineation of the tumour volume and the adjacent organs at risk. This may be a challenge when MR/PET is used for radiation dose planning. The visually appreciated tumour border may vary between different morphological and physiological MRI sequences and may in addition not coincide with the increased uptake seen on PET using different tracers. Quantifying imaging data may introduce further differences. Thus, a better understanding of the biological implications of the different imaging findings is needed to perform accurate multi-modality-based delineation. MR and PET images are registered to obtain spatial agreement,

which is easiest for the head and extremities, but may be problematic for moving organs, e.g. in the thorax and abdomen, if simultaneous MR/PET scanning is not performed. The MR images have higher resolution than the PET images. In addition, the MR images may be geometrically distorted due to magnetic field inhomogeneity caused by technical problems, patient configuration (e.g. neck region) or by artefacts from metal implants and inherent air spaces (e.g. paranasal sinuses, lungs). Patient motion also degrades the image quality and registration accuracy. Hardware modifications to allow direct correlation between imaging and treatment equipment geometry, such as a flat tabletop and immobilization devices, prevent the use of ordinary receiver coils for MRI leading to inferior image quality. Also, these devices may be problematic to accommodate in an MR/PET scanner with a smaller bore due the PET insert. Successful integration of MR/PET into radiation treatment planning thus requires multidisciplinary close collaboration with involvement also of radiologists.

Learning Objectives:

1. To learn about the limitations of MR/PET in defining tumour extension and organ-at-risk movements to favour optimisation in radiation oncology treatment.
2. To understand the constraints of MR/PET in optimising radiation oncology treatment.
3. To appreciate the uncertainties of MR/PET in driving treatment strategies for the cure of the tumour and for the quality of life of the patients.

17:23
Discussion

16:00 - 17:30 **Room O**

Joint Session of the ESR, EFSUMB and ESPR

Contrast enhanced ultrasound (CEUS) in paediatrics

Moderators:
M. Claudon; Vandoeuvre-les-Nancy/FR
C. Owens; London/UK

A-673 16:00

Legal issues with CEUS in children

P.S. Sidhu; *London/UK (paulsidhu@btinternet.com)*

The legal position with regards to administering off-label drugs to both adults and children is clearly defined by the national medical regulatory authorities. In the case of children further advice is forthcoming from the paediatric medical bodies, and in the United Kingdom, this is detailed in documentation issued by the Royal College of Paediatrics and Child Health. Currently 69% of drugs administered to children in the hospital setting are off-label and the use is sanctioned by the legal obligations of the prescribing physician to provide best possible care to the child patient. With the campaign to image gently, avoiding CT examinations in children, ultrasound is the ideal child friendly modality to reduce radiation dose. Contrast-enhanced ultrasound (CEUS) in adults is a well-established technique that is safe and informative, used widely and often off-label. Use in children is expanding with many physicians quick to appreciate the usefulness of the technique with rapid and accurate diagnosis possible. This talk will detail the evidence for off-label use of drugs generally in the child, and detail the role of the sonographer in using CEUS in the child. The legal position will be stated as currently understood.

Learning Objectives:

1. To understand the current status of unlicensed drug therapy in children.
2. To understand the legal position of prescribing unlicensed drugs in children.
3. To understand the responsibilities of performing CEUS in children.

Author Disclosure:
P.S. Sidhu: Speaker; Bracco SpA, Hiachi Inc, Siemens AG, General Electric.

A-674 16:18

CEUS of focal liver lesions in children

M. Sellars; *London/UK (maria.sellars@nhs.net)*

This presentation aims to display the spectrum of CEUS imaging findings of common and uncommon paediatric focal liver lesions, with computed tomography (CT) or magnetic resonance (MR) correlation. The role of CEUS in the detection, characterisation, and follow-up of these lesions in paediatric patients with acute and chronic liver disease will also be emphasised. CEUS findings of paediatric primary and secondary liver tumours will be described, with examples typical of the paediatric population, such as haemangioendotheliomas and hepatoblastomas, and others more common in adults including haemangiomas, focal nodular hyperplasia (FNH), nodular regenerative hyperplasia (NRH) and hepatocellular adenoma; focal areas of fatty sparing or infiltration and liver abscess will also be illustrated.

Learning Objectives:

1. To illustrate the spectrum of focal liver lesions in the paediatric population.
2. To understand the role of CEUS in the diagnostic pathway of children with chronic liver disease.
3. To review CEUS findings of common and uncommon benign and malignant focal liver lesions in children.

Author Disclosure:
M. Sellars: Speaker; Bracco, Spa, Milan.

A-675 16:36

CEUS in blunt abdominal trauma in children

A. Deganello; *London/UK (adeganello@nhs.net)*

CEUS has proved to be a reliable and useful tool in the assessment of abdominal trauma in the adult population, as it provides detailed evaluation of parenchymal, capsular and vascular injuries. The use of CEUS is a recognised asset in the characterisation and detection of focal liver lesions; however, its off-label applications are expanding, and the study of solid abdominal viscera traumatic injuries is becoming well established, especially in Europe. This is most relevant in the paediatric population, where the strive to reduce radiation exposure gives CEUS an increasingly important role in this setting. CEUS can in fact depict active bleeding and post-traumatic pseudoaneurysm formation in the arterial phase, whereas in the portal venous and late phases it shows with accurate detail the extent of a parenchymal laceration, as the non-injured tissues enhance normally compared to the non-enhancing lesions. Trauma patients often need to be reassessed to monitor progression or ensure resolution of the injuries and CEUS becomes a valid, safe and readily available alternative to repeated computed tomographic (CT) imaging; this is crucial in the paediatric population where effective reduction of radiation exposure is paramount. The typical CEUS findings of hepatic, splenic, renal and pancreatic injuries will be described, including examples with CEUS/CT correlation.

Learning Objectives:

1. To illustrate the usefulness of CEUS in the setting of paediatric trauma.
2. To discuss the implications of repeated radiation exposure in children following trauma.
3. To review CEUS findings of the most frequent types of solid abdominal organ injuries occurring in children.

Author Disclosure:
A. Deganello: Speaker; Bracco.

A-676 16:54

CEUS in vesical reflux in children

C. Duran; *Sabadell/ES (cduran@tauli.cat)*

Contrast-enhanced voiding urosonography (ce-VUS) is an imaging technique in which ultrasound contrast agent (UCA) is introduced into the bladder; its main indication is to detect vesicoureteral reflux (VUR). Unlike the classical gold standard, voiding cystourethrography, ce-VUS does not irradiate the patient. However, various factors have hindered the widespread adoption of ce-VUS: UCAs are currently used off-label in children and they are expensive. Moreover, at first ce-VUS was considered unable to allow the correct study of the male urethra, so it became the first-line imaging examination for diagnosing VUR in girls but not in boys, in whom it was limited to follow-up. In 2007, it was demonstrated that transperineal ce-VUS could provide high-quality morphological images of the urethra, making it possible to diagnose the most prevalent conditions affecting the male urethra. Later, the unavailability of first-generation UCA forced radiologists to use second-generation UCA (off-label), and the technique had to be modified to enable obtainment of the same quality of images of the entire urinary tract. The protocol for the new technique had the added advantages of being easier and cheaper. Finally, official organisations recognised that ce-VUS enables the correct study of the urethra and diagnosis of the most prevalent conditions that affect the male urethra. In conclusion, ce-VUS should be the first choice for studying the lower urinary tract in children: it provides high-quality images, is safe, can diagnose the most prevalent conditions and uses no ionising radiation.

Learning Objectives:

1. To illustrate the protocol for the study of the urinary tract, including the urethra, with second-generation contrast agents.
2. To demonstrate the high quality of the images obtained with this procedure.
3. To show that voiding urosonography can diagnose the most prevalent urethral pathologies.

A-677 17:12

CEUS in non-liver indications in paediatric patients

C.F. Dietrich; *Bad Mergentheim/DE (Christoph.dietrich@ckbm.de)*

The European Federation of Societies for Ultrasound in Medicine and Biology (EFSUMB) introduced guidelines on the use of contrast-enhanced ultrasound (CEUS). CEUS indications and applications have been nowadays reported for nearly all organ systems also in paediatric patients. This part of the presentation focuses on comments, illustrations and examples of CEUS in

non-liver organs in children. Reports on numerous off-label extravascular or intracavitary administrations of contrast-enhanced ultrasound agents have been published. CEUS-guided percutaneous cholangiography and percutaneous abscess drainage and injection into non-physiological cavities have been reported, e.g. CEUS detection and classification of fistulas. Use of CEUS must be decided on a case-by-case basis, usually resorting to CEUS because of inconclusive standard diagnostic techniques. Off-label use (and its funding) is of utmost importance in paediatrics because many drugs are not evaluated in randomised trials in children. As a consequence such drugs are not specifically approved for use in children. This is also true for contrast agents used in CEUS. The off-label use of CEUS in paediatric patients illustrates the need to deal with unresolved legal issues while at the same time balancing this with the need for high diagnostic performance in daily clinical routine. To solve at least some of the problems related to off-label use, EFSUMB has decided to create a database (EFSUMB Scientific Corner) to collect the European experience in the use of CEUS in children. We kindly ask you to submit your cases for the EFSUMB Paediatric Registry Data Base (www.efsumb.org).

Learning Objectives:

1. To understand indications of CEUS beyond the liver.
2. To understand extravascular and intracavitary applications of CEUS (except vesical reflux).
3. To discuss off label use in children (and adults).

16:00 - 17:30 **Room N**

E³ - ECR Academies: Modern Cardiac Imaging

E³ 1620

Cardiac imaging: to new horizons

Moderator:
E. Mousseaux; Paris/FR

A-678 16:00

A. New approaches for coronary atherosclerotic plaque characterisation
E.J.R. van Beek; *Edinburgh/UK (edwin-vanbeek@ed.ac.uk)*

The imaging of coronary atherosclerosis has gradually moved from a morphological assessment of stenosis estimation, to a functional assessment using fractional flow reserve. CT has shown to be superior in establishing the extent of plaque compared to invasive angiography of the vessel lumen. Furthermore, CT is able to determine plaque composition and is showing promise for determination of fractional flow reserve non-invasively. MRI is highly capable of assessing functional myocardium and perfusion, but thus far lags behind in depiction of coronary artery disease. What has been lacking until recently was the assessment of the vulnerability of plaque to rupture, causing an acute coronary event. Recent applications of 18 F-sodium fluoride (!8 F-NaF) have suggested that it is feasible to detect plaque that is most likely to rupture. The process behind this functional plaque behaviour relates to a chronic inflammatory component, ultimately resulting in deposition of calcium. In the relatively early phases of this process, the plaque is unstable, while later on, the plaque becomes progressively stable and calcified. This lecture will demonstrate how the combination of PET-CT is able to demonstrate these features, and will indicate how PET-MRI may offer novel approaches to functional plaque assessment.

Learning Objectives:

1. To appreciate the importance of atherosclerotic plaque characterisation with imaging.
2. To learn about developments of PET/CT and MR/PET applications for coronary plaque imaging.
3. To become aware of new research directions in this field and their possible significance.

Author Disclosure:
E.J.R. van Beek: Advisory Board; Vital Images. CEO; Quantitative Clinical Trials Imaging Services Ltd.

A-679 16:30

B. Imaging of microvascular disease
R. Manka; *Zurich/CH (robert.manka@usz.ch)*

Cardiovascular disease is the leading cause of death in the western world. Women are more likely than men to have non-obstructed coronary arteries in presence of chest pain symptoms. Coronary microvascular disease (CMD) is defined as impaired coronary flow reserve owing to functional abnormalities of the microcirculation and is associated with an adverse cardiovascular prognosis. Imaging modalities such as positron emission tomography, transthoracic echocardiography and cardiovascular magnetic resonance imaging can be used to assess the microcirculation in patients before and after treatment.

Learning Objectives:

1. To learn about pathophysiology of coronary circulation in microvascular disease.
2. To appreciate the significance of imaging of microvascular disease in a clinical setting.
3. To learn about advantages, limitations and further perspectives of cardiac imaging in this pathology.

A-680 17:00

C. Tracking of stem cells in cardiac repair: role of MR and hybrid imaging
L. Natale; *Rome/IT (lnatale@rm.unicatt.it)*

Stem cells therapy has a promising potential role for therapy of acute ischaemic myocardial injury and chronic ischaemic heart disease, as well as of paediatric cardiomyopathies. Preliminary studies have been conducted and published using factors able to mobilise endogenous stem cells, as granulcyte colony stimulating factor (G-CSF) administration, leading to contradictory results In these studies, MRI has been used not to monitor stem cells localisation in the infarcted area, but to assess their effects in terms of systolic function. More recently many studies have been published focusing on direct tracking of stem cells in the injured myocardium of experimental animal models, using MRI or hybrid imaging (PET/CT, MR/PET, SPECT/CT). MRI alone has been employed by means of super-para-magnetic iron oxide particles (SPIO) labeled stem cells and T2 weighted imaging. In PET and SPECT hybrid approach a variety of tracers have been used to label stem cells, while and MRI and CT have been employed to assess the infarct area (MRI late enhancement) or the perfusion defect (perfusion CT). Both approaches represent a potentially very useful tool to track the stem cells localisation in the infarcted area. The most recent studies will be discussed.

Learning Objectives:

1. To become familiar with the application of cardiac stem cells therapy.
2. To become familiar with techniques for stem cell labelling with radionuclide and magnetic tracers.
3. To learn about the use of hybrid imaging for the assessment of cardiac repair and remodelling during therapy with stem cells.

16:00 - 17:30 **Studio 2016**

Multidisciplinary Session

MS 16a

Uterine myomas: radiological diagnosis and treatment

A-681 16:00

Chairman's introduction
A.-M. Belli; *London/UK (Anna.Belli@stgeorges.nhs.uk)*

Uterine fibroids are the commonest benign pelvic tumour affecting women during their reproductive life. Symptoms range from menorrhagia to pressure on the bowel or bladder. The standard treatment has been hysterectomy and fibroids have been the single commonest indication for hysterectomy in most European countries. This has cost implications for healthcare with regard to not only the cost of the surgery, but the lost time from work. In addition, many women, even when reproduction is not required, associate their womb with femininity and prefer to avoid hysterectomy if there are other options. Alternatives to hysterectomy include myomectomy, transabdominal or laparoscopic, which are no longer considered the preserve of women seeking fertility. Minimally invasive radiologically guided therapies (uterine artery embolisation and HIFU) have been shown to be safe and effective. Imaging diagnosis is essential. This is initially done by ultrasound, but diagnosis of pathologies that mimic fibroid symptoms may require MR. Although malignancy is rare, if MR is inconclusive, surgical removal is a better option. In addition, MR gives gynaecological surgeons and interventional radiologists information about the number and location of fibroids, the size and appearance of the uterine cavity, their vascularity and source of arterial supply. It also provides useful post-procedural information with regard to extent of infarction following radiologically guided treatment. Although there is evidence that fertility is not impaired by UAE or HIFU, it is not clear whether the complication rate is increased or whether surgery is advantageous for fertility by removing the bulk of the fibroids.

Session Objectives:

1. To learn about the imaging characteristics of fibroids before and after treatment.
2. To understand the information required by gynaecologists and interventional radiologists from imaging.
3. To learn about the different therapeutic options and their outcomes.
4. To understand the impact of fibroids and the different treatment strategies on fertility.

A-682 16:05

Imaging of fibroids

R. Das; *London/UK (Raj.Das@stgeorges.nhs.uk)*

Uterine artery embolisation is now an established and effective technique in the management of uterine fibroid disease. Incorporating a management protocol of performing a contrast-enhanced MRI (CE-MRI) pelvis prior to embolisation, followed by a 6-month follow-up CE-MRI enhances patient management decisions and guides our pre-procedure and follow-up consultations with the patient, both in IR and gynaecology. Interpretation of the preprocedural MRI involves: evaluation of site, number and size of uterine fibroids; uterine size and dominant fibroid size and position; notable subserosal or submucosal fibroids that may alter management; enhancement of the total fibroid burden; endometrial cavity and cervical evaluation; junctional zone thickness and presence of concurrent adenomyosis; ovarian evaluation and presence of lymphadenopathy or alternative pathology. MR angiography (MRA) with evaluation of the uterine arterial anatomy and ovarian arterial anatomy is also essential for feasibility and planning of embolisation. This presentation will evaluate common and expected appearances of fibroid disease, relation to interventions and management; adenomyosis and endometriosis; atypical fibroid appearances and concurrent pathology. Post-uterine fibroid embolisation, CE-MRI is a valuable tool both in the routine follow-up after surgery or embolisation and also in the evaluations of complications.

Learning Objectives:

1. To describe imaging characteristics of fibroids.
2. To differentiate from other relevant pathology including malignancy.
3. To report the information required by the gynaecologist before and after surgical and radiological intervention.

A-683 16:25

Epidemiology, clinical presentation and non radiological therapeutic options for the treatment of fibroids

I. Manyonda; *London/UK (imanyond@googlemail.com)*

Fibroids are the commonest tumour in women of reproductive age (refs). Their increasing importance in the developed world lies in the changing demography in childbirth - due to career aspirations and other factors women are increasingly postponing childbirth to their mid-to-late thirties and forties. This is an age when fibroids are more prevalent and more symptomatic. The old adage "children then fibroids and then hysterectomy" no longer works for many a modern woman. Therefore, the demand for fertility-preserving treatments is likely to increase. There has been an increase in the repertoire of uterus-preserving treatments: uterine artery embolisation for the treatment of fibroids was first reported some 20 years ago, and now "NICE" recommends it as an alternative treatment to hysterectomy and myomectomy. Focused ultrasound surgery is slow in gaining momentum, mainly because of the prohibitive costs of setting up a service, and also because of the limitations of its effectiveness for large and/or numerous fibroids. Ulipristal acetate has emerged as the "first in class" medical therapy for fibroids, and while it was originally introduced as a pre-myomectomy treatment, it has recently acquired a license for use as a stand-alone treatment for symptomatic fibroids. In reality, when the uterus is to be preserved, myomectomy, especially the open abdominal approach, remains the mainstay therapy. There is a huge controversy whether fibroids cause subfertility, but current consensus is that intracavitary and submucous fibroids, and those fibroids that distort the uterine cavity, can compromise fertility and their removal enhances fertility potential.

Learning Objectives:

1. To describe the clinical presentation of fibroids.
2. To describe the medical and surgical treatment options and their outcomes.
3. To describe what is known about the impact of fibroids on fertility and how these treatments impact on this.

A-684 16:45

Radiological treatments for fibroids

A.-M. Belli; *London/UK (Anna.Belli@stgeorges.nhs.uk)*

Patients with symptomatic fibroids may undergo radiologically guided treatments such as uterine artery embolisation (UAE) or MR-guided high-intensity focussed ultrasound (HIFU) depending on their anatomical suitability. UAE is rarely technically contraindicated so long as there is identifiable arterial supply to the fibroids and no history of contrast allergy. The technique is identical for solitary or multiple fibroids irrespective of their location. HIFU on the other hand requires that 5 or fewer fibroids to be present, no larger than 10 cm in diameter and accessible to the US beam. Sensitive structures such as the bladder or bowel loops need to be displaced from the beam to avoid injury. Scar tissue should be avoided. Contraindications to either procedure include infection, refusal to consent for hysterectomy under any circumstances, pregnancy and suspected malignancy. Current evidence on outcomes confirms that both techniques improve quality of life and are safe, efficacious and cost effective. One of the problems of all uterine preservation techniques is that future fibroids may develop, or residual untreated fibroids may grow and cause symptoms to recur. Patients and clinicians need to understand the expected course of events following embolisation or HIFU, and how to recognise complications both clinically and on imaging. Either US or MR may be used to image the uterus following treatment.

Learning Objectives:

1. To describe the radiological treatment options of uterine artery embolisation and HIFU.
2. To present the current evidence on outcomes.
3. To describe how to manage expectations and complications.

17:05

Multidisciplinary case discussion

16:00 - 17:30 **Room L8**

EuroSafe Imaging Session

EuroSafe 4

You too can definitely do audits

A-685 16:00

Chairman's introduction

E.J. Adam; *London/UK (drjaneadam@gmail.com)*

Radiologists' participation in appropriate clinical audit is not only desirable, but is becoming mandatory. The process may be new and unfamiliar for many radiologists, but the ESR has produced simple tools and templates to make it easy and straightforward to start auditing against attainable safety standards in any radiology department.

Session Objectives:

1. To learn how to introduce an effective clinical audit programme.
2. To introduce the ESR audit tool as an aid to improving quality in radiology services.
3. To explore how the use of such a system will satisfy external authorities.

A-686 16:05

Experience from an established national programme

D. Remedios; *Harrow/UK (denis.remedios@imperial.ac.uk)*

Clinical audit, a requirement for all healthcare professionals in the UK for 20 years, goes beyond compliance with governance standards to quality improvement and providing proof of quality. The concept of an aspirational standard well beyond the mandatory requirement has facilitated improvement by individuals, facilities and regions. No project is too small. Utilising local internal audit, a 4-hour session may provide the data to show underperformance, stimulate change through the innate wish to improve and demonstrate such improvement through subsequent audit cycles in an upward spiral for quality and safety. The six dimensions of quality in healthcare may be addressed: safety, effectiveness, patient-centred care, timeliness, efficiency and equity. Better, uniform practice nationally may be encouraged through internal audit with external direction, better known as national audits, usually led by professional organisations such as the UK medical Royal Colleges such as the Royal College of Radiologists. National audits in their simplest form address organisation, e.g. hospital paediatric radiology services, provision of MRI/US services. Process audit improves ways of working, e.g. appropriate imaging, cancer staging and use of a safety checklist. Outcome audit will have an effect on patients' health but is the most difficult to perform, e.g. UK Nephrostomy Audit. The wish to improve in all of us drives up performance closing the gap between best and everyday performance.

Learning Objectives:

1. To learn how an established national clinical audit programme can work effectively.
2. To learn how to design, run, and publish audits.
3. To understand the benefits of local clinical audit.

A-687 16:30

The challenges of introducing a national audit programme

A. Vargha; *Hidegség/HU (varghaandras@gmail.com)*

The wish to perform high-quality everyday work is a basic issue for all radiologists. However, difficulties can arise when individuals alone try to perform a kind of quality management. Should they be consultant radiologists or big department leaders without having a uniform national practice sometimes more conflicts come than benefit. The fast development in some countries, e.g. in Hungary on one hand is good but on the other hand problems can occur when the installed new technique stands alone without a new professional milieu including individual matters which may differ in countries.

Reimbursement systems might also act against quality. The "pay per result" systems gain the "making more examinations philosophy" instead of high performance both technically and during reporting. In the end all stakeholders loose. The patients are unsatisfied, the doctors burn out and it all costs a lot for the state without having the required results. Clinical audit could be a good base for organising national-level quality management in healthcare. To learn from the unsuccessful steps and unnecessary turfs may help to perform better in the future when organising a national audit program.
Learning Objectives:
1. To highlight which kind of critical issues could occur on a national level during implementing an international (EU) guideline for clinical audit.
2. To understand ways to avoid unnecessary turf battles.
3. To appreciate how to set up a realistic plan for clinical audit implementation in radiology.

A-688 16:55

How to make audit easy: the ESR Audit Tool
P. Cavanagh; *Taunton/UK (petecavanagh@gmail.com)*

Clinical audit is an important tool in improving the quality of a radiology service. The European Commission (EC) Euratom Directive states that Clinical audit should be carried out in relation to nuclear medicine, diagnostic radiology using ionising radiation. Thus, carrying out Clinical audit in line with national processes is a statutory duty. This presentation will introduce the ESR's newly developed web-based tool that will aid individual departments to introduce a clinical audit programme by selecting appropriate processes to audit as well as providing advice on how to undertake effective audit.
Learning Objectives:
1. To learn about the ESR Clinical Audit Tool.
2. To understand how it can be used at local and national levels.
3. To explore what makes clinical audit an effective quality improvement tool.

17:20
Panel discussion

16:00 - 17:30 **Room E1**

Multidisciplinary Session

MS 16b
Sports injuries: diagnosis and management

A-689 16:00

Chairman's introduction
M. Padrón; *Madrid/ES (mario.padron@clinicacemtro.com)*

Imaging plays an increasing role in the diagnosis and management of sports injuries, aiding injury grading, prognosis and guiding therapy. These processes apply equally to elite and recreational athletes. Understanding the relevance of imaging findings is easier when accompanied by an adequate clinical information and knowledge of the biomechanics and pathological processes involved in injury formation. Working in sports imaging means team effort, whereby sports physicians, physical therapists, orthopaedic surgeons and radiologists work closely together. Diagnostic imaging plays an essential role in this process.
Session Objectives:
1. To understand the point-of-view of the different actors involved in a sport injury based on personal experiences.
2. To learn how to focus on a sport injury with a multidisciplinary approach.
3. To review actual concepts on diagnosis and management of sports injuries.

A-690 16:05

What does the radiologist offer?
C. Faletti; *Turin/IT (falettic@atlink.it)*

To have a significant role in the management of sports injuries, the radiologist needs to know on the one hand the various techniques that can be adopted in the assessment of injury and on the other he must be familiar with the mechanisms that cause injuries, so he can apply, according to a standardised protocol, the various imaging techniques. X-rays, US and MRI are the modalities more frequently used. Single diagnostic technique must be applied of course in relationship to the modalities and timing of onset of the trauma as well as its site, be it muscle, tendon, joint or mixed. The report, drawn up on the basis of the correct detection of the lesion, must be adapted according to recognised international standards parameters in different pathologies and correlated with the specific sports activity carried out by the athlete. Diagnostic imaging also plays an important role not only in the follow-up, but also in helping with treatments, especially US guided, to solve various alterations caused by trauma to muscles-tendons and joints, both in acute and chronic phase.
Learning Objectives:
1. To become familiar with the specific role the radiologist has in the management of sports injuries.
2. To understand the relative importance of what should be and should not be included in the radiological report.
3. To understand the role of imaging-guided intervention in the management of sports injury.

A-691 16:20

How I face a sport injury: the sport physician's approach
J.-M. Alonso; *Doha/QA*

The Sports and Exercise Medicine (SEM) Physician faces injuries thousands of times throughout a professional career. A needed skill of SEM physicians is to respond quickly to common but difficult scenarios by training and practicing the necessary competencies in stressful situations. The injuries can be generally presented acutely or gradually. As team physicians we should be able to respond promptly and efficiently to acute injuries such blunt traumas, fractures, dislocations or acute soft-tissue sprains and strains. Overuse injuries pose also important demands to the clinician. The identification of the anatomical site is of paramount importance. In all situations and as much as thorough as possible, history should be completed which is not always an easy thing to do. The collection of data of injury mechanism is key and, in some instances the team physician him/herself witnesses the injury on the sideline. A systematic physical exam will lead the SEM physician to complete an analysis and working diagnosis that will lead to the decision of the most appropriate investigation. The multidisciplinary collaboration with radiologists will help to take the most of any imaging technique to confirm diagnosis. The use of diagnostic ultrasound has become a common scenario and more and more MRIs are being used to help the diagnosis of the most common muscle and tendon injuries. SEM physicians usually implement early rehabilitation steps to minimise the pain and the injury and to speed to rehabilitation process enabling the athletes to return to play as earliest as possible.
Learning Objectives:
1. To identify the injury mechanism.
2. To localise which anatomic structures are affected.
3. To select and indicate the appropriate imaging techniques.

A-692 16:35

The physiotherapist's view
A. Zerolo; *Madrid/ES (info@dfisio.com)*

The physiotherapist's view about how a radiologist (or a sports doctor capable of doing US scans) and an ultrasound system can help the physiotherapist with their treatment decisions on Golf Professionals at the European Tour of Golf. How important it is to have a radiologist on site in a golf tournament for injury prevention and diagnosis?
Learning Objectives:
1. To become familiar with the specific role the physiotherapist has in the management of sports injuries.
2. To understand the aspects of the radiological report which are most important to the physiotherapist.
3. To understand how the radiologist goes on to influence the management of athletic injuries from the physiotherapist's perspective.

A-693 16:50

The surgeon's perspective
M. Leyes; *Madrid/ES (leyesm@yahoo.com)*

Although uncommon, multiple-ligament knee injuries are an important potentially limb-threatening injury that can result in significant patient morbidity and a precise diagnosis is necessary. This presentation systematically reviews the role of different diagnostic tests in the assessment of multiple-ligament knee injuries. We performed a retrospective study of 60 patients with multiple ligament knee injuries acute or chronic which required a stabilisation procedure between November 2007 and December 2014. MRI findings were correlated with what was found at surgery. The radiologist should play a key role in the multidisciplinary management of this complex set of pathologies. We stress the importance of timely diagnostic imaging and an accurate, detailed description of findings, particularly as it relates to MRI interpretation both preop and postoperatively.

Learning Objectives:
1. To become familiar with the specific role the surgeon has in the management of sports injuries.
2. To understand the aspects of the radiological report which are most important to the surgeon.
3. To understand how the radiologist goes on to influence the management of athletic injuries from the surgeon's perspective.
4. To understand the information that orthopaedic surgeons consider critical for preoperative planning and reconstruction of the multiple ligament knee injury in sports.

17:05
Multidisciplinary case presentation and discussion: Which aspects of radiological practice help and which hinder the team approachto managing the injured athlete? How can we improve on this?

16:00 - 17:30 **Room E2**

Special Focus Session

SF 16
Prostate MRI: increasing need?

A-694 16:00
Chairman's introduction
J.C. Vilanova; *Girona/ES (kvilanova@comg.cat)*

MR imaging is playing an increasing role in the clinical management of prostate cancer. Multi-parametric (mp-MRI) acquisition is showing an improved assessment for prostate cancer detection, characterisation and follow-up. The implementation of the new methodology on MRI needs to standardise the use and establish the recommendations for the clinical indications, as it has recently been presented with PIRADS v2. Prostate cancer has been usually diagnosed with systematic blinded transrectal ultrasound biopsies. However, this method has low accuracy and for this purpose different approaches have been developed to change and improve the approach to diagnose prostate cancer with the inclusion of mpMRI. The challenge is to achieve an optimal and accurate method for an imaging-guided prostate biopsy. Moreover, there is a need to use mpMRI to manage treatment/active surveillance according to low- or high-risk prostate cancer. The final step is whether mpMRI is helpful on the prostate cancer follow-up after treatment.
Session Objectives:
1. To learn about the current role of prostate MRI in managing prostate cancer.
2. To become familiar with the current recommendations and guidelines for multiparametric technique of prostate MRI.
3. To discuss the different indications of prostate MRI and analyse the improved value for patients.
4. To provide an update on the new advances in prostate mpMRI.

A-695 16:05
MRI before the first prostate biopsy: has the time come?
B. Hamm; *Berlin/DE*

Multiparametric MRI is the basis of imaging diagnosis of prostate cancer. So far, mp-MRI has mainly been used as a problem-solving method, i.e., in patients with suspected prostate cancer and prior negative transrectal ultrasound-guided biopsy (TRUS-Bx). In view of the high detection rate of prostate cancer by mp-MRI of approximately 40% after prior negative TRUS-Bx, it is increasingly being discussed whether it would make more sense to perform MRI to rule out cancer or to localize suspicious areas before the first biopsy. The discussion about performing mp-MRI before biopsy in men with suspected prostate cancer is only at the beginning and reveals different attitudes of urologists and radiologists. Several arguments can be advanced in support of mp-MRI before biopsy: a) mp-MRI has a higher detection rate of significant prostate cancer than TRUS biopsy; b) MRI-guided biopsy increases the detection of significant cancer and decreases the detection of non-significant cancer; c) MRI/US-fusion biopsy detects more high-risk prostate cancers and fewer low-risk cancers compared with TRUS biopsy. There are many open questions regarding mp-MRI before prostate biopsy and it is desirable to have these questions answered soon. Major open issues include: a) lack of evidence; b) standards in data acquisition, interpretation and communication; c) resources; and d) cost-effectiveness.
Learning Objectives:
1. To learn about the current status of TRUS-guided biopsy.
2. To discuss possible inclusion criteria for MRI before the first prostate biopsy.
3. To learn about the histological Gleason grading with special reference to MRI findings.
4. To discuss further steps for radiology in the detection of prostate cancer.

Author Disclosure:
B. Hamm: Grant Recipient; 1. Abbott 2. Actelion Pharmaceuticals 3. Bayer Schering Pharma 4. Bayer Vital 5. BRACCO Group 6. Bristol-Myers Squibb 7. Charité research organisation GmbH 8. Deutsche Krebshilfe 9. Dt. Stiftung für.

A-696 16:28
The role of prostate MRI in active surveillance
A.R. Padhani; *London/UK (anwar.padhani@stricklandscanner.org.uk)*

mpMRI has the potential to increase the precision of patient selection at initial triage for AS, helping to minimise the inclusion of higher risk patients. The combination of MRI features best predict treatment-free survival is under investigation. Changing mpMRI phenotype during AS period should prompt additional histologic sampling (not a trigger for active treatment by itself). However, how much & which mpMRI component change is pathologic/clinically significant is unknown as is frequency of follow-up studies. Physician communication via structured, pictorial reporting is key to the successful implementation of mpMRI for AS.
Learning Objectives:
1. To provide an overview of the concepts underpinning active surveillance (AS) strategies for low risk prostate cancer.
2. To discuss the role of mpMRI for confirming clinical patient selection criteria for AS and highlight the benefits of mpMRI for detecting cases at higher risk and thus unsuited for AS.
3. To demonstrate changing imaging phenotype during AS period and corresponding clinical actions.
4. To highlight need for effective communication with clinicians regarding initial and continued suitability for AS.
Author Disclosure:
A.R. Padhani: Advisory Board; Siemens Heathcare. Consultant; Siemens Heathcare. Investigator; Siemens Heathcare. Speaker; Siemens Heathcare.

A-697 16:51
Is prostate MRI accurate enough for focal treatment planning?
V. Panebianco; *Rome/IT (valeria.panebianco@uniroma1.it)*

Multiparametric magnetic resonance (mp-MR) with anatomic T2-weighted (T2W) imaging, MR spectroscopic imaging (MRSI), dynamic contrast-enhanced MRI (DCE-MRI) and diffusion-weighted imaging (DWI) is considered a valuable tool for early detection of clinically significant prostate cancer (PCa). The PI-RADS (Prostate Imaging Reporting and Data System) is a structured reporting scheme for evaluating the possibility of PCa with mp-MR. Mp-MRI demonstrated high specificity for evaluation of extra-capsular extension, seminal vesicle invasion and overall stage; although it has a poor and heterogeneous sensitivity for local PCa staging it can be slightly improved with the use of higher field strengths and functional imaging techniques. The negative predictive value (NPV) of mp-MRI in PCa diagnosis has been claimed to be 0.91-0.97. The high NPV and specificity suggest that negative prostate mp-MR may support a patient remaining under active surveillance. Because its characteristics mp-MRI can be used not only to detect the PCa but also to plan the patient management, therapy - especially in case of minimally invasive/focal therapy - but it can also be used to target/guide the biopsy and the therapy. Basing on recent European Urology Association (EAU) guidelines the mp-MR-targeted biopsy has been recommended if the clinical suspicion of PCa persists in spite of negative biopsies. The high accuracy of mpMRI in detection, location and volume definition can select the candidate to focal therapy. Moreover, the MR guidance can drive focal therapy as high-intensity focused ultrasound (HIFU), cryoablation and laser ablation.
Learning Objectives:
1. To provide an overview of mpMRI in terms of accuracy, sensitivity, specificity and especially PPV and PNV in the initial diagnosis of PCa.
2. To discuss the role of mpMRI as an important tool for selection criteria for focal therapy.
3. To demonstrate the role of mpMRI to guide the targeted therapy.
4. To underline the role of mpMRI in the follow-up of the patients treated and its reproducibility.

17:14
Panel discussion: Does the use of MRI improve the outcome in prostate cancer?

16:00 - 17:30 **Room F1**

E³ - European Diploma Prep Sessions

E³ 1623
Interventional

A-698 16:00
Chairman's introduction
M. Szczerbo-Trojanowska; *Lublin/PL (m.trojanowska@umlub.pl)*

Interventional radiology comprises a wide range of vascular and non-vascular minimally invasive image-guided therapeutic procedures allowing patients to be treated with less risk and shorter hospital stays. The list of diseases and organs amenable to therapeutic procedures is continuously growing. Interventional radiology procedures can be divided into vascular and non-vascular interventions. The most common vascular interventions are angioplasty, stenting and thrombectomy which are offered to the patients with artery stenosis or occlusion. Significant advances are seen in the treatment of malignant diseases. Oncological interventions include intra-arterial chemo-radioembolisation and catheter-delivered gene therapy. Non-vascular percutaneous procedures are performed in the treatment of malignant diseases on biliary, urinary, gastrointestinal tract and in musculoskeletal system. Another group of non-vascular interventions are percutaneous thermo-, cryo-, microwave and chemical ablations used in neoplasms treatment. Continuous evolution of imaging technology and improved design of endovascular instruments is permanently increasing indications and effectiveness of interventional radiology.
Session Objectives:
1. To understand the principles and techniques of angiography and image-guided interventions.
2. To become familiar with the different methods of hepatobiliary interventions.
3. To describe the most common vascular interventions.

A-699 16:03
A. Basic principles of angiography and image-guided interventions
T.K. Helmberger; *Munich/DE (Thomas.Helmberger@klinikum-muenchen.de)*

Even without specialization in interventional radiology, basic knowledge of indications, patient preparation, techniques, and complications in vascular and non-vascular interventions is essential also for radiology trainees. The two classic fields of interventional radiology that are represented in most national curricula and the ESR training curriculum are trans-vascular and percutaneous diagnostic and therapeutical procedures. Knowledge of the typical arterial and venous anatomy and its variants is important not only from the diagnostic perspective but also with respect to planning proper access routes, puncture site/technique, and pathways for trans-vascular procedures. These may encompass diagnostic and interventional procedures as recanalisation (e.g. balloon and stent angioplasty), vascular occlusion techniques (e.g. bleeding, vascular malformations), and perfusion (e.g. trans-arterial oncological interventions). Basic percutaneous diagnostic (i.e. biopsy, fluid evacuation) and therapeutic procedures (i.e. drainage of, e.g. abscess, haemorrhage) should also be part of the armamentarium of every radiologist since radiological imaging tools allow an ease of use. Therefore, an understanding of the typical indications and contraindications for biopsy/drainage, typical access routes and image guidance is mandatory.
Learning Objectives:
1. To describe the normal anatomy and normal variants of the arterial and venous vascular system.
2. To understand diagnostic and interventional angiographic techniques.
3. To explain basic percutaneous image-guided techniques including abscess drainage and biopsy taking.

A-700 16:32
B. Interventions of the hepatobiliary system
J.I. Bilbao; *Pamplona/ES (jibilbao@unav.es)*

The portal vein is formed from the embryologic remnants of the vitelline veins and their interconnections and variations are scarce when referring to its main trunk. This is not the case for the morphology and pattern of ramification of the lobar and segmental branches and, for some, there is not even a stabilised pattern of branching. The liver arteries come, embryologically, from three different arteries (left gastric, coeliac trunk and superior mesenteric); this is the reason why there is a wide range in the morphologic branching of the arteries (Michels´ classification). The hepatic veins come, embryologically, from the vitelline veins and have, also, an heterogeneous pattern of ramification. There are three major veins but many others, with different sizes, will drain the liver along the inferior vena cava. Every major vessel has its own and specific, appealing intervention. Portal vein embolisation is an accepted presurgical method for obtaining an increase in the volume of the future liver remnant. The arterial approach is an excellent method for treating liver tumours due to its specific vascularisation. The hepatic vein is the way to transhepatically access the portal vein for performing percutaneous shunting (TIPS). Liver tumours can be percutaneously accessed and directly ablated by the administration of energy (i.e. radiofrequency) or chemical agents (i.e. ethanol). The percutaneous catheterization of the bile ducts allows not only its drainage if obstructed but also a wide catalogue of therapeutic options for treating stenoses, leaks or lithiasis among many other clinical situations.
Learning Objectives:
1. To describe the normal anatomy and normal variants of the hepatobiliary system.
2. To explain vascular hepatic interventions including transarterial chemoembolisation.
3. To understand percutaneous hepatobiliary interventions including thermal ablation techniques.
Author Disclosure:
J.I. Bilbao: Advisory Board; Boston Scientific. Consultant; Cook. Speaker; Sirtex Medical.

A-701 17:01
C. Vascular interventions
J.A. Reekers; *Amsterdam/NL (j.a.reekers@amc.uva.nl)*

In this session various basic vascular interventions will be discussed. Access, wires and catheters, materials and outcomes will be discussed. Also various technologies including angioplasty, stent placement and new stent technologies will be discussed. There will be ample time for case discussions. The aim is to understand the whole pathway from clinical problem, through diagnostic imaging, to endovascular treatment. This course is a preparation for the EDiR.
Learning Objectives:
1. To explain endovascular treatment options of atherosclerotic diseases.
2. To understand common angioplasty procedures, such as renal, iliac and femoral angioplasties.
3. To describe indications and techniques for arterial stenting procedures.
4. To explain techniques of arterial embolisation and coiling.

16:00 - 17:30 **Room F2**

Breast

RC 1602
Tomosynthesis: the new mammography
Moderator:
D. Bernardi; Trento/IT

A-702 16:00
A. Should we abandon 2D mammography?
S. Zackrisson; *Malmö/SE (sophia.zackrisson@med.lu.se)*

Full-field digital mammography, also called 2D mammography, with flat panel detectors has been broadly used in clinical routine and screening for about a decade. In 2D mammography, a specially designed digital detector captures the x-rays and converts the information to a digital image, which is displayed on a high-resolution computer monitor, and transmitted and stored just like computer files. Inherent in a 2D modality like mammography is that dense breast tissue may cause overprojection and hide or simulate the presence of a tumour on these images even if several views are acquired. Digital breast tomosynthesis, DBT is a 3D mammography technique that, to a large extent, can suppress the confounding effect of the overlapping tissues. DBT is a strong competitor to 2D mammography both for screening and clinical examinations. This presentation will cover 2D mammography in terms of technical background and radiation dose. Furthermore, it will discuss the advantages and disadvantages of 2D mammography compared to DBT and evaluate if there are situations where 2D mammography still could be the preferred method if DBT is transitioned into screening and clinical practice.
Learning Objectives:
1. To understand the technique of 2D mammography and what the limits could be.
2. To know how to calculate radiation dose in 2D mammography and ways to improve image quality.
3. To understand when 2D mammography is better than DBT.
Author Disclosure:
S. Zackrisson: Speaker; Speaker's fees and travel support from Siemens Healthcare AG and Astra Zeneca.

A-703 16:30

B. Clinical validation and results in the last 5 years: where do we stand?
P. Skaane; *Oslo/NO (PERSKA@ous-hf.no)*

Digital breast tomosynthesis (DBT) is a promising technique for breast imaging based on a full-field digital mammography (FFDM) platform. DBT images are obtained in the same projections as conventional mammography. For DBT, the x-ray tube moves through a proscribed arc, and several low-dose projection images are acquired. Images are usually reconstructed into a stack of 1 mm slices. Radiation dose is approximately the same as for FFDM. DBT eliminates superimposed tissue, thus improving detection of lesions otherwise hidden by dense parenchyma and reduces interpretation problems caused by overlapping tissue. Consequently, DBT improves sensitivity and specificity in women with dense parenchyma. Studies comparing DBT and FFDM in the diagnostic setting have confirmed several advantages of tomosynthesis. Tumours are more easily identified and delineated, and extent and size measurement are improved. DBT can replace conventional cone-down magnification views for non-calcified breast lesions. Fine-focus magnification views may still be necessary for evaluation of indeterminate calcifications. About 11 retrospective US studies and 3 prospective European trials comparing DBT and FFDM in breast cancer screening have so far been reported. All but one study have shown significant reduction in recall rates using DBT, and most studies have demonstrated a significant increase in detection rate of invasive cancers, mainly those presenting as speculated mass or distortion. A challenge for implementing DBT in large-scale screening programs includes reading time for radiologists. The challenge of radiation dose when using two-view 2D plus 3D is solved by synthetic 2D images reconstructed from the dataset of tomosynthesis.

Learning Objectives:
1. To become familiar with the technique of DBT.
2. To understand the results of DBT in the screening and diagnostics settings.
3. To know the evolution of tomosynthesis in screening organisation.

Author Disclosure:
P. Skaane: Equipment Support Recipient; Equipment provided by Hologic Inc. Research/Grant Support; Support for overtime reading provided by Hologic Inc.

A-704 17:00

C. The future of mammography: my predictions
E.M. Fallenberg; *Berlin/DE (eva.fallenberg@charite.de)*

Early detection of breast cancer through x-ray mammography (MG) has been shown to reduce mortality; however, the method is limited by a decreased sensitivity and specificity, particularly in young patients and women with radiographically dense breasts due to tissue overlying and masking tumours or architectural distorsions. The introduction of full-field digital mammography gave the possibility to develop further technical methods, to overcome these limitations. Some of these are and tomosynthesis and contrast-enhanced mammography and contrast-enhanced tomosynthesis as well as most recently also breast CT. In this talk, we will present the background of tomosynthesis, contrast-enhanced mammography techniques and breast CT, how they are performed, clinical performance results versus mammography and ultrasound, as well as data demonstrating the benefit of tomosynthesis in a diagnostic setting, data comparing contrast-enhanced mammography and MRI and first results on contrast-enhanced tomosynthesis and breast CT. Potential advantages and disadvantages will be indicated and a sample of clinical cases will be presented to illustrate how the different techniques contribute to the detection of lesions and how they can be used in routine workup. The potential of combining the new methods in mammography with molecular or optical imaging in the future will be discussed.

Learning Objectives:
1. To understand the role of mammography in analysing and characterising breast lesions.
2. To become familiar with new developments in digital mammography such as contrast mammography, tomosynthesis and 3D contrast mammography.
3. To learn about the new potential of combining mammography with molecular imaging, optical imaging and texture analysis.

Author Disclosure:
E.M. Fallenberg: Advisory Board; GE Healthcare. Board Member; EUSOBI. Research/Grant Support; GE Healthcare, Bayer Healthcare, Guerbet. Speaker; GE Healthcare, Guerbet.

16:00 - 17:30 **Room D1**

E³ - ECR Master Classes (Chest)

E³ 1626

Less common infiltrative lung diseases

Moderator:
M. Regier; Hamburg/DE

A-705 16:00

A. Pleuroparenchymal fibro elastosis
A. Devaraj; *London/UK*

Pleuroparenchymal fibroelastosis (PPFE) is an uncommon interstitial pneumonia characterised by upper lobe pleural thickening and subpleural fibrosis. Although PPFE is classified as an idiopathic interstitial pneumonia, it is known to be associated with certain aetiological factors including recurrent infections and bone marrow transplantation. This presentation will review the typical and atypical CT features of PPFE and will provide an overview of how PPFE can be distinguished from other upper lobe predominant fibrosing lung diseases.

Learning Objectives:
1. To become familiar with this newly recognised idiopathic interstitial pneumonia.
2. To learn how to interpret upper zone changes on thoracic CT.

A-706 16:30

B. Alveolar proteinosis
W.F.M. De Wever; *Leuven/BE (walter.dewever@uzleuven.be)*

Alveolar proteinosis (AP) is a rare disease and is characterised by alveolar accumulation of surfactant components. AP is classified into three groups: auto-immune AP, secondary AP and genetic AP. The diagnosis of AP is suspected when CT scan demonstrates a patchy crazy-paving pattern (CPP). The diagnosis is confirmed by broncho-alveolar lavage. Surgical lung biopsy can be performed, but is less frequently done. Whole lung lavage is the gold standard therapy. The clinical course is unpredictable and 5-year survival is 95%. The CPP is a common finding on (thin-section) computed tomography. CPP is the superimposition of a linear pattern on ground-glass opacities (GGO). GGO is defined as a hazy increase in lung density with preservation of airway and vessel margins. GGO occurs when there is a mild decrease in the amount of air in the airspaces and a partial filling of the airspaces with fluid, cells or other material, thickening of the alveolar walls or thickening of the interstitium. The linear component of this pattern can be caused by thickening of the interlobular septa, thickening of the intralobular interstitium (intralobular reticular pattern and intralobular branching lines) or a linear deposition of material within the airspaces at the borders of the acini (periacinar pattern). CPP was initially described as a pathognomonic sign of AP; however, nowadays, this pattern has been reported in a variety of acute and chronic diseases, like pulmonary infection (e.g. PJP), AIP, lung bleeding, NSIP, vasculitis, etc.

Learning Objectives:
1. To become familiar with the CT features enabling the radiologist to suggest this diagnosis.
2. To learn about other diseases with crazy-paving as a predominant pattern.

A-707 17:00

C. Lymphangioleiomyomatosis
A. Oikonomou; *Toronto, ON/CA (anastasia.oikonomou@sunnybrook.ca)*

Lymphangioleiomyomatosis (LAM) is a rare cystic lung disease caused by infiltration of the lung with smooth muscle cells. It occurs in patients with tuberous sclerosis complex (TSC-LAM) and in a "sporadic" form in patients without tuberous sclerosis (S-LAM). S-LAM is seen exclusively in women of reproductive age while TSC-LAM may also be seen in men. Parenchymal lesions in LAM mainly include cysts, which are thin-walled, well-defined, rounded, usually small in size up to 2 cm and may reach large numbers. They have no zonal lung predominance. Nodules are extremely rare in S-LAM and are more commonly seen in TSC-LAM. They may either be solid or ground-glass and usually tiny. They represent multifocal micronodular pneumocyte hyperplasia. Pleural manifestations include chylothorax and pneumothorax. Chylous pericardial effusions may be seen. Recent guidelines for the diagnosis of LAM from the European Respiratory Society LAM task force classifies LAM as definite, probable and possible. LAM is differentiated by other cystic lung diseases such as Langerhans histiocytosis (PLCH), Birt-Hogg-Dube (BHD), lymphocytic interstitial pneumonia (LIP) and amyloidosis. In PLCH the cysts have a bizarre shape, are variable in number and are upper and middle lobe predominant. In LIP the cysts are round and variable in size but usually small and random in distribution surrounded by ground glass opacity. In BHD the

cysts are elliptical in shape and have a subpleural, lower zone predominance adjacent to vessels. In amyloid the cysts are variable in size but usually large and diffusely distributed. Nodules are seen in PLCH and amyloid.
Learning Objectives:
1. To learn about the parenchymatous and pleural manifestations of the disease.
2. To learn how to distinguish LLM from other cystic diseases of the lung.

16:00 - 17:30 **Room D2**

Radiographers

RC 1614

Safety issues in medical imaging

Moderators:
C. Leidecker; Forchheim/DE
J. Santos; Coimbra/PT

A-708 16:00

A. Safeguarding patients and staff in MRI
T. Owman; *Lund/SE (titti.owman@gmail.com)*

MR scanners and MR examinations are rapidly increasing worldwide. Unfortunately, so are also MR incidents and MR-related accidents. The reported number of dangerous events rises with an alarming speed concluding that safety routines need to be improved. The role of the MR radiographer is extremely important and cannot be exaggerated when it comes to creating and maintaining MR safe routines and how to perform adequate examinations in a safe way and in a controlled environment. The importance of understanding these risks and how to avoid them must never be neglected. A very strong magnetic field that can create extremely dangerous flying objects is a well-known risk factor but performing MR examinations also means dealing with heating problems, acoustic noise, implants and several other potential threats. Performing proper MR screening and testing procedures are necessary to create a safe situation for patients, staff and everybody else involved. Thorough MR safety screening may be supplemented by ferromagnetic detectors but these detectors must never replace a careful personal screening procedure. Local exercises on how to handle emergency situations in the MR environment should be performed routinely and clear recommendations regarding MR safety responsibilities are needed. Proper routines, sufficient education and extensive training are of great importance to everybody working with or nearby MR scanners.
Learning Objectives:
1. To understand the patient and staff risk in MRI examinations.
2. To become familiar with guidelines and recommendations for patient and staff safety.
3. To become aware of the importance of the role of radiographer in MRI safety.

A-709 16:23

B. Safety aspects in an interventional radiology setting?
D. Catania; *Milan/IT (cataniadiego@hotmail.com)*

In the USA National Commission on Radiological Protection (NCRP) Report 160 (2006) radiation exposure was reported as 50% due to background radiation and 48% due to medical therapies. Despite the fact that interventional radiological procedures accounted for only 4% of all medical radiation exposure, they contributed 14% of the overall cumulative dosage. In more recent years interventional procedures are more routinely performed due to reduced mortality rates compared to patient management involving open surgery. However, as complexity of procedures increases this potentially impacts upon radiation risks for patients and operators. Specific procedures are known as potentially high-dose examinations due to their complexity, or if performed on paediatrics. The international literature demonstrates that the operators working in radiology interventional suites are exposed to chronic low doses of radiation; therefore, if adequate protection is not utilised, there is an increased probability of developing cancer. The radiation dose obtained by both patient and operator can be decreased considerably, by optimising the imaging parameters with additional proper use of radiation protection measures. Highly trained professionals who understand radiation risk implications will support optimal quality in terms of execution of procedural examination. The importance of correct dose management, to include diagnostic reference level (DRL) establishment and dose data archiving for audit all form important aspects of safety management. These factors will be outlined in addition to other aspects of safe clinical management in the interventional suite. Relevant guidelines and directives related to these safety issues will be discussed.
Learning Objectives:
1. To become aware of patient and staff risk in an interventional radiology setting.
2. To appreciate the importance of radiation protection measures considering the nature of interventional procedures.
3. To recognise the need for education and training in interventional radiology settings in order to promote radiation safety.

A-710 16:46

C. An introduction to mammography safety: what can be done?
D. O'Leary; *Hertfordshire/UK (desiree.oleary@ucd.ie)*

Breast imaging, and screening mammography in particular, has been subjected to numerous critiques and poor press in the media recently. Those working in the area have, therefore, become increasingly vigilant of the global issues that surround the performance of imaging of the breast. This vigilance is of necessity multi-faceted including (but not limited to) infection control and radiation protection, including the correct application of compression through specialised training. National and international guidelines for mammography safety are in place and widely available for implementation in all symptomatic and asymptomatic breast imaging centres. The guidelines have evolved with evidence from research and with a change in technology and training. The evolution of the guidelines has resulted in these being similar from country to country especially in the areas of mammography safety. This presentation will examine the various guidance in the evidence-based guidelines regarding mammography safety. The presentation will concentrate on the pivotal role of the radiographer in the multi-disciplinary team that is assembled to guard mammography safety and thereby reduce external criticism.
Learning Objectives:
1. To understand the definition of safety in a mammography context.
2. To become aware of mammography best practices in radiation protection, compression and infection control.
3. To understand the radiographer's role as safety gatekeeper in mammography.

A-711 17:08

D. Safety in CT: dose minimisation and beyond
R. Booij; *Rotterdam/NL (r.booij@erasmusmc.nl)*

In recent years, CT manufacturers have created several different new applications to reduce dose, improve diagnostic quality and shortening of examination time with high reproducibility. Thereby, international recommendations and standards have been provided by several professional associations regarding dose issues and radiation safety in adults and paediatrics. To consolidate knowledge of dose reduction potential and to implement international recommendations, it is of utmost importance that personnel is properly trained and educated to integrate these new technologies into daily routine to benefit their full potential. In addition, it is important to image at the right dose, instead of imaging at lowest dose, with a proper balance of image quality. Radiographers are provided with automated and intuitive software tools to improve workflow and optimise dose, but they should be aware to still act consciously. For this a consolidate knowledge is needed of image quality and dose-influencing parameters in the scan and reconstruction process.
Learning Objectives:
1. To become aware of international recommendations, standards and directives in order to promote safety.
2. To consolidate knowledge in dose reduction of CT examinations.
3. To enhance understanding about the tradeoffs between dose reduction and image quality.
Author Disclosure:
R. Booij: Other; Our departement has a master research agreement with Siemens AG. Personally no disclosures.

16:00 - 17:30 **Room K**

Physics in Radiology

RC 1613
MR: artefacts and devices

A-712 16:00
Chairman's introduction
M. Tosetti; *Pisa/IT (michela.tosetti@fsm.unipi.it)*

Metallic biomedical implants, give rise to artefacts in the magnetic resonance image (MRI) of patients. Such artefacts impair the information contained in the image namely near the metallic device. Many ferromagnetic materials are contraindicated because of the hazards associated with their movement during the MRI procedure and those with less magnetic properties could reduce the image information content due to the presence of artefact related to the magnetic susceptibility of the metal or, if the susceptibility is sufficiently small, to the presence of additional artefact due to electrical conductivity or to the local filed perturbation induced. These could reduce the quality of the MR procedure in particular in many advance MR techniques more sensitive to the variation of local magnetic field. The extent of the artefact is dependent on the object's magnetic susceptibility, size, shape, position in the patient's body, the technique used for imaging and the image processing method. As well as to be learned that the MRI conditions are crucial (strength of the static magnetic field, RF field, RF transmit coil, pulse sequence, body part imaged, position of the fixation device relative to the transmit RF coil, etc)., importantly it has to be highlight that several imaging strategies and new imaging or post-processing techniques could substantially reduce artefacts associated with metallic objects.
Session Objectives:
1. To learn about MR image distortions.
2. To appreciate the appearance of metal-induced image distortions in MRI.
3. To appreciate image distortions in perfusion- and diffusion-weighted imaging.

A-713 16:05
A. Image artefacts in MRI and their mitigation
D.J. Lurie; *Aberdeen/UK (d.lurie@abdn.ac.uk)*

No imaging modality can reproduce the original object under study in a completely faithful manner, because all imaging technology is susceptible to artefacts. It is very important that the sources of artefacts are understood so that the fidelity of images can be maximised. Artefacts in MRI can be discussed according to their primary source, under the following four categories. (a) Physics: artefacts include those arising from magnetic susceptibility differences, often around tissue/air interfaces, and chemical-shift artefacts, at fat/water boundaries. These effects can be mitigated by manipulation of gradient strengths and directions and sampling bandwidths. (b) Hardware: examples include RF or gradient miscalibration or instability, leading to image shading and ghosting; RF interference, causing zipper artefacts; and gradient non-linearity, causing geometric distortion. These issues can be addressed by careful calibration and quality control procedures, and sometimes by post-processing. (c) Software: this includes artefacts arising from pulse sequences, including aliasing and slice-overlap shading (slice cross-talk); these can usually be reduced by careful setting of gradient directions and acquisition parameters. Other software-sourced artefacts are related to signal sampling and Fourier transformation, including Gibbs ringing artefacts at boundaries. (d) Physiological: artefacts can arise due to regular motion of the heart, or of abdominal organs during the breathing cycle. Mitigation is by gating, breath-holding and the use of rapid pulse sequences. Irregular, involuntary motion such as peristalsis in the gut can also lead to ghosting artefacts, which can be reduced by the administration of pre-scan medication and by ultra-rapid MR pulse sequences.
Learning Objectives:
1. To identify common types of artefacts in MR images.
2. To learn about the physical origins of artefacts in MRI.
3. To learn methods of minimising artefacts on MR images.

A-714 16:28
B. Imaging around metal implants: artefact reduction in MRI
C. McGrath; *Belfast/IE (cormac.mcgrath@belfasttrust.hscni.net)*

The presence of metallic implants within a patient distorts the main static magnetic field of an MRI scanner and can lead to very severe image artefacts that may render the resultant image non-diagnostic. The physics behind these artefacts is described. Acquisition parameter changes, such as matrix size, receive bandwidth and pulse sequence choice, are described that can reduce the impact of these artefacts and improve the diagnostic quality of these scans.
Learning Objectives:
1. To review the origin of signal in MRI.
2. To understand the MRI physics of artefact reduction around metal implants.
3. To understand the parameters used in an optimised imaging protocol.
Author Disclosure:
C. McGrath: Other; The author has presented a similar presentation at two MRI Symposia organised by GE Healthcare.

A-715 16:51
C. Artefacts in perfusion and diffusion MRI
I. Tsougos; *Larissa/GR (tsougos@uth.gr)*

Accurate brain damage diagnosis plays an essential role in the selection of the optimum treatment strategy, as the nature of the damage and the definition of nature and grade defines the therapeutic approach. Advanced magnetic resonance imaging (MRI) techniques have added incremental diagnostic information regarding brain damage characterisation over conventional MRI alone. Particularly, diffusion-weighted imaging, diffusion tensor imaging and perfusion imaging provide, non-invasive, significant structural and functional information on a microscopic level, revealing aspects of the underlying pathophysiology. Although over the last 10 to 20 years, diffusion and perfusion MRI have become established techniques with a great impact on differential diagnosis, like any other MRI technique they remain subject to artefacts and pitfalls. Hence, it is evident that obtaining reliable data and drawing meaningful and robust inferences is of utmost importance. The current exhibit aims to: review the artefacts and pitfalls of diffusion MRI on a qualitative basis, especially in terms of eddy currents and sensitivity to motion; review and evaluate the possible issues that can affect the accuracy of measurements regarding dynamic susceptibility contrast (DSC)-MRI (measurements of cerebral blood flow (CBF), cerebral blood volume (CBV), and mean transit time (MTT)); introduce possible strategies that have been developed to mitigate or overcome these artefacts and pitfalls.
Learning Objectives:
1. To review the artefacts and pitfalls of diffusion MRI on a qualitative basis, especially in terms of eddy currents and sensitivity to motion.
2. To review and evaluate the possible issues that can affect the accuracy of measurements regarding dynamic susceptibility contrast (DSC)-MRI (measurements of cerebral blood flow (CBF), cerebral blood volume (CBV), and mean transit time (MTT)).
3. To introduce possible strategies that have been developed to mitigate or overcome these artefacts and pitfalls.

17:14
Panel discussion: Clinically applicable tools/strategies to minimising/avoiding MR imaging artefacts

16:00 - 17:30 **Room G**

Neuro

RC 1611
Update on endovascular stroke treatment: a medical breakthrough?

Moderator:
S. Rohde; Dortmund/DE

A-716 16:00
A. A critical appraisal of the current literature
W. van Zwam; *Maastricht/NL (w.van.zwam@mumc.nl)*

In 2015, five randomised controlled trials were published, reporting a clear benefit of endovascular treatment over standard care for patients with an acute ischaemic stroke caused by a large vessel occlusion of the anterior intracranial circulation. These results caused a revolutionary change in stroke treatment since the introduction of intravenous therapy with thrombolytics more than twenty years before. The different trials used different inclusion criteria and showed differences in outcome. In this lecture a short history of acute stroke treatment trials, an overview of the differences between the 2015 trials and

new studies with subgroup analyses and pooled data from these studies will be presented and discussed.

Learning Objectives:

1. To understand the strengths and shortcomings of the relevant multi-centre trials assessing the role of endovascular treatment in patients with acute ischaemic stroke.
2. To understand the outcomes of these trials, the context in which they were achieved and how they can be ensured in a different environment.
3. To appreciate potential differences in management of patients with anterior vs posterior circulation strokes.

Author Disclosure:

W. van Zwam: Investigator; Co-P.I. of MRCLEAN study. Research/Grant Support; MRCLEAN was sponsored by the Dutch Heart Foundation and by unrestricted grants from several industry partners. Speaker; Institution received speaker fee from Stryker.

A-717 16:30

B. Which techniques can we use to reopen an occluded cerebral blood vessel?

T. van der Zijden; *Edegem/BE (thijsvanderzijden@hotmail.com)*

Nowadays, the use of mechanical clot retrieval has become an important therapeutic tool in primary acute ischaemic stroke treatment. The benefits in terms of high recanalisation rates and better clinical outcome in adequately selected patients are already widely acknowledged. Although endovascular practice implies certain specific risks, mechanical thrombectomy, if performed by adequately trained specialists, is considered a relative safe procedure with rather low complication rates. During the years several different devices and techniques have been developed. They evolved from only using micro-catheters with micro-guidewires, over using balloon and stent angioplasty, to the development of specific clot retrieval devices. Today, the most applied technique is the use of dedicated stent retrievers. These retrievers are self-expandable, non-detachable stents. After put in place by micro-catheters, these stents are capable of catching and subsequently removing the clot in a fast and safe way. Another widely used technique is endovascular clot aspiration using a catheter proximal to the clot. The two techniques can be used interchangeably if needed. In difficult cases a combination of the two techniques can be used. Although preferably to avoid, in case of persistent, clinically relevant stenosis or occlusion, stenting of cranial arteries might be needed. In these cases, the benefit of stenting should be outweighted carefully against the potential risks.

Learning Objectives:

1. To understand the principles underlying endovascular clot aspiration.
2. To become familiar with the different materials available for mechanical clot retrieval.
3. To understand the circumstances in which stenting of an intracranial blood vessel is needed.

A-718 17:00

C. Endovascular stroke treatment: ethical and economical concerns

K.-O. Løvblad; *Geneva/CH (karl-olof.lovblad@hcuge.ch)*

While stroke has known enormous advances both in imaging and treatment since the 1990s, it has been the recent breakthrough with the use of so-called stentrievers that has caused the most enthusiastic response. Indeed, we have seen that with these controversial methods, it is possible to on the one hand extract safely and quickly the thrombus without secondary haemorrhage. While this is extremely encouraging a few things need to be considered: on the one hand, there will be an enormous demand in a very strictly organized stroke treatment system based on stroke units and stroke centres. Some that will carry out the initial examination and maybe treatment while the patients that need endovascular treatment may be referred to centres that dispose of 24/7 state of the art imaging and post-treatment setups. The costs incurred will be caused on the one hand by and increase in treated patients, then an increase in the management and treatment costs themselves due to the stents. However, this should be counterbalanced by a decrease in morbidity and mortality with decreased re-adaptation costs. One major concern is the case of the increased need for improved informed consent ways for these patients that may not initially be able to agree or disagree to the treatment, which is critical due to the short time-window available. Also while the industry is necessary to continue to support the needed R&D, in this field it should give physicians freedom to provide the best choice of materials adapted to the patient.

Learning Objectives:

1. To appreciate the structure that is necessary to organise interventional stroke treatment for a large population.
2. To understand the cost implications and their mitigation.
3. To become familiar with the associated ethical concerns (such as informed consent) and the different ways of addressing them.

Sunday, March 6

08:30 - 10:00 **Room A**

E³ - ECR Academies: Interactive Teaching Sessions

E³ 1721
MR imaging in sports medicine II

A-719 08:30
A. Sports injuries of the ankle
P. Robinson; *Leeds/UK (philip.robinson10@nhs.net)*

Acute ankle injuries are among the commonest problems encountered at all levels of sporting activity and thus even rare chronic sequelae are still a significant problem. Radiologists play an important role in imaging and treatment of athletes with acute and chronic injuries as clinical assessment is often difficult and non-specific. This presentation will illustrate ankle anatomy and the most significant sports-related acute and chronic injury processes and demonstrate the use of MR imaging and ultrasound in the diagnosis and management of these conditions; where appropriate image-guided therapy will also be discussed. Acute sports injury processes will include osseous, osteochondral and ligament injury. Chronic overuse injuries to the tendons, osteochondral unit and soft tissue impingement syndromes will be illustrated.
Learning Objectives:
1. To learn the anatomy of the ankle.
2. To learn the evaluation of common ankle injuries.

A-720 09:15
B. Shoulder injury
M. Zanetti; *Zurich/CH (marco.zanetti@hirslanden.ch)*

Standard radiographs, MR imaging, CT and ultrasound provide clinically useful information in detecting and characterising injuries of the rotator cuff, cartilage, labrum and bone. The appropriate use of these modalities in common and uncommon shoulder injuries will be demonstrated in an interactive session. Tips and tricks will be given with the special focus on the normal anatomy, variants and potential pitfalls.
Learning Objectives:
1. To review the anatomy of the shoulder in 3-dimensions.
2. To learn the evaluation of common shoulder injuries.

08:30 - 10:00 **Room B**

Abdominal Viscera

RC 1701
Differential diagnosis in pancreatic imaging

A-721 08:30
Chairman's introduction
B. Marincek; *Cleveland, OH/US (Borut.Marincek@UHhospitals.org)*

Pancreatic disease often is asymptomatic until tissue damage and complications occur or until malignancies have reached advanced stages and have metastasized. Imaging techniques perform well in the diagnosis of typical forms of ductal adenocarcinoma. A small percentage of pancreatic cancers, however, manifest as acute pancreatitis making noninvasive diagnosis difficult. In contrast, imaging features of mass-forming pancreatitis (focal chronic pancreatitis, paraduodenal pancreatitis, focal autoimmune pancreatitis) can be misdiagnosed as malignant neoplasm. A multimodality imaging approach is essential in equivocal cases. If the diagnosis remains in doubt, tissue diagnosis should be obtained to avoid surgery for benign lesions. Cystic pancreatic lesions are commonly encountered in everyday clinical practice. Imaging and patient features should be integrated into a judgement about the appropriate management. The single most important patient feature is the presence or absence of symptoms. The pathologic spectrum of cystic lesions ranges from simple benign (epithelial and non-neoplastic mucinous cysts) and inflammatory (pseudocysts) to cystic neoplasms. The spectrum of cystic neoplasms ranges from benign serous lesions (serous cystadenoma) to malignant or potentially malignant mucinous neoplasms. While there is considerable overlap in imaging appearance of larger mucinous and non-mucinous cystic lesions, small cystic lesions (< 3 cm) often have no diagnostic imaging features. Incidentally detected, i.e. asymptomatic pancreatic lesions can also be solid. Although uncommon, they are more likely to be malignant than incidental small cystic lesions. The spectrum of diagnoses includes early ductal adenocarcinomas, neuroendocrine tumours, metastases to the pancreas and intrapancreatic accessory spleen.
Session Objective:
1. To briefly introduce the diagnostic challenge in patients presenting cystic or solid pancreatic lesions.

A-722 08:35
A. Pancreatic cancer or pancreatitis
R. Manfredi; *Verona/IT (riccardo.manfredi@univr.it)*

Non-neoplastic mimickers of pancreatic adenocarcinoma are diseases characterised by an enlargement of the pancreatic gland on non-neoplastic character, which closely resemble pancreatic adenocarcinoma. They are responsible of 5-10% of non-necessary pancreatectomies. Clinical, radiological and pathological features of these entities vary according to their macroscopic pattern that may be prevalently solid, such as in autoimmune pancreatitis, or prevalent cystic, such as in paraduodenal pancreatitis. The involvement of the pancreatic parenchyma by the above-mentioned inflammatory-fibrotic process may involve the whole pancreatic gland in a diffuse form, or only one segment of the gland in a focal form. The focal forms are those that represent a challenge in clinical practice for the differential diagnosis with pancreatic adenocarcinoma. The diagnostic imaging criteria of pancreatic adenocarcinoma, autoimmune pancreatitis and paraduodenal pancreatitis will be illustrated on the pancreatic parenchyma and on the pancreatic duct system. Correlation between the diagnostic imaging findings and the macroscopic pattern, as observed on the pathologic specimen will be analysed. In case of autoimmune pancreatitis, diagnostic imaging findings following steroid treatment will be illustrated. Clinical, laboratory and diagnostic imaging findings useful for the differential diagnosis between pancreatic adenocarcinoma and non-neoplastic mimickers by means of ultrasound, computed tomography and magnetic resonance imaging will be discussed.
Learning Objectives:
1. To learn about the inflammatory lesions, which can mimic a pancreatic tumour.
2. To become familiar with the imaging features, which can support the differential diagnosis between pancreatic cancer and pancreatitis.
3. To understand the value of the integration of the imaging modalities that define the correct diagnosis.

A-723 08:58
B. Cystic tumours vs pseudocysts
M.A. Bali; *Brussels/BE (mbali@ulb.ac.be)*

Pancreatic cystic lesions include epithelial and non-epithelial neoplasm and non-neoplastic cysts, classified as benign, potentially malignant and malignant (WHO classification). Pancreatitis-associated pseudocysts are among the non-epithelial non-neoplastic cysts. Among the epithelial neoplasms, serous cystadenoma is the most common with a benign behavior, followed by potentially malignant or malignant mucinous neoplasm as mucinous-cystic neoplasm, and intraductal papillary mucinous neoplasm. The diagnosis of these different entities is based on: patient clinical presentation (history of pancreatitis, elevated tumoural markers, etc)., radiologic investigations (MR/MRCP and/or MDCT), endoscopy (EUS, ERCP), cyst fluid analysis EUS-FNA with cytologic analysis (amylase, > 1000 ng/mL are found in pseudocyst, CEA and mucin stain useful to differentiate between mucinous and non-mucinous lesions). At imaging, several morphologic features may allow differential diagnosis between these entities and may also be suggestive of malignancy: the localisation, the cystic pattern (unilocular/multilocular), the presence of septa, wall thickness, calcifications (central or peripheral, thin or thick), mural nodules, communication with the pancreatic ducts and the concomitant dilatation of the main pancreatic duct (MPD). Nevertheless, cystic lesion smaller than 3 cm may lack specific morphologic features. For the mucinous neoplasm, imaging findings highly suggestive of malignancy are: for brunch-duct IPMN, mural nodules and dilatation of the MPD; for main duct-IPMN, MPD larger than 1 cm, mural nodules and symptoms; for mucinous cystic neoplasm, large lesion (> 4 cm), mural nodules, mass-forming lesions and peripheral calcifications.
Learning Objectives:
1. To become familiar with the imaging features of cystic tumours and pseudocysts.
2. To become familiar with the clinical presentation and the radiological signs that may be observed in cystic tumours and pseudocysts.
3. To understand the value of the integration of the imaging modalities that define the correct diagnosis.

A-724 09:21

C. Incidental findings

C. Stoupis; *Männedorf/CH (c.stoupis@spitalmaennedorf.ch)*

The frequency of asymptomatic pancreatic lesions (APLs), being discovered incidentally with CT, MRI-MRCP and endoscopic-US is increasing and for radiologists it is not always easy to make decisions about patient management. Many of these APLs are small and the precise diagnosis is not always possible at the time of detection. APLs can be solid or cystic. Solid APLs represent either small adenocarcinomas or asymptomatic neuroendocrine tumours, therefore are often biologically aggressive and surgery is recommended in almost all cases (otherwise careful surveillance is strongly recommended). Lesion-attenuation in contrast-enhanced imaging is not helpful to differentiate malignant from benign. Cystic APLs could be mucinous or non-mucinous: mucinous include malignant intraductal papillary mucinous neoplasms (IPMNs), mucinous cystic neoplasms (MCN) and benign branch duct-type IPMNs (BD-IPMN). Differentiation between cystic APLs is necessary and through cyst fluid analysis using EUS with fine-needle aspiration (FNA) possible. Additionally, in cystic APLs, size, communication and/or dilatation or abrupt change in caliber of pancreatic duct, as well as nodular and /or enhancing elements are worrisome features. Surgery is recommended for IPMNs and MCN and, depending upon the general health and age of the patients, for most BD-IPMN. If the EUS FNA reveals non-mucinous tumours, clinical reassessment and surveillance (i.e. to exclude growth) by means of MRI, MRCP and EUS (with or without FNA) is recommended.

Learning Objectives:

1. To become familiar with the most common incidental findings in the pancreas with different imaging modalities.
2. To understand how to define the correct diagnosis.
3. To discuss how to manage incidental findings.

09:44

Panel discussion: How do we manage difficult cases and incidental findings?

08:30 - 10:00 **Room C**

Joint Session of the ESR and ESHI

Medical hybrid imaging

Moderator:
K. Riklund; Umeå/SE

A-725 08:30

Introduction

L. Donoso; *Barcelona/ES (ldonoso@clinic.ub.es)*

The decision to establish the European Society for Hybrid Medical Imaging (ESHI) under the umbrella of the European Society of Radiology (ESR) was taken by the ESR Executive Council back in May 2015. The background for this decision was the growing need for knowledge and skills among the imaging community as the use of PET/CT and MR/PET is steadily increasing. The establishment has been preceded by a discussion ongoing over several years. Moreover, a session about hybrid imaging training was held during the ESR Annual Leadership Meeting in November 2014 upon demand from a vast majority of delegates of the ESR's institutional member societies, who were in favour of increasing the learning activities and supported the idea to establish a European Society for hybrid Imaging. Additionally, there is also a strong wish from radiology residents to increase their training in nuclear medicine, as a survey of all ESR members in training conducted by the ESR Radiology Trainees Forum in December 2014 revealed. With the establishment of the new society we strongly hope to build an even closer and more fruitful relationship between radiology and nuclear medicine that is based on a spirit of collaboration and mutual support and which will, and this is the most important thing, be to the benefit of the patient.

Session Objectives:

1. To become familiar with the background of the decision to create this new society.
2. To learn about the aims of the new society.
3. To get an overview of physics, training and medical use in hybrid imaging.

A-726 08:35

The aims of the new society

K. Riklund; *Umeå/SE (katrine.ahlstrom.riklund@umu.se)*

The main interest for the new society is to promote education in hybrid imaging, with a focus on hybrid, i.e. on the combination of structural information from CT or MRI and the functional/molecular information from PET. The background for the decision to establish the ESHI is a growing need for knowledge and skills in the imaging community as the use of PET/CT and MR/PET is steadily increasing. The establishment has been preceded by a discussion ongoing during several years. In 2007, the ESR published a white paper on multimodality imaging together with the European Association of Nuclear Medicine (EANM). In 2011, the multimodality training curriculum, written jointly by the ESR and EANM, was published in Insights into Imaging. This curriculum is a framework for crossover training, starting from radiology or nuclear medicine and working towards obtaining the necessary skills for working with hybrid imaging. The goal is to advance the quality of performance and reporting of hybrid imaging by defining the scope of training for medical specialists in hybrid imaging. ESHI is created to improve training in hybrid imaging, to ensure the best use is made of PET/CT and PET/MR. The focus is on ensuring optimal use of hybrid imaging for patient care. It is important to take advantage of both structural and molecular information in each examination and, with continuous education, most hybrid examinations should be read by one specialist in the future. The intention is to establish a collaborative relationship between radiology and nuclear medicine.

Learning Objectives:

1. To introduce the new society.
2. To inform about the activities of the new society.

A-727 08:50

Training of hybrid physicians

G. Antoch; *Düsseldorf/DE (antoch@med.uni-duesseldorf.de)*

The history of fusing morphology and function has evolved dramatically over the past twenty years. With commercial distribution of in-line hybrid imaging systems acquisition of fused anato-metabolic data sets has become available to the general medical public. SPECT/CT, PET/CT, and, recently, MR-PET have been installed for in-patient and out-patient assessment focussing on oncological indications. However, while hybrid imaging has evolved dramatically, collaboration between radiology and nuclear medicine, the two main medical disciplines involved in image acquisition and assessment of hybrid data sets, still has room for development. We have learned that high-quality hybrid imaging requires expertise in both, function and morphology. Using low-dose CT only for anatomical correlation of PET may be reasonable in some indications, most of the times, however, state-of-the-art CT will be required. On the other hand, PET or SPECT must be recognised as more than just the new contrast agents for CT or MRI. Thus, training of physicians able to read and interpret hybrid data sets is mandatory. Until today, there has been no consensus on the European level concerning a training program including both sides of the hybrid procedure. A potential consensus is further aggravated by different regulations on a national level. This talk highlights different potential solutions to defining a combined training program for hybrid physicians.

Learning Objectives:

1. To understand why implementation of training programs for hybrid physicians is mandatory.
2. To become familiar with current differences in training programs when comparing European countries.
3. To recognise the need for a standardised European hybrid training program.

A-728 09:05

The beauty of physics in hybrid imaging

T. Beyer; *Vienna/AT (thomas.beyer@meduniwien.ac.at)*

"no abstract submitted"

Learning Objectives:

1. To lay out the fundamentals of physics in hybrid imaging.
2. To illustrate physics and physicists as partners to hybrid imaging users.
3. To speculate on the future of hybrid imaging as supported through physics.

A-729 09:20

Functional hybrid imaging: 1+1 = 3?

O. Clément; *Paris/FR (olivier.clement@egp.aphp.fr)*

Recent hybrid imaging techniques such as TEP-CT, TEP-MR can, when acquired simultaneously, provide complementary functional information, like perfusion or diffusion and glucose uptake values. The aim of this talk is to review the potential many other applications that can be developed, and to highlight the unique capabilities offered for functional imaging.

Learning Objectives:

1. To learn about the functional capabilities of hybrid imaging techniques.
2. To understand that combined functional information results in additional cross correlation and validation.

A-730 09:35

Practical challenges of hybrid imaging in clinical practice

O. Ratib; *Geneva/CH*

Hybrid imaging has gained momentum in the recent years with the emergence of new hybrid imaging devices but has also raised a load of new challenges.

Some practical challenges emerge from the technical requirements of performing such hybrid procedures, but more importantly from the new requirements and needs for interpreting and analysing these procedures to make the most out of the added value of concurrent information that can be extracted from complementary imaging modalities. It also raises significant challenges of adequate training and certification for being able to perform such tasks in clinical routine. Most hybrid imaging techniques today combine nuclear medicine and radiological modalities requiring proper skills and training in these two disciplines that have evolved in separate subspecialities in the recent years. While acquiring the proper training for the specific type of clinical domains covered by some hybrid imaging modalities, it is more challenging to acquire the proper certification and credential for it in these separate and often competing disciplines. More importantly, adequate analysis of such combination of often-complex imaging modalities require specific analysis tools and interpretation protocols that go beyond the ones needed for interpreting each modality separately. Developing such tools and providing proper training of the users represent an additional challenge if we want to benefit from the added value of hybrid imaging modalities in providing more objective and quantitative results that can improve the quality and accuracy of clinical decision making.

Learning Objectives:

1. To review the current applications of hybrid imaging in well-established clinical pathways.
2. To become familiar with the added values of hybrid imaging in patient management.
3. To learn about opportunities beyond diagnostic applications.

09:50
Discussion

08:30 - 10:00 **Room O**

Professional Challenges Session

PC 17

European variation in imaging: focus on technology

A-731 08:30

Chairman's introduction

G. Frija; *Paris/FR (guy.frija@egp.aphp.fr)*

Significant disparities exist between European countries regarding the availability of advanced medical imaging equipment, the deployment of eHealth tools such as PACS, and the use and legal regulation of teleradiology. It is worth illustrating the extent of these discrepancies with a few examples. While in Italy there are almost 25 MRI scanners per million population, in Hungary it is less than 3; the number of CT scanners shows similar extremes, with one million Greeks having access to 35 scanners, whereas the British and Hungarian populations are limited to around 8 CTs per million people. Stark differences in eHealth deployment are evident in the fact that in Scandinavia, usage of PACS is virtually universal, while this technology is only used in one quarter of hospitals in Cyprus, Greece and France. And differences are no less pronounced in the use of teleradiology, which are reinforced by varying legal standards. The ESR is actively pursuing a strategy to improve harmonisation efforts at the European level, embodied in its Call for a European Action Plan for Medical Imaging. Launched at the European Parliament in 2014, the Action Plan offers proposals in the areas of quality and safety, education and training, eHealth, and research to address these discrepancies. This is aimed at both understanding the causes for these disparities and at exploring ways of promoting best practice. The ESR's engagement with EU and international institutions is guided by this approach to ensure that patients in Europe enjoy a uniformly high standard of healthcare.

Session Objectives:

1. To highlight the current European disparities in terms of eHealth; in particular, teleradiology and equipment.
2. To explore the opportunities, benefits and possible concerns arising from a harmonised European approach.

A-732 08:33

PACS and eHealth

D. Caramella; *Pisa/IT (davide.caramella@med.unipi.it)*

In the ESR Action Plan for Medical Imaging it is stated that advances in information technology are paving the way for cross-border telemedicine services including teleradiology. It is important to emphasize the need for European standards in the development of clinical decision support systems. In many instances picture archiving and communication systems have evolved from a departmental level, towards enterprise-wide and cross-enterprise communication using IHE. This trend is not only relevant for a better patient care but may also benefit lifelong learning in radiology.

Learning Objectives:

1. To understand the European perspective of interoperability issues regarding radiology.
2. To become familiar with the availability of departmental, enterprise-wide and cross-enterprise communication of radiological studies and reports.

Author Disclosure:

D. Caramella: Speaker; Bayer.

A-733 08:48

Reporting and communication

O. Ratib; *Geneva/CH*

Image interpretation and diagnostic tasks performed by radiologists in daily routine are becoming more complex and require new way of reporting and communicating findings and results obtained from imaging procedures. Quantitative data are being extracted for more objective analysis of imaging studies and visual communication of results require new and innovative ways of generating graphical and parametric images. Multidimensional data beyond simple 3D representations often involve temporal parameters (4D) as well as functional and molecular dimension (5D). These new requirements lead to the development of new ways of communicating results by not only associating parametric images with the traditional report but also in multidisciplinary clinical conferences and tumour boards. These new practices require new IT infrastructures and software platforms for reporting and communication of results from variety of functional, metabolic and hybrid imaging techniques. ESR eHealth and Informatics Subcommittee has elected to engage in a joint effort with RSNA working group on standard reporting to promote standard reporting and improve reporting practices. The RSNA initiative called RadReport (http://www.radreport.org/) aims to create a library of structured report templates that incorporate reusable knowledge, and make it possible to integrate all of the evidence collected during the imaging procedure including clinical data, coded terminology, technical parameters, measurements, annotations and key images. But beyond these standard structured reporting efforts there is also a need for promoting more graphical and multimedia reports that can convey the complexity of quantitative analysis of imaging data in a simple and comprehensive way.

Learning Objectives:

1. To understand the value of clinical radiology.
2. To explore opportunities for improved reporting solutions, e.g. structured reporting.
3. To learn the requirements for communication of relevant or unexpected findings.

A-734 09:03

Procedure codes and lexica in radiology for supporting workflow improvements

P. Mildenberger; *Mainz/DE (peter.mildenberger@unimedizin-mainz.de)*

The use of procedure codes and lexica differs in an extremly wide range throughout Europe. However, there are some reasons for considering a common approach, e.g. ordering of imaging procedures and use of clinical decision support would require clear categorisation of imaging procedures. An IHE-profile for supporting such technology is already available. Another example would be structured reporting. There is a clear intention in many discussions and papers to improve SR, but one of the great advantages of SR would require some level of coding of informations, and this should be done with a lexicon, which would be accepted by a huge number of stakeholders. Therefore, a discussion on opportunities for a common effort might be worth to be initiated.

Learning Objectives:

1. To become familiar with available coding systems for procedures and radiological findings.
2. To explore opportunities for a European approach.

Author Disclosure:

P. Mildenberger: Board Member; IHE-Europe. Speaker; Fédération des Hôpitaux Luxembourgeois, Bracco.

A-735 09:18

Equipment and innovation

B. Brkljačić; *Zagreb/HR (boris@brkljacic.com)*

Advances in radiology equipment provide fast and accurate diagnosis, and offer new, previously non-existing options for treatment guidance, thus improving the health outcomes and quality of life for the patients. The fast development of technology created new medical imaging modalities, but it also resulted in accelerated technical and functional obsolescence of imaging equipment, consequently creating a need for renewal. Radiological equipment has a definite life cycle span and older equipment has high risk of failures and breakdowns. The unavoidable decrease or loss of image quality renders

equipment useless after the certain period. This may cause delays in diagnosis and treatment of the patient and safety problems both for the patient and the medical staff. European Society of Radiology is promoting the use of up-to-date equipment, especially in the context of the EuroSafe Imaging Campaign, as the use of up-to-date equipment will improve quality and safety in medical imaging. Reduction in radiation dose when utilizing state-of-art equipment is of utmost clinical importance. Every healthcare institution or authority should have a plan for medical imaging equipment upgrade or renewal, since the equipment older than ten years is no longer state-of-the art equipment and the replacement is essential. Operating costs of older equipment will be high when compared with new one and sometimes maintenance will be impossible if no spare parts are available. Public procurement is another important issue in the renewal of equipment. Situation in Europe is very heterogeneous and often long and complicated procurement procedures hinder timely equipment renewal.

Learning Objectives:

1. To become familiar with the need for innovation of radiological equipment - opportunities and weaknesses for radiology departments throughout Europe.
2. To understand the dependency between radiation exposure and equipment renewal.
3. To understand the dependency between innovation, equipment renewal and quality of imaging practice and to discuss procurement issues.

09:33

Panel discussion: What is the European vision on imaging technology?

08:30 - 10:00 **Room N**

E³ - ECR Master Classes (Head and Neck)

E³ 1726a

Characterisation of salivary gland masses

Moderator:
A. Trojanowska; Lublin/PL

A-736 08:30

A. Ultrasound

C. Karaman; *Aydin/TR (cankaraman@hotmail.com)*

Salivary gland neoplasms account for less than 3% of all tumours. The vast majority of salivary gland tumours originate in the major salivary glands, mostly in parotid gland, and most of them are benign. Pleomorphic adenoma and Wartin's tumour are the most frequent benign neoplasms. Mucoepidermoid carcinoma and adenoid cystic carcinoma are the most common malignant ones. For lesions in the major salivary glands ultrasound is the best modality for initial evaluation. Parotid and submandibular glands are relatively superficial structures convenient for high-resolution ultrasound. Ultrasound limited in visualisation of the deep lobe of parotid gland, owing to its retromandibular localisation. Ultrasound provides excellent tissue characterisation, multiplanar information and vascular pattern with Doppler technique. Contrast-enhanced Doppler ultrasonography may ease to show the vascular network of the tumour. Sonoelastography may enhance the diagnostic value of ultrasound. Ultrasound is also an optimal tool to guide fine-needle aspiration cytology or core-needle biopsy with its ability to provide real-time image guidance. Since some of the tumours have similar appearances on all imaging studies, fine-needle aspiration cytology is routinely recommended. Ultrasound-guided core-needle biopsy has been reported as a complementary tool for inconclusive cytology and was found to be significantly superior in providing a specific tissue diagnosis. Ultrasound is mostly capable to confirm the existence, define intra-glandular or extra-glandular location, detect features of malignancy or benignancy, assess local extension and/or invasion, and identify local nodal metastases. The accuracy of ultrasound with its all complementary techniques is dependent on specialist expertise.

Learning Objectives:

1. To recognise the signs of malignancy with B-mode and Doppler mode.
2. To become familiar with the technique and clinical applications of US elastography and contrast-enhanced US for salivary gland tumours.
3. To be able to specify the role of fine US fine needle aspiration cytology and US core needle biopsy.

A-737 09:00

B. CT, MRI and PET/CT

N.J.M. Freling; *Amsterdam/NL (n.j.freling@amc.uva.nl)*

70% salivary gland tumours are benign pleomorphic adenomas. Malignant tumours make up for 20-30% and may show aggressive characteristics: direct infiltration into adjacent compartments such as masticator space, retropharyngeal space, vascular space, infratemporal space or skull base. Location of a tumour in the deep lobe of the parotid gland favours a malignant nature. A primary parapharyngeal tumour must be excluded, although this may be difficult in case of a large lesion. Ill-defined borders may indicate a malignant nature, but sometimes can be observed in benign lesions as well. Low T2 signal is more commonly observed in malignant compared to benign tumours. Diffusion restriction is seen in highly malignant salivary gland tumours and in malignant lymphoma, but there is overlap between low-grade malignant and benign tumours. Perineural extension (enhancement) along the Vth and VIIth cranial nerves, clinically silent in > 50% of patients, should be carefully assessed and matched with radiation fields to avoid local recurrence. However, a well-defined solid tumour in the superficial parotid gland may be benign, but can be malignant as well. Imaging, therefore, should always be followed by histologic confirmation before treatment options are discussed. In high-grade malignant tumours a base-line MRI with DWI/ADC after surgery may help to detect recurrent disease. Most recurrences are seen within 3 years after the end of treatment. FDG-PET CT is useful for staging primary tumours to detect distant metastases, which occur in 20% of patients, but has no additional value during follow-up because of false-positive findings.

Learning Objectives:

1. To learn how to perform CT and MRI when a tumour of salivary glands is suspected.
2. To learn the morphological signs of malignancy at CT and MRI.
3. To know the role and limits of FDG PET in salivary gland tumours.

A-738 09:30

C. MRI diffusion and perfusion

S. Espinoza-Boireau; *Paris/FR (sophie.espinoza@gmail.com)*

MRI provides essential information to characterise parotid gland tumours. This information concerns the position of the lesion in the gland which can be deep or superficial. This element is important both for the surgeon and for determining the risk of facial nerve injury. MRI shows the shape of the lesion: ill-defined contours or an invasion of neighboring structures indicate a high risk of malignancy. Functional imaging techniques such as diffusion and perfusion provide new qualitative and quantitative data that can be useful for lesion characterisation. These elements are very important because there are malignant tumours whose support is not surgical (such as lymphoma) and, on the other hand, some benign tumours have to be removed (such as pleomorphic adenoma) because of the risk of malignant evolution. We present an MRI analysis considering all the data it provides: from the morphological characteristics to the diffusion and perfusion data, through the study of the signal in T1- and T2-weighted images. With a standardised and rigorous analysis of morphological and functional MRI data, we get a reliable characterisation of tumours in more than 90% of cases. The complete MRI analysis takes less than 10 minutes.

Learning Objectives:

1. To become familiar with the principles of MRI diffusion and perfusion.
2. To understand how to integrate these techniques in the MRI protocol in daily practice.
3. To learn the role of these techniques in mass characterisation.

08:30 - 10:00 **Studio 2016**

Genitourinary

RC 1707

Prostate imaging: how I do it

A-739 08:30

Chairman's introduction

H.-P. Schlemmer; *Heidelberg/DE (h.schlemmer@dkfz.de)*

Prostate cancer is the most frequent male cancer in the industrialised countries with high morbidity and accordingly high socio-economic impact. PSA serum measurements and TRUS-guided biopsies are conventionally used for establishing the diagnosis and for deciding upon the therapy. This approach has several limitations, however, causing unnecessary prostate biopsies due to unspecific PSA rise including false-negatives findings due to missed cancer and uncertainty about the right treatment due to the lack of reliable prognostic biomarkers. Conventional sonography is mainly used for prostate volume assessment and guidance of systematic biopsy. Multiparametric MRI is currently the most accurate method for detecting and characterising suspicious lesions in the prostate, for guiding biopsy using TRUS/MR fusion biopsy systems, for local staging as well as for therapy planning and guidance. A particular potential of multiparametric MRI is to identify the dominant intraprostatic lesion to improve the accuracy of prostate biopsy and to serve as biomarker for follow-up during active surveillance. Combined MRI-US-guided biopsy may aid to separate clinical significant from clinically insignificant prostate cancers. Standardised image interpretation (PI-RADS) is highly valuable for objective documentation and communication of imaging findings.

The gained information supports individualised decision making concerning treatment selection, planning, guidance, monitoring and follow-up. In case of active surveillance functional MR parameters additionally yield objective and reproducible biomarkers for monitoring temporal changes of individual tumour aggressiveness during follow-up. The course will provide detailed knowledge on how multiparametric MR imaging can be performed and interpreted "state-of-the-art" in clinical routine.

Session Objectives:

1. To learn the fundamentals of multiparametric MRI in prostate cancer.
2. To become familiar with the current options for image-guided biopsy.
3. To understand the clinical relevance of multiparametric MRI for treatment decision-making during active surveillance and after initial therapy.

A-740 08:35

A. Detection and assessment of aggressiveness

P. Puech; *Lille/FR*

"no abstract submitted"

Learning Objectives:

1. To understand the different types of prostate cancer within the gland.
2. To become familiar with common pitfalls of prostate cancer semiology at multiparametric MRI.
3. To understand the MRI "biomarkers" of prostate cancer aggressiveness.

A-741 08:58

B. Image-guided biopsy and staging

J.J. Fütterer; *Nijmegen/NL (jurgen.futterer@radboudumc.nl)*

MRI is applied for tumour detection and subsequent targeting. Several commercial devices are available for targeted prostate biopsy ranging from TRUS-MR fusion biopsy to in-bore MR-guided biopsy. In this presentation we will give an update: a diagnostic dilemma exists in case a male has a clinical suspicion for prostate cancer and the transrectal ultrasound-guided biopsy session turns out negative. Although transrectal ultrasound-guided biopsy is the standard of care, a paradigm shift is being observed in males with at least one negative biopsy session. TRUS-MRI fusion biopsy and in bore-biopsy will be discussed.

Learning Objectives:

1. To understand the techniques of prostate biopsy.
2. To become familiar with in-bore MR and MR/TRUS fusion guided biopsy approaches.
3. To learn about the optimal imaging protocol for the staging of prostate cancer.

A-742 09:21

C. Role of imaging in active surveillance and detection of recurrence

V. Logager; *Copenhagen/DK (vibeke.loegager@regionh.dk)*

Active surveillance is one of several treatment arms for patients with prostate cancer (PCa). The arm is reserved for patients with Gleason score $\leq$7, no extracapsular extension, no involvement of the seminal vesicles and no extraprostatic lesions (e.g. bone metastasis and/or metastasis to lymph nodes). These patients have until now been followed with biopsies at regular intervals and PSA measurements to monitor PCa status, increase of tumour size and/or increasing Gleason score. With the improvement in MRI, multi-parametric MRI (mpMRI) can most likely provide the information that is necessary to follow these patients after the initial workup (PSA, DRE, TRUS-biopsy) upon which the decision on treatment arm is taken. Such an approach will reduce the number of biopsies and unnecessary prostatectomies. Only 20-30% of the patients progress within one year according to pre-MRI data. The specificity and sensitivity of mpMRI seem sufficient in a clinical situation to distinguish the two groups of patients: unchanged vs progression. When imaging recurrence after treatment, it is mandatory to have the highest image quality and knowledge of prior treatments. One must be familiar with normal effects of treatment (radiation, hormones, cryotherapy, etc). Finally it is important to know the location of tumour prior to treatment either by images or biopsy results. The finding of vital tissue by diffusion-weighted imaging (DWI) and dynamic contrast-enhanced MRI (DCE) can guide for further biopsy and treatment. Cases of active surveillance and recurrence after treatment from Herlev Hospital will be shown.

Learning Objectives:

1. To learn about the role of multiparametric MRI in guiding therapy towards active surveillance.
2. To learn about the imaging findings in local recurrence after treatment.
3. To understand the impact in treatment planning as a consequence of these findings.

09:44

Panel discussion: Multiparametric MRI: what are the challenges and strategies to solve these?

08:30 - 10:00 **Room E1**

State of the Art Symposium

SA 17

Emergency imaging of the pregnant patient

A-743 08:30

Chairman's introduction

R. Basilico; *Chieti/IT (rbasilic@unich.it)*

In recent years, the use of radiologic examinations in pregnant women has considerably increased. Although ultrasonography is the first-line examination of choice in pregnant women, CT and MR are sometimes required to make a diagnosis, especially in trauma patients, for the suspicion of acute abdomen or pulmonary embolism and these examinations often require the intravenous injection of contrast material. When a contrast-enhanced CT or MR imaging study is being considered for a pregnant patient, the potential risks to the foetus related to exposure to radiation, high magnetic fields or contrast agents must be considered and weighed carefully against the risks of potential misdiagnosis due to refusing contrast agents and imaging studies. In fact, radiation dose concerns related to emergency in pregnancy, lack of information about the use of diagnostic contrast agents in pregnant patients and guidelines sometimes contradictory, often make radiologists uncomfortable when imaging pregnant patients, even in the emergency setting. But, if we bear in mind that maternal death almost always results in foetal death and that the best chance for foetal survival is maternal survival, all efforts have to be made to save the mother. Therefore, when used appropriately (taking into account the risks and potential benefits), contrast-enhanced CT and MR imaging can be of significant value in management of emergency during pregnancy.

Session Objectives:

1. To consolidate knowledge of the role and the appropriate uses of the different imaging techniques.
2. To become familiar with the risk of using imaging modalities in pregnant emergency patients.
3. To learn about radiation dose concerns related to emergency in pregnancy.

A-744 08:35

Polytrauma: US, CT or MR

A. Palkó; *Szeged/HU (palkoand@gmail.com)*

Pregnant patient represent a special subgroup of trauma victims. Physiological and anatomical changes in the patient's organism significantly influence the type, severity, extent of outcomes of injuries. Radiation protection considerations are of utmost importance in this patient group; therefore, the diagnostic imaging algorithm and protocol is to be adapted accordingly. Clear priorities have to be defined based on the understanding that the primary goal is to guarantee the survival of the mother. Imaging algorithm, techniques and typical findings are introduced beyond introduction of general considerations regarding significance of imaging evaluation of trauma patients, with special emphasize on the indications and possible use of modalities using ionising radiation.

Learning Objectives:

1. To discuss the imaging modalities used in the evaluation of pregnant trauma patients.
2. To identify the imaging findings associated with non-pregnancy-related and pregnancy-specific injuries.
3. To become familiar with a diagnostic imaging algorithm for the evaluation of polytrauma in pregnancy.

Author Disclosure:

A. Palkó: Advisory Board; Affidea.

A-745 09:00

Pulmonary embolism: CT or scintigraphy?

M.-P. Revel; *Paris/FR (marie-pierre.revel@cch.aphp.fr)*

Lung scintigraphy and CT angiography (CTA) can both be performed in pregnant women with pulmonary embolism suspicion. The foetal radiation dose is considered to be negligible, it is slightly lower with CTA during the first and second trimester. The 2012 recommendation from the American Thoracic Society is to start with compression ultrasound in women with leg symptoms. If negative or if there are no leg symptoms, chest x-ray should be performed. If normal, lung scintigraphy should be performed instead of CTA because the maternal breast radiation dose is much lower than for CTA. If inconclusive or if chest x-ray is abnormal, CTA must be performed with an adapted low-kilovoltage protocol to minimise the radiation dose and maximise the pulmonary arterial enhancement. Deep inspiration favoring unopacified blood

flow return from the inferior vena cava should be avoided. There is no risk of neonatal thyroid dysfunction in newborns who had a single exposure to iodinated contrast medium in utero. One advantage of CTA is the possibility to provide alternative diagnosis to pulmonary embolism.
Learning Objectives:
1. To review the role of CTA and pulmonary scintigraphy for the diagnosis of pulmonary embolism during pregnancy.
2. To learn how to optimise CTA protocols and pulmonary scintigraphy for adequately ruling out pulmonary embolism.
3. To review key imaging findings.

A-746 09:20

MRI and contrast media: what are the risks for the foetus?
M. Wozniak; *Lublin/PL (mwozniak@hoga.pl)*

Magnetic resonance imaging (MRI) is recognised as generally safe imaging modality and thus appropriate to be used in the diagnostics of the pregnant females and foetuses. It has been used to evaluate obstetrical, placental, and foetal abnormalities in pregnant patients for more than 25 years and is a proven, established imaging modality for evaluating foetal anomalies that are not well assessed with sonography. Magnetic resonance not only contributes to diagnosis but also serves as an important guide to treatment and delivery planning and counseling. However, to some extent the technique may carry some risks when used during pregnancy. Although there is no scientific evidence in humans to suggest that the risk to the foetus from a routine MRI imaging examination is significantly increased during pregnancy among potential adverse effect of MRI the following types may be recognised: 1) acoustic damage, 2) teratogenic effects 3) direct non-thermal interaction of the electromagnetic field with biological structures, 4) heating effect of MR gradient changes and 5) risk of teratogenesis from gadolinium. Thus, foetal MRI should be performed only for a valid medical reason, and only after careful consideration of sonographic findings or family history. Moreover, to keep the foetus safe, deep knowledge of potential bio-effects is mandatory as is understanding the background and the influence of particular factors for safety.
Learning Objectives:
1. To review the biological effects and safety of MRI.
2. To review procedural issues, indications and contraindications for MRI in pregnant emergency patients.
3. To discuss the risks associated with the administration of iodinated and gadolinium-based contrast agents during pregnancy, and how to monitor or avoid them.

A-747 09:35

Ionising radiation: when should we be concerned?
J. Damilakis; *Iraklion/GR (damilaki@med.uoc.gr)*

When a pregnant patient requires an emergency x-ray examination and there are no alternative non-ionising techniques, there should be no hesitation to perform the procedure. When the uterus is remote from the directly exposed anatomical area, the embryo/foetus is exposed to scattered radiation and its dose is negligible (dose lower than 1 mGy). Normally, a detailed embryo/foetus dose evaluation is not needed for such studies. Radiologic examinations involving the abdomen and/or pelvis may deliver relatively high radiation dose to the unborn child. For abdominal examinations, maternal body size and uterus position should be taken into consideration to obtain accurate dose estimation. A standard CT examination for appendicitis or ureteral stones performed on the mother would result in an embryo/foetus dose of 10-25 mGy. Multi-phase abdominal CT examinations may deliver relatively high doses to the unborn child. Doses to the unborn child below 100 mGy should not be considered a reason for therapeutic abortion. The risk to the embryo/foetus for stochastic effects is assessed on the basis of radiation dose using appropriate risk factors. Although these risks from a single diagnostic procedure are low for the vast majority of diagnostic x-ray examinations, it is important to ensure that radiation doses to the mother and child are kept as low as reasonably achievable. As part of the CONCERT project (http://concert.med.uoc.gr), a tool was developed (CODE, COnceptus Dose Estimation that allows calculation of conceptus doses and risks from x-ray examinations performed on the expectant mother. CODE can be found at embryodose.med.uoc.gr.
Learning Objectives:
1. To describe the basic concepts of radiation risks to the developing foetus at various gestational ages.
2. To identify implementation strategies for dose reduction in emergency imaging of pregnant patients.
3. To be familiar with medicolegal risk management guidelines.

09:50
Panel discussion with sample cases presentation: Emergency in pregnancy: what is best for the mother and baby?

08:30 - 10:00 **Room E2**

Special Focus Session

SF 17a
Neuro imaging in paediatrics

A-748 08:30

Chairman's introduction
A. Rossi; *Genoa/IT (andrearossi@ospedale-gaslini.ge.it)*

This special focus session is dedicated to paediatric neuroimaging, and particularly to metabolic diseases, epilepsy, and causes of headache in the paediatric age group. Through attendance to this session, participants are expected to become familiar with the MRI features of complex neuropaediatric disorders, to learn how to organize specific MRI study protocols and sequences for children with neurological disorders, and to realise that MRI is the modality of choice for paediatric neuroimaging.
Session Objectives:
1. To become familiar with the MRI features of complex neuropaediatric disorders.
2. To learn how to organise specific MRI study protocols and sequences for children with neurological disorders.
3. To consolidate MRI as the modality of choice for paediatric neuroimaging.

A-749 08:35

Imaging of metabolic disorders in children
B. Ertl-Wagner; *Munich/DE (birgit.ertl-wagner@med.uni-muenchen.de)*

Metabolic disorders of the brain can be difficult to diagnose. It is important to be familiar with the different imaging patterns of metabolic disorders and with the typical clinical presentations. Crucial clinical information needs to include the age at presentation, gender, family history and type and evolution of symptoms. Symptoms may be progressive or occur in crisis-like deteriorations. Metabolic disorders can primarily affect the white matter or the grey matter. Several disorders such as Alexander disease have an anterior-to-posterior gradient, i.e. the frontal white matter is earlier and more involved than the posterior white matter. Other disorders, such as X-linked adrenoleukodystrophy have a posterior to anterior gradient, i.e. the posterior portion of the white matter is more strongly involved. In addition, disorders may have a centrum-to-periphery gradient or vice versa. White matter disorders may lead to a delayed, arrested or abnormal myelin formation. A typical example of a hypomyelinating disorder is Pelizaeus-Merzbacher disease. Some hypomyelinating diseases have characteristic additional features such as hypomyelination with atrophy of the basal ganglia and cerebellum (H-ABC) or hypomyelination with congenital cataract (HCC). Examples of dysmyelinating diseases include metachromatic leukodystrophy, X-linked adrenoleukodystrophy or Krabbe disease. Other dysmyelinating disorders lead to a cystic degeneration of myelin; these include Alexander disease, van der Knaap disease or Canavan disease. Not uncommonly, metabolic disorders of the brain remain unclassified. It is nevertheless important to render an accurate description of the imaging pattern to enable the recognition of new disorders.
Learning Objectives:
1. To learn about the concept of MRI pattern recognition in metabolic disorders.
2. To understand the value of MRI-based grouping of patients for genetic studies.
3. To appreciate the contribution of MR techniques to the diagnosis and research of metabolic disorders.
4. To become familiar with more detailed MRI analysis and interpretation for metabolic disorders.

A-750 09:00

Imaging in paediatric epilepsy
T.A.G.M. Huisman; *Baltimore, MD/US (thuisma1@jhmi.edu)*

Seizures and epilepsy in children may result from a variety of anatomical and functional disorders and pathologies. Many of them are well depicted by high-end anatomical and functional neuroimaging techniques including focal and diffuse malformations, stroke, infections, trauma, haemorrhages, hypoxic ischaemic injury, degenerative disorders as well as a variety of metabolic disorders to mention a few. Close collaboration with the clinical team is essential to tailor the imaging for maximal diagnostic sensitivity and specificity. In the current presentation, a case-based approach will be applied to discuss frequent and less frequent aetiologies of paediatric epilepsy. In addition, practical tips will be provided for imaging protocols.

Learning Objectives:
1. To learn about the various pathologies that may result in paediatric epilepsy.
2. To understand that a complete diagnostic workup requires a multidisciplinary approach.
3. To become familiar with the MR imaging sequences that are indicated.

A-751 09:25

Imaging headache in children

E. Vázquez; *Barcelona/ES (evazquez@vhebron.net)*

Headaches are common in children, most are a benign illness or a primary headache syndrome. They may be divided into acute, acute recurrent, chronic progressive, and chronic non-progressive. Acute recurrent and chronic non-progressive headaches are likely related to a primary headache disorder; retrospective studies have shown that neuroimaging did not yield any surgically treatable condition. Secondary headache, although rare, may be caused by tumours, CNS infections or haemorrhages in 5-15 % of cases. Indications for neuroimaging include the named "red flags": cerebellar dysfunction or increased intracranial pressure, focal deficits (seizures), headaches that awake the child from sleep or present in the morning, absent family history of migraine, personality change or deterioration of school work, headaches for less than 6 months duration not responding to lifestyle changes and standard treatment, family history of CNS disorders such as brain tumours or cerebral aneurysms, accompanying systemic symptoms, or presence of secondary risk factors. MRI is the preferred modality due to greater accuracy and resolution, lack of ionising radiation, and increased sensitivity for detection of ischaemic changes (DWI) or vascular abnormalities. In sudden, unusual, thunderclap headache, a prompt diagnosis is essential, using emergent cerebral CT. If suggested aneurysm rupture, CT angiography should be afterwards performed. If suspected AVM, intra-arterial angiography is necessary. If cavernous angioma or unknown aetiology, MRI is required. In this lecture, main indications to perform a neuroimaging procedure in children with headaches will be reviewed, several representative cases will be presented and preferential use of either CT or MRI will be discussed.

Learning Objectives:
1. To learn about the role and value of neuroimaging in children with the different types of headaches, mainly primary and secondary headaches.
2. To become familiar with subtle symptoms or signs ("red flags") that raise suspicion of intracranial pathology worthy for prompt neuroimaging.
3. To emphasise some underlying aetiologies, such as neoplasms or vascular disorders, that may be potentially life threatening.

09:50
Panel discussion: Can we do without CT in paediatric neuroimaging?

08:30 - 10:00 **Room F1**

E³ - ECR Master Classes (Oncologic Imaging)

E³ 1726b

Personalised medicine in oncology: what can imaging offer?

Moderator:
R.G.H. Beets-Tan; Maastricht/NL

A-752 08:30

A. Personalised medicine in oncology: hope or reality?

E.E. Voest; *Amsterdam/NL (e.voest@nki.nl)*

Advances in our understanding of cancer biology together with enormous technological progress in DNA and RNA sequencing, molecular imaging and several other new approaches have provided an unprecedented impulse to personalised medicine or better precision medicine. Based on specific genetic alterations several drugs have now been approved for the treatment of cancer. These drugs have changed the perspective of patients with, e.g. breast cancer, melanoma and lung cancer. Despite these advances, there are still many challenges that need to be addressed: tumour heterogeneity, better understanding of the genetic complexity of cancer, and the value of molecular imaging and radionics. These questions need to be answered to be able to select patients for the best therapy, avoid unnecessary exposure to ineffective drugs and to sustain a financially sound and high-quality health care system.

Learning Objectives:
1. To become familiar with the concept of personalised medicine.
2. To learn about the current state-of-the-art management of metastatic disease.
3. To learn how biomarkers can contribute to a personalised approach.

A-753 08:55

B. Radiogenomics: can this assist personalised medicine?

V.J. Goh; *London/UK (vicky.goh@kcl.ac.uk)*

Personalised medicine brings new challenges and opportunities for imaging in oncology. Treatment individualisation requires better patient stratification prior to treatment. In recent years, the paradigm shift in imaging has provided new tools for assessing the tumour phenotype and changes in response to treatment including the ability to combine assessment of tumour morphology, physiology and image heterogeneity. The generation of large imaging datasets and integration with clinical data has led to 'radiomics'. Developments in the field of genomics has also brought the possibility of better therapeutic triage. Integration of genomics with radiomics shows promise for the future. This lecture will highlight concepts and methodology, and discuss the evidence to date to support its clinical application.

Learning Objectives:
1. To understand the rationale for radiogenomics in oncology.
2. To learn about the different strategies that can be used to extract data.
3. To understand how radiogenomics may improve tumour phenotyping.

Author Disclosure:
V.J. Goh: Research/Grant Support; Siemens Healthcare.

A-754 09:20

C. Hybrid PET/MRI: the next step in personalised cancer care?

A. Kjaer; *Copenhagen/DK (akjaer@sund.ku.dk)*

Hybrid PET/MR systems have now been commercially available for several years and may provide combined anatomical-metabolic image information. Especially in cancer patients, this may be an advantage. However, compared with PET/CT, PET/MR has a lower throughput and is more costly. Therefore, the question arises when and if PET/MR should be used in cancer patients. In addition, MR is also a functional imaging modality thus allowing for functional-functional PET/MR imaging. Imaging-guided therapy planning and monitoring is well established in various cancers using FDG-PET. This principle could now be transferred to PET/MR where combination with functional MR allows for a multi-parametric strategy. Accordingly, hybrid PET/MR scanners might become game-changers for personalised medicine. At our department we have now performed more than 2,000 PET/MR scans and based on this experience, the value of PET/MR in clinical oncology and as a research tool will be discussed with special focus on value in personalised medicine.

Learning Objectives:
1. To learn how FDG and non-FDG PET tracers can allow us to visualise cancer cells.
2. To learn about the potential of MRI/PET to improve tumour phenotyping.
3. To learn how MRI/PET could contribute to a personalised approach in oncology.

09:45
Panel discussion: Can imaging facilitate a personalised medicine approach in oncology?

08:30 - 10:00 **Room F2**

E³ - ECR Master Classes (Breast)

E³ 1726c

Challenging questions for breast imaging in 2016: breast density, how to solve the non-mass enigma, new developments in breast MRI

Moderator:
R.M. Mann; Nijmegen/NL

A-755 08:30

A. Breast density: what the breast radiologist needs to know

S.J. Vinnicombe; *Dundee/UK (s.vinnicombe@dundee.ac.uk)*

The 'dense breast' is one where the proportion of fibroglandular parenchyma greatly exceeds that of adipose tissue. The importance of mammographic breast density (MD) is twofold: firstly, obscuration of significant mammographic lesions can reduce the sensitivity of mammographic screening - a fact highlighted by the US "Are You Dense" campaign. Secondly, mammographic breast density is in itself a risk factor for breast cancer. At a population level, only age imparts greater risk than density; the relative risk of developing breast cancer is increased four- to sixfold in women with MD in the highest quintile compared with the lowest quintile. Various strategies have been proposed to improve the sensitivity of mammographic screening in the dense breast,

including digital breast tomosynthesis (DBT), supplemental whole breast ultrasound and even breast MRI. Though all these can increase the cancer detection rate, the economic implications are significant and efficacy uncertain. A key question is whether MD could be used to improve risk prediction for the individual woman if added to widely used risk prediction tools, a crucial component of personalised, risk adapted breast screening. A prerequisite for this is the availability of fully automated, reliable methods for measurement of MD, validated against breast cancer risk. The evidence suggests that programmes such as Volpara™ and Quantra™ fulfil this need. Finally, the interplay of features such as MD, texture and background parenchymal enhancement at MRI, the latter also a possible indicator of breast cancer risk, is not well understood and further research is needed to address these questions.

Learning Objectives:

1. To learn the definition of dense breast and the consequences on mammography interpretation and strategies to overcome the limitations of the different modalities.
2. To understand the different methods to measure breast density on mammography, ultrasound and MRI.
3. To understand if breast density or (breast enhancement) BPE have an influence on breast cancer risk.

Author Disclosure:

S.J. Vinnicombe: Grant Recipient; Breast Cancer Now, EPSRC.

A-756 09:00

B. How can we manage the non-mass breast (enigma) pattern?

F. Pediconi; *Rome/IT (federica.pediconi@uniroma1.it)*

Non-mass-like enhancement (NML) includes areas of enhancement without a three-dimensional mass, which are determined on the base of distribution (focal, linear, segmental, regional, multiple regions, diffuse), enhancement pattern (homogeneous, heterogeneous, clumped, clustered ring), and symmetry or asymmetry. Segmental enhancement, clumped pattern and asymmetric descriptors have the highest PPV for breast malignancy. Segmental enhancement involves multiple ducts and it is associated with 78% of risk of breast cancer while the linear enhancement is a line of enhancement not necessarily conforming to a duct. In regard to the internal enhancement pattern, the clumped pattern is the most relevant as it is associated with the highest risk (60%) of breast cancer. DCIS and ILC frequently present as non-mass enhancement. Although the evaluation of non-mass enhancement lesions is still challenging, this pattern is associated with a significant percentage of cases of breast cancer; and because the kinetic curves, in non-mass enhancement lesions, are less representative of malignancy compared to mass lesions the distribution of the enhancement must be carefully evaluated. Moreover, informations obtained from conventional breast imaging and clinical features improves the characterisation of non-mass enhancement lesions at breast MR imaging. Several authors investigated the role of new techniques such as MR spectroscopy and DWI in non-mass enhancement lesions evaluation. The use of these tools, in particular ADC map, can help in reducing the rate of biopsies in false-positive findings improving sensitivity, accuracy and NPV in NML breast lesions.

Learning Objectives:

1. To learn the definition of non-mass in mammography and MRI and to understand why interpretation is difficult.
2. To understand the pathological correlations and the clinical problems.
3. To appraise how new technical developments can help define an appropriate integrated strategy.

A-757 09:30

C. New developments in breast MRI

L. Umutlu; *Essen/DE (Lale.Umutlu@uk-essen.de)*

Breast tissue density has been shown to be associated to a higher risk for breast cancer development. Hence, correct assessment and quantification of tissue density remains an important issue and current studies have introduced various software tools for automated assessment of tissue density, showing its comparable and even superior diagnostic potential over mammographic assessment. The first aim of this presentation is to give a review on current software tools for texture analysis and density quantification. Breast MR imaging has been well established for cancer diagnostics within the last 15 years. The combined analysis of contrast kinetics, morphology and functional parameters based on diffusion-weighted imaging have demonstrated their high diagnostic potential for tumour assessment. Nevertheless, the diffusion-weighted imaging remains to be a challenging tool, lacking standardised application as well as reading, in terms of standardised threshold for ADC values. The second aim of this presentation is to give an insight into the application and evaluation of DWI as an additive tool for breast MRI diagnostics. While the current worldwide standard of breast MRI remains to be at 1.5 Tesla imaging, 3 Tesla bMRI has been well established into clinical imaging, providing potential benefits as well as disadvantages for breast cancer diagnostics. With the successful introduction of ultrahigh-field whole body MR systems, by means of 7 Tesla, for breast imaging, a new platform for high spatiotemporal resolution assessment of breast tumours has been enabled. The final aim of this presentation is to give an insight into new developments in ultrahigh-field breast MRI.

Learning Objectives:

1. To know the principle of non-contrast breast MRI: texture analysis.
2. To understand advantages and limitations of DWI in breast MRI.
3. To become familiar with the main results of high field breast MRI, including their advantages and limitations.

Author Disclosure:

L. Umutlu: Consultant; Bayer Healthcare. Research/Grant Support; Siemens Healthcare.

08:30 - 10:00 **Room D1**

Special Focus Session

SF 17b

Actionable pulmonary nodules: should we rely on size only?

A-758 08:30

Chairman's introduction

L. Bonomo; *Rome/IT (lbonomo@rm.unicatt.it)*

The special focus session on pulmonary nodules focuses on the intrinsic limitations of pulmonary nodule size at both 2D and 3D measurements, including growth measurements during follow-up. Thus, there is a need of integrating size with other morphological characteristics as well as functional data and clinical parameters. Morphological characteristics of pulmonary nodules, like shape and density, can be predictors of subtypes and mutations in non-small cell lung cancer. Likewise, tracers used in hybrid imaging are helpful for identifying and characterising lung nodules. In particular, hybrid imaging can provide data not only using the well-known proliferation tracers, but also using all other tracers regarding perfusion, hypoxia, and metabolism. Finally, clinical data are important components to define a pulmonary nodule as actionable, covering a central role in patient management.

Session Objectives:

1. To learn about the intrinsic limitations of pulmonary nodule size by both 2D and 3D tools.
2. To appreciate the need of integrating size with other morphological characteristics as well as functional data and clinical parameters.

A-759 08:33

Limitations of nodule measurements

A.R. Larici; *Rome/IT (anna.larici@rm.unicatt.it)*

An actionable lung nodule is one that is judged by the radiologist to require further evaluation. Nodule's probability of malignancy is mainly based on size and growth rate. Nodule size has traditionally been assessed by measuring the cross-sectional diameters. Nevertheless, literature extensively demonstrated that two-dimensional (2D) measurements have low accuracy in assessing the probability of malignancy, due to the high inter-observer and intra-observer variability. The growth rate is assessed by calculating the volume doubling time (VDT) that can be estimated using an exponential growth model that assumes uniform three-dimensional (3D) nodule growth. Nevertheless, it has been reported that nodules may show an asymmetrical growth over time and, therefore, also this method may be inaccurate in this context. Volumetric analysis has been increasingly reported as a valid alternative tool to assess nodule size and growth. Many authors compared automatic or semiautomatic 3D volumetric measurement to 2D measurement, finding a superior reproducibility and a greater sensitivity for malignancy of volumetric-calculated DT. Many different ranges of VDT suggesting malignancy have been reported in literature, also according to the nodule type, and recent guidelines of BTS provided updated recommendations on that. Even automatic volume growth assessment has some limitations, being affected by several technical aspects, as well as by nodule's size, density and location, with an intrinsic variability of 25.6% that should be taken into account when calculating nodule's growth. Investigations on computer-aided diagnosis (CAD) showed that it may have the potential to increase radiologists' accuracy in assessing the likelihood of malignancy of lung nodules.

Learning Objectives:

1. To describe the limitations of 2D and 3D measurements of lung nodules, including growth measurements during follow-up.
2. To investigate the role of computer-aided diagnosis (CAD) in defining an actionable nodule.

A-760 08:51

Shape and density: predictors of subtypes and mutations in NSCLC?

O.L. Sedlaczek; *Heidelberg/DE (sedlaczek@web.de)*

The implementation of lung cancer screening not only requires the identification of the right target population but, if possible, a better morphologic characterisation of the target lesions. Morphologic CT characteristics of the lung cancers resected show a strong correlation to the histo-subtypes of NSCLC. However, while GGO lesions might represent precursor lesions of invasive lung cancer they were merely neglected in the screening trials. For dignity of the latter lesions, density plays a major role, and a relatively complicated workup is recommended. Further morphological characteristics such as solid proportions and surface properties further characterise these and also screening CT lesions. Data from a complex morphologic re-evaluation of the LUSI trial will be shown with a focus on the predictive value of density and morphology in the lesions detected and their clinical management.

Learning Objectives:

1. To appreciate the relevance of morphological characteristics of pulmonary nodules, i.e. shape and density, as predictors of subtypes and mutations in NSCLC.
2. To learn how shape and density influence the management of pulmonary nodules.

A-761 09:09

Proliferation tracers and not only

R. Boellaard; *Amsterdam/NL (r.boellaard@vumc.nl)*

Use of positron emission tomography (PET)/computed tomography (CT) in oncology is usually performed using the radiotracer fluorodeoxyglucose (FDG), which provides information on glucose metabolism. FDG PET/CT has become one of the imaging modalities of choice for diagnosis, staging of various cancers. FDG PET/CT is increasingly used for response monitoring and criteria to measure response have been proposed. FDG is, however, not specific for malignancies only and increased uptake may result from, e.g. inflammatory processes as well. Moreover, visualisation of other tumour characteristics with PET, such as perfusion, hypoxia, presence of specific targets and proliferation, may be of interest to predict or assess response to therapy or to guide localised treatments. A more comprehensive characterisation of tumour biology is of interest to more precisely personalise treatment. 3′-deoxy-3′-fluorothymidine (FLT) was developed as a proliferation tracer and is presently being further investigated as an imaging biomarker to measure treatment response and drug efficacy. FLT has been technically validated and optimal simplified quantitative analysis methods, that are clinically feasible, have been identified. FLT is taken up through the salvage pathway and FLT uptake may be low for tumours that mainly use de novo synthesis for their thymidine need. Therefore, clinical validation of FLT, either as predictive factor and/or as response marker, is warranted and currently being undertaking. Besides proliferation several other PET tracers are available for measuring hypoxia, perfusion or specific tumour targets and receptors. In this presentation, some of these tracers will be exemplified and their potential applications discussed.

Learning Objectives:

1. To become familiar with tracers used in hybrid imaging, not only well-known proliferation tracers but also all other tracers regarding perfusion, hypoxia, and metabolism, helpful for characterising lung nodules.
2. To have an in-depth understanding of the role of hybrid imaging in the evaluation of pulmonary nodules.

Author Disclosure:

R. Boellaard: Research/Grant Support; Research partly funded through IMI Quic-Concept.

A-762 09:27

How necessary is clinical data?

A.A. Bankier; *Boston, MA/US (abankier@bidmc.harvard.edu)*

The presentation will review nodule parameters other than size that are of importance when clinically assessing nodules and managing nodules in terms of follow-up examinations. In particular, shape, texture and matrix will be discussed. The role of these parameters in commonly used clinical risk calculators will be evaluated.

Learning Objectives:

1. To investigate clinical data, whether it is significant or not in defining a nodule as actionable.
2. To describe the strategy for managing a solitary pulmonary nodule by taking into account clinical data.

Author Disclosure:

A.A. Bankier: Author; Elsevier. Consultant; Spiration, Crico.

09:45

Panel discussion: How to define an actionable nodule in daily practice?

08:30 - 10:00 **Room D2**

Radiographers

RC 1714

The magic of excellent images

A-763/A-764 08:30

Chairmen's introduction

N. Mekis; *Ljubljana/SI*

A.P. Parkar; *Bergen/NO (apparkar@gmail.com)*

Due to a wide variety of use of x-rays in non-invasive and painless diagnosing and monitoring therapy it is difficult to imagine modern medical treatment without them; some of the examinations would not even be possible. The number of radiology examinations performed annually is increasing steadily. Although this increase is rightly due to better access to radiology and a higher need for radiology in the clinical decision process, quite a few of them are unnecessarily repeated. Audits have shown that more than half of the repeated examinations could be avoided by strict compliance to the adopted protocols and principles of radiographic procedures. As technology advances in all modalities, we need to ensure that good and safe practice is delivered. Radiographers are encouraged to take an active role in image optimisation and the development of standardised protocols. The aim of the session is to show the importance of optimisation of protocols and to present different optimisation methods of different modalities that will lead to better image quality, decrease of the radiation doses as well as better patient care. Radiographers play a vital role in the quality assurance of radiological examinations which ensures the best image quality and optimal patient safety. To acquire this goal radiographers and radiologists have to work together as a team.

Session Objectives:

1. To understand the contribution of the radiographers in image quality optimisation.
2. To expand on the challenges and perspectives of image quality in each field.
3. To discuss the importance of excellent images in patient care.

A-765 08:35

A. Image quality optimisation in MRI: a radiographer's perspective

M. Kiss; *Miskolc/HU (kissmate20@gmail.com)*

Magnetic resonance imaging (MRI) is used extensively in the clinical routine to study and detect the different anatomy of patient, functions and diseases. Owing to the new MRI techniques and sequences, the examinations time are shorter and we get precise and more information about the patient. There are many technical developments, which are automate the workflow, decrease the examination time (e.g. parallel imaging techniques; simultaneous multislice imaging) and zoomed imaging without aliasing artefacts. These technical possibilities help the radiologists and radiographers work. However, many advantages, there are some disadvantages, e.g. significantly increased adjustable parameter, that hardly review context and appeared specific artefacts. Owing to these drawbacks the image optimisation is more complicated and the radiographers have heavier and responsible work to detect and eliminate the image artefacts and control the MRI examinations. The radiographers have to understand the new techniques, eliminate the appeared artefacts and have to control the emerge problems. The profession of knowledge the radiographers can effectively and systematically modify the scan parameters, optimise the protocols and to help the radiologists work. This presentation aim to show the newest technical developments in the routine clinical examinations, give a short review the most commonly artefacts.

Learning Objectives:

1. To understand the role of radiographers in MR image quality optimisation.
2. To learn how to effectively and systematically modify scan parameters to optimise MRI protocols.
3. To become aware of recent developments in MRI software and hardware and how these can be used to further optimise image quality in MRI.

A-766 08:58

B. Fine tuning of image quality in computed tomography, the role of the radiographer

D. Pekarovic, U. Zdešar; *Ljubljana/SI (dean.pekarovic@kclj.si)*

The role of radiographer is crucial in team work in CT. The appropriate training and understanding should be identified and upgraded to fulfil high-quality health service. Recent advances such as automatic exposure control, iterative reconstruction, kV optimisation and others made the optimisation process easier but basic parameters like slice thickness, collimation, pitch and patient positioning still play an important role. Understanding the basic principles and possibilities offered by modern equipment is of crucial importance because

different vendors implement them in different ways. But understanding technology with no clinical experience is not enough. Only both assure radiographer to take proper steps in optimisation of each CT procedure and make quick and proper decisions. Radiographer is also the last one in radiation protection chain, which makes continuous education of radiographers even more important.

Learning Objectives:

1. To become familiar with the recent technological advances in CT and how these can be exploited for image quality optimisation.
2. To become aware of the range of possibilities relating to image quality optimisation in CT.
3. To understand the role of the radiographer in optimising CT imaging protocols.

A-767 09:21

C. X-ray radiography: tips and tricks for high quality imaging on the frontline

E. Constantarogianni; *Athens/GR (effieconstant7@windowslive.com)*

X-rays are the most frequent and oldest used form of medical imaging. The x-rays are absorbed on different parts of the body in varying degrees. Much of the radiation is absorbed from the dense bone, while muscle, organs and fat (soft tissue), allow more of the x-rays to pass through them. X-ray images were maintained as a hard film copy, until today, that most images are digital files that are stored electronically. A quality image has an appropriate level of subject contrast to differentiate among the anatomic structures, also has sufficient brightness and density to display anatomic structures, maximizing resolution and minimising distortion. This study is focused on: to introduce the importance of image quality optimisation in x-ray radiography. To discuss the contribution of the radiographer in creating high-quality x-ray images. To be aware of strategies of optimal use of hardware and software to facilitate diagnosis. During x-ray examinations special care must be taken, in purpose to produce the best images for evaluation, using the lowest radiation dose. International and national radiology protection organisations update and review the technique standards used by radiology professionals. A critical best practice in digital radiography is that the radiographers must follow the standards and protocols of their departments. Many variables affect the quality of a radiological imaging, so the use of digital imaging creates new challenges for the radiographers.

Learning Objectives:

1. To introduce the importance of image quality optimisation in x-ray radiography.
2. To discuss the contribution of the radiographer in creating high quality x-ray images.
3. To become aware of strategies for optimal use of hardware and software to facilitate diagnosis.

09:44

Panel discussion: The importance of excellent images for advancing the quality of healthcare

08:30 - 10:00 **Room K**

E³ - Rising Stars Programme

Basic Session 6: Thoracic emergencies

A-768 08:30

Vascular

R. Morgan; *London/UK (robert.morgan@stgeorges.nhs.uk)*

The majority of vascular emergencies involving the thorax are related to the thoracic aorta. Pathological entities that will be covered in the lecture will be traumatic aortic injury, ruptured thoracic aorta aneurysm and acute complicated aortic dissection involving the ascending and descending aorta. Other less common acute pathologies of the aorta include acute intramural haematoma and penetrating aortic ulcer involving the aorta. The role of aortic endografting for the management of emergencies involving the thoracic aorta will be described and the relative merits of aortic endografting compared with open surgery will be discussed.

A-769 09:00

Pulmonary

C.M. Schaefer-Prokop; *Amersfoort/NL (cornelia.schaeferprokop@gmail.com)*

The course will focus on pulmonary diseases causing acute respiratory insufficiency. Based on case-based discussions radiographic and CT features of patients with infectious, cardiogenic, vascular or interstitial diseases causing acute respiratory failure will be discussed. A systematic approach of radiographic and CT patterns will be proposed to establish typical findings suggesting a specific diagnosis and features helpful for differential diagnosis.

A-770 09:30

Cardiac

C. Loewe; *Vienna/AT (christian.loewe@meduniwien.ac.at)*

Given its central role for the human organism cardiac emergencies represent real life-threatening emergencies necessitating acute diagnosis and subsequent immediate treatment. The most frequent cardiac emergency is represented for sure by different types of myocardial infarctions as summarised under the term of "acute coronary syndrome" (ACS). Additionally, cardiac emergencies can also be caused by rhythmological disorders, by valvular diseases (including endocarditis), myocardial diseases (including myocarditis) and even pericardial diseases (including pericarditis). During the last decade, modern non-invasive imaging gained more and more importance in the management of patients suffering from acute chest pain and acute cardiac diseases and hence cardiac emergencies. Thanks to its high incidence and bad outcome, this basic session about cardiac emergencies will focus mainly on the ACS, representing the first symptom of coronary arterial disease in about 50% of all patients and representing a frequent cause for sudden cardiac death. The definition of the ACS, the most important differential as well as the currently recommended clinical algorithm for diagnosis and treatment of ACS will be presented. The changing role of imaging by means of CT and MRI in patients with and after ACS will be introduced. Additionally congenital or acquired cardiac disorders representing possible causes for cardiac emergencies including hypertrophic cardiomyopathy and coronary anomalies will be discussed and the importance for prevention and screening will be pointed out. By attending this session, the importance of modern cardiac imaging for the early diagnosis and appropriate management of cardiac emergencies will be underlined.

Author Disclosure:

C. Loewe: Speaker; Speaker Honorarium from: Siemens, Bracco, Guerbet, GE Healthcare, Medtronic.

08:30 - 10:00 **Room G**

E³ - ECR Master Classes (Neuro)

E³ 1726d

Imaging in dementia

Moderator:
D. Van Westen; Lund/SE

A-771 08:30

A. The neurochemistry of the Alzheimer's continuum

S. Engelborghs; *Antwerp/BE (sebastiaan.engelborghs@uantwerpen.be)*

During the past years, Alzheimer's disease (AD) has been redefined and the concept of the AD continuum was introduced. AD is characterised by a long preclinical phase that offers great opportunities for prevention. Once symptoms occur, they are at first instance mild, to which the terminology mild cognitive impairment (MCI) or prodromal AD refers. The dementia stage is the terminal phase of this disease. Neurochemically and neuropathologically, the formation of amyloid plaques, one of the major neuropathological hallmarks AD, is the first phenomenon that takes place in the AD brain. Amyloid plaques mainly consist of aggregates of carboxyterminally elongated forms of amyloid-β (Aβ) peptides resulting from cleavage of the transmembrane amyloid precursor protein by β- and γ-secretase. The most abundant Aβ peptides in the brain and in the cerebrospinal fluid (CSF) are Aβ1-38, Aβ1-40 and Aβ1-42, of which Aβ1-42 is the most pathological in AD as it is most prone to aggregation into Aβ plaques. Later on, the intraneuronal tau protein gets hyperphosphorylated and starts forming neurofibrillary tangles, another major neuropathological hallmark of AD. A cascade follows that includes synaptic as well as neuronal degeneration. Both imaging and biochemical biomarkers have now been incorporated into research diagnostic criteria for AD. Although the clinical examination (including full neuropsychological evaluation) is still the basis for AD diagnosis, these biomarkers are being introduced in daily clinical dementia practice as in vivo proximate markers for the confirmation of AD neuropathology.

Learning Objectives:

1. To understand what misfolded proteins are, and how they play a role in the pathogenesis of Alzheimer's disease.
2. To understand the concept of the Alzheimer's disease continuum with a long preclinical phase, a prodromal and a dementia stage.
3. To understand how insights in the neurochemistry of Alzheimer's disease have contributed to improved and early biomarker-based diagnosis of Alzheimer's disease.

Author Disclosure:

S. Engelborghs: Consultant; Innogenetics / Fujirebio Europe, Pfizer, Novartis, UCB, Roche diagnostics, Nutricia / Danone. Research/Grant Support; Janssen, ADx NeuroSciences.

A-772 09:00

B. MR contribution to diagnosis and differential diagnosis

F. Barkhof; *London/UK, Amsterdam/NL (f.barkhof@vumc.nl)*

Guidelines for dementia not only recommend MRI to rule out a surgical lesion, but also to confirm neurodegenerative disorders such as Alzheimer's disease. MRI is mandatory to diagnose vascular dementia and determine vascular loading in patients with, for example, Alzheimer. If MRI is negative, PET can be helpful to demonstrate amyloid deposition or determine frontal hypometabolism.

Learning Objectives:

1. To understand the concept of mild cognitive impairment (MCI).
2. To learn how to diagnose the different dementia forms using conventional MR.
3. To understand the role of advanced MR techniques in diagnosing dementia.

Author Disclosure:

F. Barkhof: Advisory Board; Roche, Novartis, Jansen, Biogen-IDEC. Board Member; Neurology, Brain, Radiology. Consultant; Ixico. Research/Grant Support; Philips, Toshiba, Novartis, TEVA.

A-773 09:30

C. PET imaging in dementia

K. Herholz; *Manchester/UK (karl.herholz@manchester.ac.uk)*

Positron emission tomography (PET) is providing functional and molecular imaging for differential diagnosis and monitoring of progression in dementia. Regional changes of synaptic activity, which show characteristic patterns in many neurodegenerative diseases, can be imaged with FDG PET, typically 1-2 years before the onset of dementia. Several ligands are now available to demonstrate fibrillary cortical amyloid beta deposits, including 11C-PIB (used in clinical research since more than 10 years) and 18 F-ligands florbetapir, florbetaben, and flutemetamol, which have received licenses for diagnostic use by FDA and EMA. They offer very high sensitivity to detect Alzheimer's disease (AD), and their accuracy has been demonstrated by postmortem pathological verification. Positive findings with these tracers can probably precede the clinical manifestation of dementia by up to 20 years. They are commonly being used as imaging biomarkers in clinical trials of anti-amyloid agents, and their ability to increase diagnostic certainty has been demonstrated in clinical settings. Recently, PET tracers have also been developed for imaging of pathological tau deposits, which are common in AD and other neurodegenerative conditions.

Learning Objectives:

1. To appreciate the different ligands relevant to the diagnosis of dementia
2. To understand the sensitivity and specificity of the amyloid-tracer PIB.
3. To appreciate the clinical relevance of PIB.

Author Disclosure:

K. Herholz: Consultant; PMOD Technologies. Research/Grant Support; GE Healthcare, AVID Radiopharmaceuticals.

10:30 - 12:00 **Room A**

E³ - ECR Master Classes (Musculoskeletal)

E³ 1826
MSK and intervention

A-774 10:30

Chairman's introduction

A. Gangi; *Strasbourg/FR (gangi@unistra.fr)*

A-775 10:36

A. How to biopsy soft tissue and bone tumours

G.K.O. Åström; *Uppsala/SE (Gunnar.Astrom@radiol.uu.se)*

Despite new imaging modalities musculoskeletal lesions often remain non-specific. Some benign lesions are regarded as do not touch lesions (no biopsy) because they often can be diagnosed on images alone (e.g. lipoma, enostoma, enchondroma, haemangioma, non-ossifying fibroma, fibrous dysplasia, red marrow islands). Still biopsy is in many cases needed for a diagnosis (tumour/infection). Knowledge of common radiologic and clinical findings, specimen handling and treatment option of lesions are important for the decision to biopsy, biopsy technique and biopsy approach. The lesion considered accessible with least risk should be selected for biopsy - all images of interest (MDCT, MRI, PET, bone scan) should be evaluated. The soft part or the area with most aggressive appearance is favourable as target within a lesion. Regarding osteomyelitis biopsy from bone (marrow) and soft parts is favourable. When a sarcoma is suspected one has to know the compartmental anatomy and plan the biopsy route with the orthopaedic tumour surgeon, so that the biopsy will be performed along the surgeons' planned definitive excision track. Uninvolved compartments and neurovascular structures should be avoided. This will reduce the risk of a poor biopsy resulting in larger surgery (loss of limb). Ultrasound might be favourable on most soft tissue lesions and also in some bone lesions that are not covered by intact bone; however, with US it is difficult for the surgeon to know the needle tract. Complications are rare - knowledge of previous reaction to local anaesthetics or impaired haemostasis is mandatory to reduce risks.

Learning Objectives:

1. To learn which tumours are 'no touch'.
2. To demonstrate how to plan a biopsy: when to culture and when to biopsy.
3. To discuss complications and how to deal with them.

Author Disclosure:

G.K.O. Åström: Patent Holder; Bonopty.

A-776 10:57

B. Lower back pain: what can I do?

D.J. Wilson; *Oxford/UK (davidwilson.stlukes@btconnect.com)*

In those patients where back pain persists for several weeks there comes a need to investigate and potentially treat with interventional techniques. If the patient has "red flag symptoms" then urgent investigation by MRI is indicated. The detection rate for serious disease including infection, tumour and fracture will be of the order of 20%. In this lecture I will discuss the treatment options for the 80% who have no specific identifiable disease. There is very poor correlation between the imaging appearances of disc degeneration or the facet joint arthropathy with back pain. Patients are surprisingly accurate at identifying the origin of their pain. At this stage clinical examination is vital and radiologists undertaking back pain procedures should be adept at clinical as well as imaging assessment. History is particularly helpful, pain arising from the facet joints typically wakes the patient from their sleep and is related to particular positions. Selective block of joints or nerves with bupivacaine and corticosteroids may be employed. There is poor correlation of discography with history or signs. A variety of techniques including laser, radiofrequency ablation, medial branch block, cold ablation, intradiscal steroid and intradiscal ozone have been used. It is difficult to find convincing level I evidence for their efficacy, however, individual patient if the technique works and is reasonably safe for those does not work there is compelling argument for its continued use. The lecture and references will be online at www.stlukesradiology.org.uk after the presentation.

Learning Objectives:

1. To learn which common pathologies account for lower back pain that we can treat.
2. To illustrate the common technique used in the specific pathologies.

Author Disclosure:

D.J. Wilson: Owner; Sr Lukes Radiology Oxford. Shareholder; European Scanning London.

A-777 11:18

C. Injectables - steroids and platelet-rich plasma (PRP): how and when?

M.J.C.M. Rutten; *'s-Hertogenbosch/NL*

The range and number of applications for ultrasound-guided musculoskeletal interventions, such as dry needling or autologous platelet-rich plasma injection is rapidly increasing. The procedures have specific indications and technical demands, which may influence clinical outcome. This session will highlight the fundamentals and appropriate techniques in MSK joint and tendon intervention. The increasing use of a wide variety of drugs requires a thorough understanding of the adverse effects by the radiologist. Familiarity with the commonly encountered side effects leads to a more accurate and proper clinical management. The side effects of the most commonly used drugs as corticosteroids and intra-articularly administered local anaesthetics will be discussed. Even though treatment with corticosteroid injections and PRP holds great promise and has received extensive publicity, there is still debate about indications and its potential effectiveness in the treatment of injuries. This lecture will review the current clinical evidence-based literature and discuss the evidence on the use of corticosteroids and PRP.

Learning Objectives:

1. To learn about appropriate technique in MSK joint and tendon intervention.
2. To learn about the complications.
3. To illustrate the evidence on the use of steroids and PRP.

A-778 11:39

D. Painful solitary bone lesions: what is the most appropriate approach?

F. Arrigoni; *L'Aquila/IT (arrigoni.francesco@gmail.com)*

Interventional radiology (IR), thanks to the development in technological and knowledge skills, has achieved a first-line role in the treatment of bone lesions. In particular, a large range of benign and malignant lesions can be treated: not only the well-known ablations of osteoid osteoma and bone metastasis can be performed, but also the ablation of lesions that are painful but classified as

benign. Many lesions, generally epiphyseal (periosteal chondroma, periosteal desmoid, etc)., are painful but not correlated with malignancy: the bone oedema (due to a chemical and mechanical origin) is the main feature that identifies, in the imaging, the painful area. In these cases an ablation can be suggested to achieve pain relief avoiding surgery (clearly more invasive) otherwise required to treat these lesions. The choice of the most appropriate technique must be done in relation with the position and the characteristics of the lesions itself: for example, MRgFUS is the most suitable technique for lesions on the bone surface, instead the cryoablation is a very handy and effective technique for large lesions with irregular margins and morphologies. The most common complications are mainly related to the possible injury to the closest structures: great attention must be paid for planning the treatment and for choosing the less invasive pathway to reach the lesion. The follow-up must show the effectiveness of treatment in terms of destruction of the target tissue and of appearance of fibrosis and of reparative sclerosis.
Learning Objectives:
1. To learn which painful bone lesions can be treated.
2. To learn how to plan the treatment and how to choose the most appropriate technique.
3. To illustrate complications and diagnostic follow-up.

10:30 - 12:00 **Room B**

ESR meets Colombia

EM 3

From practice to reality: how we do it

Welcome by the ESR President:
L. Donoso; Barcelona/ES
Presiding:
K. Riklund; Umeå/SE
F.G. Lubinus; Bucaramanga/CO

A-779 10:30

Introduction
F.G. Lubinus; *Bucaramanga/CO (flubinus@hotmail.com)*

It is a real honour for the Colombian Association of Radiology (ACR) to be invited to participate as invited society to the ESR meets session. The ACR has just reach its 70th anniversary as a radiological society and its growth over the years has given the association a very important place in Latin American Radiology. It hosts one of the mayor radiological events of the continent and has signed cooperation agreements with the most important radiological societies of the world. The ACR has been invited to participate at the ESR International Summit every year to discuss core topics of our specialty and it is committed to the challenges that are inherent to the advantages of dealing with modern communications an medical technology. Two of the most important topics dealing with the practice of radiology today has to do with turf battles and interventional procedures guided by images. That is the reason why we have chosen these topics to discuss during the ESR meets Colombia Session because we certainly believe that our place in modern medical systems will be in accordance to the way we as radiological societies interact with these matters and generate the changes necessary to continue acting as a major component of today's health system. The possibility of counting with a law of Radiology that gives as the status of rightness and the already walk through images that facilitates performing imaging-guided procedures are our best advantages over our peers.
Session Objectives:
1. To have a glance at our country's peculiarities; not only the cultural aspects, but also its laws and management of diseases.
2. To explore new ways of finding solutions to possible problems presented in our profession.

A-780 10:35

The law of radiology in Colombia: how we arrived to it
R. Restrepo; *Medellin/CO (jrorestrepo@une.net.co)*

Presentation of the environment where radiology is practiced in Colombia under the force of the Law 657 with a demographic description of the country, the health system and its features. Summary of the conditions justifying the enactment of the law considering previous experiences and difficulties in obtaining approval. Main achievements and improvements in the regulatory elements: definition of the profession and its objects. Formulation of skills and the exclusive right to practice radiology. Legal documents and certificates are regulated. Radiologists' rights are established. Implementation of a certification program for the benefit of quality. The Act recognises the Association of Radiology as a consultative organ of the State. Finally, it states that the violation of this law has legal implications and responsibility. Analysis of legislative aspects of the law in different countries. Space for debate and reflection according to experience, to propose and promote specific laws, taking into account the improvement of the quality of health care, legislative development in different countries, professional identity and future of radiology considering negligence, perverse incentive, self-reference, multidisciplinary work and legal responsibility.
Learning Objectives:
1. To learn about government regulation of the practice of radiology in Colombia.
2. To become familiar with the existing regulations for the practice of radiology in different countries.
3. To understand the application of Act 657 of 2001, which regulates the practice of radiology in Colombia.
4. To promote a comprehensive strategy for navigating the radiology-centred regulatory laws.

10:55
Interlude: The history of radiology in Colombia

A-781 11:00

Percutaneous biopsies: how do I do it?
F. Uriza; *Bogota/CO (lfuriza@gmail.com)*

Percutaneous-guided biopsies by images are growing procedures in Colombia. In a high-complexity institution, and in a period of 20 years, they went from performing an average of 50 biopsies a year to 50 biopsies a week. The diagnostic performance has also changed with a current initial diagnostic accuracy of 80% to 92%. Some factors lessen the sensitivity like the size of the lesion, the existence of necrosis, its depth, a single sample, inflammation or the minimum operator experience. The specialists' training and experience have resulted in a low rate of complications over time with only one fatal outcome in 20 years, due to the inability to control bleeding in a patient with a bleeding disorder. The selection of imaging modality or the use of more than one for the initial evaluation, the needle selection and the use of contrast media are part of the decision-making that can facilitate the process and reduce the complications risk. The main conclusions in our experience are applied to continuous improvement: the need for procedural guidelines and measure adherence, also implement a safety stop before procedures and checklists. The procedural guidelines should not go against the autonomy of the specialist, who in some cases can adapt the technique to the specific characteristics of the patient or his own skills and experience.
Learning Objectives:
1. To propose possible modifications to conventional biopsy techniques tailored to certain cases where ideal conditions cannot be met.
2. To present the local experience of a high complexity hospital in Latin America.
3. To determine when a multimodality imaging evaluation prior to biopsy is required.
4. To establish in which cases contrast administration is appropriate before a CT-guided biopsy is conducted.

11:20
Interlude: Colombia, magical realism

A-782 11:25

Minor interventional procedures in tropical diseases
A. Morillo; *Bogota/CO (ajmorillo@gmail.com)*

Tropical diseases include several infectious diseases that were prevalent within the wide geographical area of the planet that lies between 23 degrees of Northern and Southern latitudes, the Tropic of Cancer and the Tropic of Capricorn, respectively. These are neglected diseases that were more common in warm and humid territories and in underdeveloped countries with scarce economical and health resources, and in malnourished populations. Tropical diseases are no longer geographically contained. Several factors have displaced such diseases outside their expected geographical and climatological boundaries. Global warming has been held responsible for the displacement of insect vectors of some of the tropical diseases into regions where altitude and weather used to prevent them from thriving. Human migrations also displace cultural and medical conditions into countries where some diseases were never expected. An interesting common characteristic of some of the most contagious tropical diseases is the sense of panic and the general ignorance and unpreparedness among the populations where these diseases arrive, ignorance that manifests in inadequate governmental policies and lack of proper control and preventive measures by health care personnel. Some tropical infectious diseases have typical imaging appearances, but most are not amenable to interventional techniques. Some common minor procedures can be indicated, such as ultrasound-guided central venous access or the percutaneous drainage of abscesses. Other than maximizing barriers and universal precautions for radiologists and other health care professionals, these interventional techniques need no major changes when applied to patients with tropical diseases.

Learning Objectives:
1. To learn about various manifestations of tropical diseases.
2. To review cases of tropical diseases that can benefit from interventional procedures.
3. To become familiar with the role of interventional radiology in the diagnosis and management of tropical diseases.
4. To understand the indications of interventional procedures in specific manifestations of tropical diseases.

11:45
Panel discussion: Minimally-invasive procedures: is there a place for the non-interventionalradiologists?

10:30 - 12:00 **Room O**

Professional Challenges Session

PC 18
Monitoring safety and quality

A-783/A-784 10:30
Chairmen's introduction
G. Frija; *Paris/FR (guy.frija@egp.aphp.fr)*

A. Torresin; *Milan/IT (alberto.torresin@unimi.it)*

In the medical area, important technological and scientific developments have led to a remarkable radiation exposure excess. The need to implement Radiation Dose Index Monitoring (RDIM) systems, for the most important ionising radiation procedures (CT and angiography) in connection with stochastic and deterministic risks, have become more and more important. During the section, experiences of safety and quality management will be introduced through a terminology definition of radiation dose structured report and patient dose structured report and the method used for estimations and accuracy should be discussed. RDIM is a software that passively or actively collects Radiation Dose Index (RDI) from ionising radiation modalities, stores RDI in data base along with patient demographic and study information, allows the final user to visualise RDI by study type and patient. These data can be used for quality assurance procedure in diagnostic department (patient study for specific investigations can be collected and useful parameters can be used to compare different modalities). RDIM is not the patient dose and patient organ dose data base; the RDIs do not represent absorbed dose in an individual patient because are related to x-ray beam output and x-ray absorption at the image receptor. To use the RDIM system properly, an interdisciplinary team has to work in strong cooperation (lead radiologist, medical physics expert, lead technologist, PACS IT leader, clinical engineering). The team must be responsible for RDIM software selection; each member with specific responsibilities. A lot of work for commissioning, testing the software (once installed) and data analysis must be planned in advance.
Session Objectives:
1. To introduce experiences of safety and quality management.
2. To focus on the specific aspects of dose management.
3. To highlight the need of a strong IT support.

A-785 10:35
Experience of total management of quality and safety
L. Oleaga Zufiría; *Barcelona/ES (lauraoleaga@gmail.com)*

Quality and safety represent fundamental principles of health care. In the radiological process there are different stages in which we can influence to improve safety and quality: patient identification, imaging test, report and communication. It is essential to built up a quality and safety culture in all imaging departments. It is important to establish and maintain effective performance improvement programs. There are different aspects that should be part of the check up in a radiology department including: equipment safety control, infection control, patient and personnel safety, patient education and quality control. There are different tools that can be implemented to improve quality and safety in a radiology department, including a patient identification policy, a reporting incidents system to analyse and report complications and adverse events or identification of the risk zones. Continuous advances in imaging technology have yield to an increase in both the type and frequency of imaging studies being performed, with an increase in cost and radiation exposure for both patients and professionals. Recording radiation dose systems and implementation of dose reduction methods have a major impact on patients safety. Imaging studies should be reviewed and evaluated as part of the quality program. Monitoring should include evaluation of the accuracy of interpretation as well as the appropriateness and justification of the examination. Peer-review procedures to detect errors, justification and standardization of imaging tests directly influence in the quality of imaging studies.

Learning Objectives:
1. To introduce the concept of overall quality and safety in a radiology department.
2. To define the distinct aspects of quality and safety to be monitored.
3. To indicate several tools that can be used or implemented for quality control.

A-786 10:55
Dose monitoring systems in CT
D. Caramella; *Pisa/IT (davide.caramella@med.unipi.it)*

IT tools are now commercially available to allow a real-time analysis of dose performances in CT. The knowledge obtainable using this new IT tools may reduce all variations that are not clinically justified and trigger focused training initiatives. However, dose monitoring systems may provide incomplete and even misleading data. Therefore, appropriate actions need to be taken to increase the reliability of data provided by the software. An important output of dose monitoring is a better communication strategy with patients who can be reassured by the documented efforts made for guaranteeing dose optimisation, thus strengthening the public perception of Radiology Departments as trusted dose gatekeepers.
Learning Objectives:
1. To highlight the importance of systematic dose monitoring in CT.
2. To demonstrate that dose monitoring may reduce clinically unjustified variations.
3. To propose a paradigm shift from risk communication to safety assurance.
Author Disclosure:
D. Caramella: Speaker; Bayer.

A-787 11:15
Experience from a group of imaging centres
A. Palkó; *Szeged/HU (palkoand@gmail.com)*

Quality and safety measures are considered - beyond responding to social and professional requirements - as tools to gain advantage in the competition among service providers in the field of radiology. As a consequence we may have witnessed significant financial investment and professional efforts recently at most major private companies involved in imaging diagnostic and teleradiological activities. The toolkit used to achieve progress in this area typically includes implementation of diagnostic and imaging technical protocols, standardised and/or structured reporting, peer reviewing of reports, use of computer-assisted clinical decision support systems and lean management solutions. Companies providing services for patients in multiple centres began to move in the direction of creating a kind of a franchise system allowing them to standardise all aspect of their activities. Obviously these measures will improve the quality of service and motivate other service providers to move in the same direction.
Learning Objectives:
1. To explain how quality and safety management principles may be realised in the everyday practice of radiology service providers.
2. To discuss the significance of standardising various aspects of quality and safety in workflow management, image and report quality and patient comfort.
3. To emphasise the importance of uniform attitude and networking in a multi-centre service-providing system.
Author Disclosure:
A. Palkó: Advisory Board; Affidea.

A-788 11:30
Dose monitoring systems in interventional radiology
A. England; *Salford/UK (A.England@salford.ac.uk)*

Interventional radiology (IR) is making an increasing use of ionising radiation for both diagnostic and therapeutic procedures. The radiation dose received by the patient can be highly variable and may exceed the threshold value of deterministic effects. IR procedures are expanding rapidly both in the number of procedures performed per annum and also in the range of procedures offered. Procedures once undertaken by interventional radiologists are now increasingly being performed by vascular surgeons, cardiologists, gastroenterologists and urologists. To promote safe practice within the IR department it is important to appropriately monitor and record radiation dose. This presentation will discuss the options for dose monitoring within the the IR room. Options for monitoring both patient and staff dose will be considered together with the advantages and disadvantages of each. Such dose monitoring systems will include direct and indirect methods and discussions will focus on the practicalities and utilities of each system. The discussion will also focus on the wider issue of dose monitoring and the available evidence surrounding its benefit to patients and staff. Future opportunities for dose monitoring will also be highlighted and debated.

Learning Objectives:
1. To introduce the concept of dose monitoring systems within interventional radiology.
2. To focus on the different dose monitoring solutions available within clinical practice.
3. To highlight the benefit of real-time dose monitoring for patients and staff.

11:45
Panel discussion: What are the bottlenecks in safety and quality management?

10:30 - 12:00 **Room F1**

E³ - European Diploma Prep Sessions

E³ 1823
Paediatric

A-789 10:30
Chairman's introduction
V. Donoghue; *Dublin/IE (vdonoghue@gmail.com)*

This broad-based session covers abnormalities in three different systems in the paediatric patient - the brain, chest and the abdomen. Relevant features pertaining to normal organ development will be addressed. The most common congenital abnormalities and the most frequently encountered tumours will be discussed in all lectures. Imaging of the infant with respiratory distress and the common chest complications of treatment will be covered. In the abdomen, diagnostic evaluation of common conditions in the paediatric age group, such as appendicitis and intussusception will be discussed in more detail. The aim of the session is to give radiologists some basic knowledge of the common conditions encountered in a general paediatric radiology department which will aid their preparation for the European Diploma examination.
Session Objectives:
1. To understand the imaging features of the most common congenital and neoplastic disorders of the brain in children and adolescents.
2. To describe the imaging presentations of the most common disorders of the lung and mediastinum in the paediatric age group.
3. To be familiar with the imaging features of important acute disorders of the abdomen in children and adolescents.

A-790 10:33
A. Paediatric neuro imaging
M.I. Argyropoulou; *Ioannina/GR (margyrop@cc.uoi.gr)*

Age-related changes depending on neuronal migration, gyration and myelination have been described in the paediatric brain. These changes are responsible for the different imaging patterns as the paediatric brain matures. Conventional MR sequences along with diffusion tensor imaging (DTI) and functional MRI (f-MRI) offer important information regarding the structural and functional maturation of the brain. Congenital malformations of the brain can be assessed with conventional sequences but DTI using ADC, FA maps and tractography and f-MRI offers valuable structural and functional information and help in the detection of additional malformations. The incidence and localisation of different brain tumours depend on the age. Conventional MRI offers useful information but further evaluation with DTI, susceptibility contrast-enhanced perfusion imaging, spectroscopy and f-MRI is very important in the diagnostic workup and before the application of any therapeutic scheme. A number of brain tumours may metastasize through CSF and additional imaging of the spinal canal to look for seeding metastases is necessary. MRI is the modality of choice for imaging the paediatric brain; nevertheless, in neonates and infants, brain sonography with colour Doppler should be the first imaging approach. Brain sonography offers valuable information provided that a state of the art technique is applied.
Learning Objectives:
1. To describe the normal development of the brain.
2. To explain the most common congenital disorders of the brain.
3. To understand the most common brain tumours in children and adolescents.

A-791 11:02
B. Paediatric chest imaging
C. Owens; *London/UK (owensc@gosh.nhs.uk)*

This presentation aims to provide the attendee with a good basic knowledge of the normal development of the lungs, leading on to a comprehensive overview of congenital bronchopulmonary malformations with illustrations of the more important disorders. These will include congenital pulmonary airway malformations (CPAMs), duplication cyst, bronchopulmonary sequestration, and bronchial atresia. The imaging features of neonatal respiratory distress syndrome will be reviewed along with examples of chronic lung disease in infancy. Examples of paediatric thoracic neoplastic disease will also be reviewed. By attending the session delegates should expect to leave with a clear understanding of these important and common disorders.
Learning Objectives:
1. To describe the normal development of the lung and mediastinum.
2. To explain imaging features of congenital disorders of the lung and mediastinum.
3. To understand the imaging manifestations of respiratory distress and bronchopulmonary dysplasia in infants.
4. To describe the most common tumours of the chest in children.

A-792 11:31
C. Paediatric abdominal imaging
S.G.F. Robben; *Maastricht/NL (s.robben@mumc.nl)*

Paediatric abdominal diseases are highly age dependent. Newborn infants may have congenital diseases as Hirschsprung's disease or meconium ileus or may develop necrotising enterocolitis, incarcerated inguinal herniation and midgut volvulus. Infants and preschool children have intussusceptions, urinary tract infections and (rare) haemolytic uraemic syndrome. Children and adolescents have appendicitis, genito-urinary infections, ovarian torsion and Henoch Schonlein purpura. Abdominal neoplasms can occur at any age, even at birth. Considering radiation dose in children and the excess value of ultrasonography (US) in small individuals, US plays an important role as initial diagnostic modality in paediatric abdominal emergencies. Sensitivity and specificity for US in diagnosing intussusception, midgut volvulus, urinary tract abnormalities and appendicitis is over 90%. Conventional abdominal radiographs or fluoroscopy are valuable in Hirschsprung's disease, meconium ileus, malrotation and necrotising enterocolitis. I consider CT as an additional technique when the initial techniques (US and conventional radiography) are inconclusive. MRI is seldom indicated in paediatric patients with abdominal emergencies because of motion artefacts in anxious children and sometimes limited MR capacity. However, in children with abdominal neoplasms it is the modality of choice.
Learning Objectives:
1. To understand the imaging features of congenital disorders of the abdomen.
2. To describe the diagnostic evaluation and imaging presentation of appendicitis in children.
3. To describe the diagnostic evaluation and imaging presentation of volvulus and intussusception in children.
4. To understand the imaging presentation of the most common oncologic disorders of the abdomen in children.

12:30 - 13:30 **Room B**

E³ - The Beauty of Basic Knowledge: Breast Imaging

E³ 24E
High-risk lesions: solving the dilemma
Moderator:
J. Camps Herrero; Valencia/ES

A-793 12:30
High-risk lesions: solving the dilemma
A. Linda; *Udine/IT (annalinda33@gmail.com)*

Although the management of the majority of breast lesions diagnosed at imaging-guided core-needle biopsy (CNB) is straightforward, a small group of lesions - high-risk lesions - poses a dilemma when diagnosed at percutaneous biopsy. These lesions - papilloma, radial scar, lobular neoplasia, atypical ductal hyperplasia, and flat epithelial atypia - are benign, but have an increased risk of upgrade to malignancy when the entire lesion is evaluated after surgical excision. Overall, for all types of high-risk lesions, the current literature suggests upgrade frequencies between 3% and 21%. Published studies on the underestimation rates for each of these lesions have profound methodological shortcomings, and pathologists are far from achieving a consensus on the diagnostic criteria for these lesions. Given the fact that objective evidence is still lacking, there is an intense debate on whether these lesions should be excised or followed. Notably, not all high-risk lesions are the same in terms of likelihood of upgrade to malignancy: upgrade rate and management of these lesions should be addressed on a lesion-by-lesion basis. Additionally, specific features of biopsy technique (needle size, use of vacuum assistance, number of samples, imaging guidance) influence the risk of underestimation. The role of mammography and sonography in guiding the management of high-risk lesions has been investigated with inconclusive results; however, preliminary studies have shown that MRI has a high negative predictive value in ruling out malignancy in cases of high-risk lesions, particularly in those associated with the lowest risk of upgrade (radial scars and papillomas).

Learning Objectives:
1. To learn about the most common high risk lesions and their respective breast cancer risks.
2. To know how to manage these lesions in a multimodal way.
3. To understand how to deal with these lesions in terms of intervention and follow-up.

12:30 - 13:30 **Room D1**

E³ - The Beauty of Basic Knowledge: Chest Imaging

E³ 25E

Dose optimisation made easy in computed tomography of the chest

Moderator:
N. Howarth; Chêne-Bougeries/CH

A-794 12:30

A. Dose descriptors
D. Tack; *Baudour/BE (denis.tack@skynet.be)*

Standard radiography and computed tomography are the most frequently performed chest imaging diagnostic tests. As they utilize ionising radiations, one needs to understand the methods and metrics used to quantify and compare the delivered radiation dose. Dose descriptors for these techniques are standardised on phantoms, but they do not represent patient dose or patient risks. The methods for collecting dose descriptors for surveys will be discussed together with those for converting dose delivered to patients into cancer risks. Finally, frequently used terms for qualifying dose reduction will be the commented.
Learning Objectives:
1. To review the frequently used terms in qualifying CT dose.
2. To learn how to explain dose description to your patients.
3. To know the lack of appropriateness of the terms used.

A-795 13:00

B. CT angiography and CT of lung disease
X. Montet; *Geneva/CH (xavier.montet@hcuge.ch)*

In this lecture, we will first review some general factors that influence the dose delivered to patients during CT. Analysis of patients centering, scan length and of the use of automatic exposure control (AEC) and kVp settings will be discussed in detail. Then, personalised protocols will be discussed in relation to the patient and to the clinical question. We will discuss the fact that a chest CT protocol for CT pulmonary angiography could (and should) not be the same as for pulmonary interstitial lung disease or follow-up of a lung nodule, at least from a dose point-of-view.
Learning Objectives:
1. To review practical methods of dose reduction in CT angiography and CT of lung disease.
2. To learn how to apply these methods in everyday practice.
3. To know that these practical methods are independent of the CT scanner.

14:00 - 15:30 **Room F1**

E³ - European Diploma Prep Sessions

E³ 1923

Urogenital

A-803 14:00

Chairman's introduction
D. Akata; *Ankara/TR (dakata@hacettepe.edu.tr)*

This E3 session will highlight the fundamentals of urogenital imaging and will clarify the role of the different imaging modalities in the evaluation of urinary calculi, as well as the most common neoplastic and infectious disorders of the urinary tract. Pathognomonic imaging signs, as well as atypical imaging features and pitfalls will be discussed. Multiparametric prostate MR is gaining more significance in the diagnosis of prostate cancer. PIRADS scoring system is very useful not only in diagnosis but also in planning targeted therapy and follow-up. Awareness of strengths and limitations of different imaging techniques will increase the diagnostic confidence of radiologist, which will guide to the specific diagnosis and the decision making in patient management. After this session, the target audience should be familiar with the basics of urogenital imaging and be prepared to pass the urogenital part of EDiR examination.

Session Objectives:
1. To become familiar with the imaging presentation of common neoplastic and infectious disorders of the kidneys.
2. To describe the typical imaging features of calculous and neoplastic disorders of the ureter and bladder.
3. To understand the imaging presentation of benign and malignant disorders of the prostate.

A-804 14:03

A. Renal and adrenal imaging
L.E. Derchi; *Genoa/IT (derchi@unige.it)*

Imaging plays an important role in patients with renal and adrenal diseases. Such lesions may be encountered during imaging studies performed for unrelated purposes or may be symptomatic and suspected on clinical grounds. Radiologists are then requested to identify the disease process, to recognise its nature among the many possible pathological conditions affecting these organs and to stage it. Knowledge of anatomy and of its many variants is of basic importance for correct interpretation, and choice of the most appropriate imaging technique is the second step to obtain the most useful informations from our studies. This presentation with deal with the imaging features of benign and malignant tumours of the kidneys and adrenal glands, as well as on the role of imaging in patients with renal infectious disorders. The most common appearances of these lesions will be discussed, together with the criteria which help to differentiate benign vs malignant lesions and to guide the most appropriate therapeutic approach in each case. Special attention will be given to the information that imaging has to provide to guide minimally invasive surgery in patients with renal tumours.
Learning Objectives:
1. To describe the normal imaging anatomy and variants of the kidney and adrenal.
2. To understand the imaging features of benign and malignant tumours of the kidneys.
3. To describe imaging features of benign and malignant tumours of the adrenal glands.
4. To explain the imaging features of infectious disorders of the kidneys.

A-805 14:32

B. Imaging of the ureter and bladder
J.-M. Correas, R. Renard Pena, O. Hélénon; *Paris/FR (jean-michel.correas@aphp.fr)*

The purpose of this course is to provide sufficient information for better interpretation of the imaging features of the ureters and the bladder, including normal anatomy and variants. The imaging protocols at CT and MRI should be adapted to each indication. Post-processing of the native images, including multiplanar reformats and maximum intensity projections, is enhancing the diagnostic capabilities. The radiation should be maintained as low as possible. The typical and atypical imaging findings of calculus disease and ureteral and bladder tumours will be reviewed. Ultrasound is also playing a key role for the diagnosis of renal colic and an appropriate imaging algorithm should be taken in order to avoid unnecessary x-ray exposure. The imaging features of reflux and benign bladder diseases will be reviewed.
Learning Objectives:
1. To explain the imaging anatomy and variants of the ureter and bladder.
2. To understand the diagnostic evaluation and imaging features of calculi of the ureter and bladder.
3. To describe the imaging features of benign and malignant tumours of the ureter and bladder.

A-806 15:01

C. Prostate imaging
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Prostate imaging is increasingly performed using multiparametric MRI (mpMRI) to detect and stage significant prostate cancer as well as for active surveillance in a patient with a known cancer. The requirements to perform correct mpMRI including high-resolution T2, diffusion-weighted MRI (DW-MRI) and dynamic contrast-enhanced MRI (DCE-MRI) are specified in the PIRADS vs 1 and 2 (Prostate Imaging and Reporting Data System). The aim of prostate imaging is to detect a significant cancer defined as a tumour with a volume $\geq$ 0.5 cc or a Gleason score of $\geq$ 7. PIRADS version 2 assessment uses a 5-point scale based on the likelihood that a combination of mpMRI findings on T2, DW-MRI and DCE-MRI correlate with the presence or absence of clinically significant prostate cancer for each lesion in the prostate gland. PIRADS 1 and 2 mean that clinically significant cancer is unlikely to be present, PIRADS 3 is intermediate/equivocal and PIRADS 4 and 5 indicate a high likelihood of significant prostate cancer. (PIRADS 4: size $<$ 1.5 cm, PIRADS 5: size $<$ 1.5 cm). Most of the prostate cancers are located in the peripheral zone, where DW-MRI is the dominant sequence to make the correct diagnosis. In the

transition zone, T2 is the dominant sequence. In this presentation, typical findings will be discussed and also benign diseases such as prostatitis and benign prostatic hyperplasia will be demonstrated as potential differential diagnoses.

Learning Objectives:

1. To explain the PIRADS system in prostate imaging.
2. To describe the imaging features of benign prostatic hypertrophy.
3. To understand the imaging features of prostate cancer.
4. To describe the imaging features of inflammatory changes of the prostate.