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A

Postgraduate Educational Programme

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Wednesday, March 4

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

E³ - ECR Academies: Image-Guided Interventions in Oncology

E³ 121
Changes of the gastrointestinal tract after treatment

A-001 08:30
A. Gastrointestinal tumours
A. Laghi; *Latina/IT (andrea.laghi@uniroma1.it)*

Gastrointestinal tumours include a variety of lesions, with the most frequent being adenocarcinoma of the small and large intestine, small bowel lymphoma, neuroendocrine tumours (NETs) and gastrointestinal stromal tumours (GISTs). According to histology, location and initial imaging staging, those lesions may require completely different therapies: surgery alone, adjuvant chemotherapy (CHT), neoadjuvant CHT followed by surgery or a combination of neoadjuvant chemoradiotherapy (CRT) followed by surgery. After treatment, imaging follow-up is mandatory. The most common post-operative findings after small bowel or colonic resections will be presented, together with clues for early detection of recurrence. In those cases which underwent adjuvant CHT, imaging findings and diagnostic criteria related to the use of either cytotoxic or cytostatic drugs will be shown, to facilitate the interpretation of radiologists in assessing response to therapy. Finally, tissue changes following neoadjuvant CRT will be discussed, particularly in rectal cancer. The possibilities of different imaging modalities in assessing either complete or partial response to therapy will be presented, with a critical analysis of different imaging findings.
Learning Objectives:
1. To become familiar with common findings after medical treatment of gastrointestinal tumours.
2. To become familiar with changes after radiotherapy for gastrointestinal tumours.
3. To understand the changes which occur after surgery for gastrointestinal tumours.
Author Disclosure:
A. Laghi: Equipment Support Recipient; General Electric Healthcare. Speaker; Bracco, General Electric Healthcare, Alfa Wassermann, Bayer.

A-002 09:15
B. Non-tumoural intestinal diseases
J. Rimola; *Barcelona/ES (jrimola@clinic.ub.es)*

Whereas clinical assessment can be used as a reliable tool for monitoring medical treatment in infectious enteritis, it has a poor correlation with the changes in inflammatory lesions in patients with inflammatory bowel disease. Mucosal healing (MH) has been associated with better outcomes in Crohn's disease (CD) in terms of reduction of relapse rates, decreasing hospitalisation requirements and reducing the need of surgery. By contrast, persistence of severe lesions (ulcers) independently predicts a more aggressive disease course with increased colectomy rates. Therefore, mucosal healing is likely to become an important therapeutic outcome in patients with CD, particularly in patients with severe activity or complicated disease course. Endoscopy is the gold standard for the assessment of luminal lesions in CD, but there is the need to introduce imaging modalities for assessing the response to medical treatment in clinical practice and in research due to its less invasiveness and the potentialities to explode the small and the large bowel. A good correlation between the presence and severity of endoscopic lesions and cross-sectional imaging signs of inflammatory activity in the bowel has been reported. There is some evidence indicating that cross-sectional imaging can be considered a responsive and reliable tool as it detects meaningful changes in patient's status over time after therapeutical interventions.
Learning Objectives:
1. To become familiar with useful signs after medical treatment of Crohn's disease.
2. To understand the changes which occur after recurrence in Crohn's disease.
3. To understand the alterations which occur after treatment of infectious intestinal processes.

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

Abdominal Viscera

RC 101
Pitfalls in interpretation in pancreatic imaging

A-003 08:30
Chairman's introduction
R. Pozzi-Mucelli; *Verona/IT (roberto.pozzimucelli@univr.it)*

Although a great improvement has been achieved in the diagnosis of pancreatic diseases by means of modern imaging modalities, a number of challenging lesions are still difficult to be detected and characterised. This occurs with both inflammatory and neoplastic diseases which, in a limited number of cases, may present with similar imaging features which can be misdiagnosed and undergo unnecessary surgical treatment. Pitfalls in interpretation occur both with solid and cystic masses. In the first case the main differential diagnosis is between pancreatic adenocarcinoma and rare forms of pancreatitis, mainly autoimmune pancreatitis and paraduodenal pancreatitis; in the second case, cystic masses, the main and initial differential diagnosis is between cystic tumours and pseudocysts. To make a correct differential diagnosis, clinical, morphological, structural (i.e. density and signal intensity) findings have to be evaluated at the same time. The value of the integration of imaging modalities to reach the correct diagnosis will also be evaluated. A further problem is represented by incidental findings. As in other organs, incidental findings in pancreatic imaging are becoming more and more frequent with the improvements in resolution of modern imaging modalities. Incidental findings can be represented by solid or cystic masses. A number of open questions on how to characterise them, what to do with incidentally detected pancreatic masses, how to perform the follow-up wait to be answered and will be discussed in this course.

A-004 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 with non-neoplastic character, which closely resemble pancreatic adenocarcinoma. They are responsible for 5-10% of non-necessary pancreatectomies. Clinical, radiological and pathological features of these entities vary according to their macroscopic pattern, that may be prevalent solid such as in autoimmune pancreatitis, or prevalent cystic such as in paraduodenal pancreatitis. The involvement of the pancreatic parenchyma by the abovementioned 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 of 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-005 08:58
B. Cystic tumours vs pseudocysts
M.A. Bali; *Brussels/BE (mbali@ulb.ac.be)*

Pancreatic cystic lesions include epithelial and non-epithelial neoplastic and non-neoplastic cysts, classified as benign, potentially malignant and malignant, according to the 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 behaviour, followed by potentially malignant or malignant mucinous neoplasm as mucinous-cystic neoplasm and intraductal papillary mucinous neoplasm

(IPMN). The diagnosis of these different entities is based on: patient clinical data (history of pancreatitis, elevated tumoral markers, …), radiologic investigations (MR/MRCP and/or MDCT), endoscopy (EUS, ERCP), EUS-FNA cyst fluid (amylase, > 1000 ng/mL found in pseudocyst, CEA and mucin stain is useful to differentiate between mucinous and non-mucinous lesions) and cytologic analysis. At imaging, several morphologic features may allow differential diagnosis between these entities and may also be suggestive of malignancy: the localization, 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-006 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 ultrasound (EUS) is increasing and for radiologists it is not always easy to make decisions about patient management. Many of these APLs are smaller than 3 cm 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. Cystic APLs could be mucinous or non-mucinous: mucinous include malignant intraductal papillary mucinous neoplasms (IPMNs), mucinous cystic neoplasms (MCNs) and benign branch duct-type IPMNs (BD-IPMN). Differentiation between cystic APLs is necessary and possible through cyst fluid analysis using EUS with fine-needle aspiration (FNA). Additionally, in cystic APLs, size, communication and/or dilatation or abrupt change in calibre of pancreatic duct, as well as nodular and/or enhancing elements are worrisome features (see Sendai criteria). Surgery is recommended for IPMNs, 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) are 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**

Special Focus Session

SF 1a

Acute gastrointestinal tract emergencies: an update

A-007 08:30

Chairman's introduction

F. Caseiro-Alves; *Coimbra/PT (caseiroalves@gmail.com)*

Acute gastrointestinal tract pathology is an important cause of emergency admissions, generally putting pressure to obtain a quick and correct diagnosis. This may lead to the simultaneous use of concurrent imaging techniques, more or less invasive, where the diagnostic accuracy may also be operator-dependent. It is important to the radiologist to understand how, when and why medical imaging should be used for each clinical context under appreciation. Imaging protocols should be optimally set in order not to miss the most subtle diagnostic signs. Radiologists should be conversant in all aspects of these emergency situations including the ability to provide minimally invasive treatment options such as abscess drainage or vascular embolisations. Although MDCT is considered the workhorse in the diagnostic management, imaging alternatives must be kept in mind, especially when a diagnostic-therapeutic combination is the best and quickest life-saving procedure to be applied.

Session Objectives:

1. To understand the advantages and shortcomings of the different imaging techniques.
2. To understand how imaging techniques drive patient management.
3. To appreciate the role of interventional radiology.

A-008 08:34

The acute abdomen: inflammation and its mimics

M. Zins; *Paris/FR (mzins@hpsj.fr)*

CT is the most accurate technique for the diagnosis of acute diverticulitis; the most frequent and valuable findings are bowel wall thickening, fat stranding, and diverticula. An inflamed diverticulum is a rounded, paracolic outpouching centered within fat stranding; although less sensitive than the previous signs, it is a highly specific sign of colonic diverticulitis. US is a well-established alternative to CT for suspected appendicitis and should be used as the initial step followed by CT only if sonographic diagnosis is uncertain. Imaging criteria for positivity for appendicitis at US include visualisation of an inflamed appendix (diameter > 6 mm) and non-compressible appendix. US is an accurate technique in establishing the diagnosis of acute cholecystitis and should be used as the initial step followed by CT only if sonographic diagnosis is uncertain or in case of suspected gangrenous cholecystitis.

Learning Objectives:

1. To describe and propose an effective diagnostic imaging strategy for the assessment of acute abdominal pain.
2. To describe typical and atypical findings of appendicitis, colonic diverticulitis and cholecystitis from different imaging modalities.
3. To discuss alternative diagnoses in right and left lower abdominal pain including epiploic appendagitis, infarction of the greater omentum and inflammatory bowel disease.

A-009 08:52

Mechanical bowel obstruction

D.J.M. Tolan; *Leeds/UK (damian.tolan@nhs.net)*

While other imaging modalities have a role, CT is the most effective tool for evaluation of patients with abdominal distension and suspicion of obstruction. Surgical management relies on a rapid diagnosis to differentiate ileus from obstruction of the type and site of obstruction. CT technique in such cases of obstruction is straightforward comprising no oral preparation and intravenous contrast with images acquired in a portal venous phase. While high grade small bowel obstruction may be managed conservatively, a radiologist must be vigilant for signs of closed loop obstruction warranting urgent surgery; this is difficult to detect clinically and may precipitate ischaemia or infarction of a small bowel segment. Similarly, high-grade large bowel obstruction with a competent ileocaecal valve may lead to caecal ischaemia and perforation and it is important to evaluate for an underlying cause to allow treatment planning; for example, surgical resection of colonic cancer or endoluminal stent placement. Multiplanar reformation of the imaging can be critical for determining the correct diagnosis and these cases can be very challenging to interpret.

Learning Objectives:

1. To appreciate the imaging findings on cross-sectional imaging to diagnose large and small bowel obstruction.
2. To learn to differentiate between the common aetiologies for mechanical obstruction of the large bowel and the small bowel.
3. To learn features that differentiate mechanical obstruction from ileus.
4. To understand the features that warrant emergency intervention to relieve obstruction.

Author Disclosure:

D.J.M. Tolan: Equipment Support Recipient; Vital Imaging. Speaker; Bracco.

A-010 09:10

Evaluation of the ischaemic bowel

S. Romano; *Naples/IT (stefromano@libero.it)*

Aim of the lecture would be to describe pathophysiology of the vascular disease of the bowel to better interpret any radiological sign of bowel ischaemia (that could be a total reversible event) or infarction (that corresponds to a tissue death). Vascular injuries of the bowel could have different aetiologies: arterial blood supply deficiency (embolism or thrombosis); low-flow conditions (decreased mesenteric blood flow); impaired venous drainage. In Emergency, any acute mesenteric ischaemia condition represents an important diagnostic challenge that requires a prompt and effective diagnosis: the role of the cross-sectional imaging is essential nowadays, however, knowledge of all findings related to the different form of disease is

mandatory. Cases of vascular disease of the intestines related to impaired venous drainage, arterial blood flow insufficiency, reperfusion damages and progression of the disease will be considered and discussed.
Learning Objectives:
1. To learn about pathophysiology of the vascular diseases of the bowel.
2. To understand radiological signs of bowel ischaemia and infarction.
3. To appreciate the role of cross-sectional imaging in emergencies for an effective diagnosis.
4. To describe the different stages of vascular bowel injury.

A-011 09:28

The acute GI bleed
O.M. van Delden; *Amsterdam/NL (o.m.vandelden@amc.uva.nl)*

GI-bleeding can be variceal or non-variceal in nature but this lecture will focus on non-variceal bleeding only. For most types of non-variceal bleeding endoscopy is the treatment modality of first choice. When the hemorrhage is not amenable to endoscopic treatment or when endoscopic treatment fails, there is an important role for transcatheter arterial embolisation. This may occur when bleeding recurs after at least two attempts at endoscopic treatment, when there is ongoing bleeding in spite of endoscopic treatment, when endoscopy fails to identify or reach the site of bleeding or when endoscopy is not feasible. Because endoscopic techniques continue to improve with new techniques (e.g. Gold probe®, Hemospray®) indications for embolisation are also continuously being modified. Common indications for embolisation in the upper GI-tract include ulcer bleeding in stomach and duodenum, iatrogenic haemobilia and bleeding from the pancreatic duct in pancreatitis whereas indications in the lower GI-tract mainly include colonic bleeding, most often from a diverticulum. Results for GI-embolisation vary (success rates 60-90%) depending on the vascular territory involved, with rebleeds being more common in the upper GI-tract because of the abundant collateral supply in the upper GI-tract. Complications include bowel ischaemia, the incidence of which is low (< 5%) with the use of proper technique. CT-angiography prior to embolisation is indicated to assess whether there is ongoing bleeding, whether there is un underlying vascular abnormality, when the bleeding source or location is unknown or when vascular anatomy is unclear.
Learning Objectives:
1. To learn about the pathophysiology and different types of common of acute GI haemorrhage.
2. To learn about the diagnostic work-up of and imaging algorithms for investigating acute GI hemorrhage.
3. To learn about the role of interventional radiology for acute GI haemorrhage including results and complications of interventional procedures.

09:46
Panel discussion: How should acute GI tract emergencies be managed?

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

Physics in Radiology

RC 113
Cone-beam CT

Moderator:
J. Vassileva; Sofia/BG

A-012 08:30

A. Fundamentals of cone-beam CT
J. Kuntz; *Heidelberg/DE (j.kuntz@dkfz.de)*

In the recent years, flat detector-based cone-beam CT (CBCT) has been used in a wide variety of clinical applications, including mobile or stationary C-arm CT systems for interventional and surgical applications, dental volume tomography (DVT) scanners, and image-guided radiation therapy (IGRT). In contrast to multi-slice CT (MSCT), traditionally regarded to as diagnostic CT, acquiring several slices of a volume simultaneously, CBCT systems acquire a volume with up to 1500 slices in a single circle scan. Even if specific reconstructions taking the relevant cone-angle into account are necessary in both systems, only flat detector-based CT, i.e. the non-diagnostic CT, is denoted as CBCT. This distinction is useful, as there are decisive differences in application, performance, and image quality. MSCT allows for short scan times and high image quality, whilst remaining very dose-efficient. In CBCT the spatial resolution is rather high but scan speed, dose efficiency and low-contrast resolution are relatively low. This is mainly due to the flat detector technology with its relatively thin scintillators and its limited dynamic range (about 1:1000 in CBCT detectors as opposed to 1:10000000 in MSCT detectors). Even though the performance and image quality of CBCT are different compared to MSCT, it shows valuable advantages in a variety of modern clinical applications, including the high spatial resolution, the compact design and its flexibility. The differences of CBCT and MSCT will be reviewed in the presentation, the specific advantages and disadvantages demonstrated, and the most important image quality parameters explained.
Learning Objectives:
1. To understand the principles of volumetric image formation with flat detectors.
2. To understand the difference between cone-beam CT (CBCT) and multi-slice CT (MSCT).
3. To learn about reconstruction techniques and image processing.
4. To become acquainted with the important image quality parameters.

A-013 09:00

B. Medical applications of cone-beam CT
M. Grass; *Hamburg/DE (michael.grass@philips.com)*

Cone-beam (CB) imaging with flat detectors is performed on a variety of different imaging systems. The most important area is CB imaging using interventional C-arm systems. Minimal invasive procedures carried out on these systems benefit from the availability of high-resolution 3D images for intervention planning, guidance and outcome control. Interventional CB imaging was first applied in neuroradiology using rotational angiography acquisitions. Today, it is used for a variety of procedures in interventional radiology, cardiology and oncology based on angiographic and soft tissue protocols. One of the inherent advantages of this approach is the direct registration of the volume images into the interventional procedure. Other application areas of CB imaging using different scanning systems are on-board imaging in radiation therapy or the integration of flat detector tomography and SPECT. This part of the course teaches the generation of 3D volume information from flat detector systems and its utilisation in different clinical applications. Image acquisition protocols, scan modes, and system design parameters are explained. Application-specific calibration and processing steps are introduced to show how CB imaging is tailored for specific clinical applications. Examples are presented for angiographic and soft tissue volumetric imaging. Medical applications utilising the tomographic images for diagnosis, intervention planning, guidance or outcome control are discussed.
Learning Objectives:
1. To become acquainted with the applications of cone-beam CT.
2. To learn about systems' designs and parameters.
3. To understand image quality characteristics.
4. To learn how to use cone-beam images in image-guided interventions.
Author Disclosure:
M. Grass: Employee; Philips Research.

A-014 09:30

C. 3D dentomaxillofacial imaging
H. Bosmans, A. Stratis, G. Zhang; *Leuven/BE (hilde.bosmans1@telenet.be)*

3D CBCT imaging is gaining rapid access in the dental practices. It offers the dentist 3D functionality at a superb high-resolution contrast of the bony structures. This will be illustrated with a few examples. One of the challenges today is the wide variety in design parameters of the systems currently on the market, with some of these parameters having an effect on dose and image quality. Both aspects should be properly balanced. While dental CBCT has many common characteristics with multi-slice CT or volume CT, image quality tests cannot be just copied between modalities. Specific phantoms have to be used for both modalities. There are now a few candidate phantoms that could be used to assess and optimise dental CBCT scans and discuss them. The challenge applies for dosimetry as well: while doses in CT scanning are characterised by means of CTDIvol and/or dose-length-product, this approach cannot be readily applied to CBCT systems due to their large FOVs (cone beam). Some CBCT systems indicate dose-area-product. Comparison to patient doses from panoramic dental acquisitions or even intra-oral imaging is difficult for similar reasons, namely, different exposure indicators or even absence of indications. We will review the current dosimetry for CBCT and compare this to other modalities.
Learning Objectives:
1. To become acquainted with cone-beam CT systems for dentomaxillofacial imaging.
2. To learn about image quality characteristics.
3. To understand patient dose compared with other techniques in dentomaxillofacial imaging.

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

Computer Applications

RC 105
Mobile IT in radiology

A-015 08:30
Chairman's introduction
E. Neri; *Pisa/IT (emanuele.neri@med.unipi.it)*

Tablets in radiology represent a novelty. Since the introduction of the tablets on the market, the radiological field has been probably the first medical discipline to discover the many advantages of these devices. In fact, many applications for image management have been made available on the app stores (Apple, Android, Windows), and allow radiologists and non-radiologists to handle DICOM images on the tablet, as part of the patient's record. However, the emerging applications are driving the process from the simple DICOM image viewing to the full integration of the tablet with the PACS, allowing the handling of a patient's full record and presumably the possibility to report. In view of this rapid technological development, again radiology falls in the middle of a storm and is asked to find a solution to problem: are tablets suitable to read and report DICOM images? And if so, which kinds of images (CT, MRI, x-ray, etc).? How can we manage the portability of patients' data (security issues, data loss, etc).? What will be the impact on teleradiology? These issues will be addressed by the panel of experts who will speak in the refresher course.
Session Objectives:
1. To appreciate the current state of tablet technology and its practical use in radiology.
2. To understand the pros and cons of the use of tablets.
3. To learn about specific critical areas of utilisation (DICOM images reading and teleradiology).

A-016 08:35
A. Tablet-computers: a technical overview
J. Fernandez-Bayó; *Sabadell/ES (jFernandezB@cspt.es)*

Since their introduction, tablet PCs have evolved extensively. They have become very popular, filling the gap between laptop computers and smart mobile phones. Tablets are designed for general-purpose uses. They are not designed for primary radiologic diagnosis; however, some of their display characteristics and parameters make them attractive for viewing images, and they are great devices for consulting and reviewing radiologic images. Tablets can make access easier, improving image distribution and making reports available to referring clinicians; they may be especially useful for patient rounds, communicating with patients about findings, and non-diagnostic consultations. However, the images they display should look the same as those available in the reading room, and their quality should be similar, too. Clinicians need to know how to create the appropriate viewing conditions with these devices. Some of the tablets and mobile applications for radiology have been approved by the US Food and Drug Administration, but only for limited diagnostic viewing and when no diagnostic workstations are available. Even in these cases, certain precautions are necessary: one should take steps to ensure optimal conditions, for instance, cleaning off the fingerprints that normally cover the screen and going to the dimmest part of the room. Most importantly, the display should be DICOM-calibrated like the displays used in primary diagnostic workstations in the reading room. Nowadays tools are available to calibrate the tablet display to make it DICOM conformant.
Learning Objectives:
1. To learn about the PC evolution: from desktops, to laptops and tablets.
2. To appreciate the versatile features of a tablet.
3. To understand the hardware features for display and networking.

A-017 08:58
B. Reading DICOM images on the tablet
O. Ratib; *Geneva/CH*

Touch screen tablets are becoming widely available providing convenient mobile solutions for physicians and healthcare providers. This is particularly attractive in medicine where "nomad" physicians who need to be able access relevant patient data and images anywhere-anytime in their daily practice where they are rarely a single location. Whilst 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 designs 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, whilst the second solution can continue to function after disconnecting from the network. Most PACS 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. We choose to develop a stand-alone companion application to our Open Source imaging platform OsiriX. With the increasing capacity and computing power of mobile devices, users will soon be able to perform most of the processing and image manipulation functions that are today only feasible on desktop or laptop computers.
Learning Objectives:
1. To learn which DICOM readers are available for tablets.
2. To appreciate the local and remote approaches and the PACS/tablet integration.
3. To understand the pros and cons of image quality and display.

A-018 09:21
C. Mobile teleradiology: radiological features of the tablet-computer
E.R. Ranschaert; *'s-Hertogenbosch/NL (ranschaert@telenet.be)*

Over the past few years, several applications and viewers have been developed for tablet computers to enable remote viewing and interpretation of radiological images. When connected to a wireless network the images can be viewed from any location within or outside the hospital. Outside the hospital tablets seem most useful in the emergency settings and for providing teleradiology services to remote or underdeveloped areas. In the hospital tablet computers may have several purposes such as clinical reviewing and communication with both referring doctors and patients. The implementation of mobile devices in the hospital environment also introduces new questions about security and safety of patient information. These issues and potential solutions will be discussed.
Learning Objectives:
1. To learn about mobile teleradiology within the hospital.
2. To learn about mobile teleradiology outside the hospital.
3. To appreciate the potential risks: data security, confidentiality.

09:44
Panel discussion: Confidence in the use of tablets in our clinical practice

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

Special Focus Session

SF 1b
Up-to-date imaging for hearing loss

A-019 08:30
Chairman's introduction
A. Trojanowska; *Lublin/PL (agnieszka30@yahoo.com)*

The prevalence of hearing problems in the Western world has doubled over the past 30 years. There are many factors responsible for both conductive and sensorineural hearing loss and usually treatment vaguely depends on imaging findings. High-resolution computed tomography and high-resolution magnetic resonance imaging complement each other in assessing different aspects of the temporal bone and the auditory pathway in such patients. A constant communication between the imaging specialist and ENT surgeon improves image interpretation and ensures a successful therapy.
Session Objectives:
1. To understand the problem of conductive and sensorineural hearing loss and the role of radiologist in treatment planning.
2. To discuss commonly used devices for hearing augmentation and restoration and their radiological appearance.
3. To know how to evaluate images in cases of treatment failure.

A-020 08:35
New devices in the treatment of hearing loss
B. Ozgen Mocan; *Ankara/TR (burce@hacettepe.edu.tr)*

Hearing loss affects about 10% of the globe population to some degree. In children, it may affect the development of language and can cause work-related and social difficulties for adult. It may result from impairments anywhere along the auditory pathway, from the external auditory canal to the central nervous system. Disorders of the external and middle ear usually produce a conductive hearing loss (CHL) by interfering with this mechanical transmission. Most patients with congenital and acquired CHL can be helped by modern tympanoplasty, ossiculoplasty with different types of prosthesis and stapedectomy. In addition, hearing aids are a useful nonsurgical option for most patients with conductive hearing loss. Sensorineural hearing loss (SNHL)

is due to pathologies of the inner ear, cochlear nerve or auditory pathways. SNHL patients can be helped with hearing aids or implantable hearing devices such as bone-anchored hearing aids, implantable middle-ear devices, cochlear implants or auditory brainstem implants. Cochlear implants are implanted devices that bypass damaged structures in the inner ear and directly stimulate the cochlear nerve. They are surgically implanted to improve hearing in people with severe or profound hearing losses. The auditory brainstem implant (ABI) is an option for patients who do not have a anatomically or functionally intact cochlear nerve and who are, therefore, not candidates for cochlear implantation. NF2 patients as well as pediatric patients with cochlear aplasia and/or cohlear nerve aplasia are typical candidates for this type of device.
Learning Objectives:
1. To understand the mechanism of hearing loss.
2. To become familiar with treatment options.
3. To review most the most popular devices for hearing augmentation and restoration.

A-021 09:00

Pre- and postoperative imaging in middle ear implants
E. Loney; *Bradford/UK (elizabeth.loney@bthft.nhs.uk)*

Middle ear implants are divided into two categories; active and passive. These groups work in very different ways and are used to treat different forms of hearing loss but both require high-resolution pre-operative CT imaging. Radiology is essential in providing accurate anatomical detail to allow selection of the correct implant and surgical approach, exclude pre-existing pathology that might compromise their placement/ function and avoid preventable complications. Important anatomical variants may increase surgical risk and this should inform patient consent and expectations. Post-operative imaging is usually limited to those patients who experience device failure or other complications. Implants may also preclude subsequent MRI depending on their components.
Learning Objectives:
1. To learn how to image temporal bone prior to surgery and implant placement.
2. To review the most popular types of surgical procedures in the middle ear.
3. To apprehend the typical appearance of reconstructed ossicular chain and possible complications.
Author Disclosure:
E. Loney: Speaker; I have lectured on Active Middle Ear Implantation at Conferences organised by MedEL, who manufacture the Vibrant Soundbridge device.

A-022 09:25

Pre- and postoperative imaging in inner ear and brainstem implants
B. Verbist, J.H.M. Frijns; *Leiden/NL (b.m.verbist@lumc.nl)*

For a long time, amplification of sound was the only treatment offered to patients with hearing loss. However, in case of severe sensorineural loss or deafness due to substantial loss or damage to inner hair cells simple amplification of sound will not suffice to regain auditory sensations. Nowadays, implants have become available to directly stimulate the auditory nerve or auditory pathway: cochlear implants and auditory brainstem implants (ABI). In this lecture, indications and working of these implants will be explained. Findings on preoperative imaging relevant in regard to contraindications or possible risk factors will be discussed. Postoperative findings of complications will be illustrated with several patient cases. The MRI compatibility of implants will shortly be commented upon.
Learning Objectives:
1. To know how to evaluate temporal bone in order to qualify for implant placement.
2. To understand how cochlear and brainstem implants work.
3. To discuss possible complications and the role of imaging studies.
Author Disclosure:
B. Verbist: Research/Grant Support; Advanced bionics: research grant for PhD student. **J.H.M. Frijns:** Board Member; advanced bionics (medical advisory board). Consultant; advanced bionics. Research/Grant Support; Advanced Bionics, STW, Med-El, Zon MW, Heinsius-Houbolt fund: research grants in the field of cochlear implants.

09:50
Panel discussion: Changing demands for imaging in hearing loss

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

Special Focus Session

SF 1c

Internal derangement of joints: choosing the right test for the problem

A-023 08:30

Chairman's introduction
A.J. Grainger; *Leeds/UK (andrewgrainger@nhs.net)*

The choice of imaging modality for joint internal derangements includes MR arthrography and CT arthrography. These techniques continue to play an important role in imaging pathways, but MRI technology has continued to improve and in this day and age conventional MRI may be sufficient in many situations. In this session, experts will review the relative merits and disadvantages of conventional MRI, MR-arthrography and CT-arthrography. In particular, the evolving roles of these techniques in the current decade will be discussed.
Session Objectives:
1. To become familiar with the imaging techniques commonly used for internal derangements of joints.
2. To understand how the role of these techniques has changed as technology improves.
3. To appreciate the advantages and disadvantages of the techniques discussed, appreciating their strengths and weaknesses.
4. To be aware of the potential for further optimisation of the techniques in the future.
Author Disclosure:
A.J. Grainger: Equipment Support Recipient; Siemens Healthcare, GE Ultrasound. Grant Recipient; Arthritis Research UK. Research/Grant Support; National Institute of Health Research (UK). Speaker; GE Healthcare.

A-024 08:35

CT arthrography: acceptable if MR availability is limited?
B. Vande Berg; *Brussels/BE (bruno.vandeberg@uclouvain.be)*

CT arthrography is an invasive imaging modality that requires direct intra-articular injection of iodinated contrast material and the use of ionising radiation. MRI is the best non-invasive imaging modality to evaluate joint disorders. The objectives of this lecture are to provide an overview of the technique of CT arthrography and the strengths and weaknesses of this imaging modality. As a major advantage over MR imaging, CT-arthrography provides a superb analysis of the surface of the articular structures that are covered by the articular fluid such as cartilage, menisci and intra-capsular ligaments. The value of CT-arthrography derives from its high spatial reconstruction with high resolution multiplanar reconstructions and the high contrast between the articular fluid (high density) and the adjacent structures (low density). As a significant disadvantage with respect to MRI, CT arthrography yield limited contrast resolution and does not enable to detect non calcified lesions that develop within the substance of the articular components that do not reach the articular surfaces (menisci, cartilage, ligament, tendons, muscles, synovium). In Belgium, the amount of CT arthrography represents a fifth of the total amount of joint MR studies. CT arthrography can be an alternative to MR arthrography (wrist, shoulder, hip) except in young patients. CT arthrography is also performed after total joint replacement in case of suspicion of septic loosening. Knee CT arthrography is also routinely performed in the work-up before joint replacement (complete versus partial) as comparative knee radiographs, goniometry and arthrography are all combined in the same procedure.
Learning Objectives:
1. To appreciate the current indications for CT arthrography and how they may evolve.
2. To understand the technique and requirements for CT arthrography.
3. To become familiar with the limitations of CT arthrography.
4. To recognise how CT arthrography complements other techniques.

A-025 09:00

MR arthrography: exquisite soft tissue contrast
E.L. Rowbotham; *Leeds/UK (emmarowbotham@doctors.org.uk)*

MR Arthrography is a commonly performed diagnostic procedure which is invaluable in investigating internal derangement and pathology within the shoulder, hip, wrist and elbow and less commonly within the smaller joints. Arthrography was first introduced in the early 1900s using air as a contrast medium, DTPA gadolinium via an intraarticular injection for MR arthrography was first described in 1987. MR arthrography has the advantages of providing

capsular distension, cartilage and labrum contour visualisation, contrast leak into defects and tears and delineation of intra articular bodies. The current indications for MR arthrography have evolved since the advent of this technique and include labral pathology, evaluation of rotator cuff tears, TFCC tears and delineation of intraarticular bodies. These will be described in this presentation as well as a discussion of the techniques and protocols involved in both direct and indirect arthrography and a summary of the potential limitations and pitfalls of this procedure. The relative role of MR arthrography with respect to other cross sectional techniques is important to appreciate and a review of the current evidence regarding its relative sensitivity and specificity compared with other available modalities will be included. The evolving role of MR arthrography in the future will also be covered with reference to progressive technology and particularly, increasing magnet strength.
Learning Objectives:
1. To appreciate the current indications for MR arthrography and how they may evolve.
2. To understand the technique and requirements for MR arthrography.
3. To become familiar with the limitations of MR arthrography and appreciate its pitfalls.

A-026 09:25
MRI: when is it enough?
C.W.A. Pfirrmann; *Zurich/CH*

MRI: when is it enough?-Arthrographic techniques enhance visualisation of structures which are in contact with the joint space. However, in most joints presenting with an internal derangement, some fluid is present, which acts as a natural contrast material. Periarticular structures are not better visualised by injection contrast material in the joint cavity. Arthrography may introduce pitfalls by injection of contrast into intact structures or obscure conditions like ganglion cysts or synovitis. In inflammatory conditions with synovitis, iv gadolinium administration is more helpful compared to a direct arthrography. With further improvement of MR sequences and coils, spatial resolution increases. 3D sequences have the advantage of reducing partial volume effects. Reformatted images can be obtained in any plane using the data from a single acquisition. MRI: when is it enough?-Almost always.
Learning Objectives:
1. To understand the limitations of non-arthrographic MRI.
2. To appreciate how MRI can be optimised to minimise the need for invasive arthrographic techniques.
3. To recognise where MRI is enough and where arthrographic techniques are still needed.
Author Disclosure:
C.W.A. Pfirrmann: Advisory Board; Siemens MR-MSK. Consultant; Medtronic.

09:50
Panel discussion: Can one technique ever fulfil all the roles? How will our optimal techniques change in the next 5 years?

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

Oncologic Imaging

RC 116
How about the lymph nodes?

A-027 08:30
Chairman's introduction
J.J. Fütterer; *Nijmegen/NL (jurgen.futterer@radboudumc.nl)*

Lymph node characterisation is a challenging job for a radiologist. Currently size and shape criteria are being applied to differentiate between benign and malignant nodes. Although reported sensitivities and specificities differ between tumor type and lymph node, characterisation is not always reliable with imaging. In this refresher course insights will be provided in novel imaging techniques (DWI and USPIO), which are being applied to improve our sensitivity and specificity.
Session Objectives:
1. To learn the criteria for nodal staging on CT, MRI and PET.
2. To understand the pitfalls and challenges of nodal staging on imaging.

A-028 08:35
A. The current criteria for nodal involvement on CT/MRI
W. Schima; *Vienna/AT (wolfgang.schima@khgh.at)*

In a variety of diseases, such as metastatic disease, lymphoma and inflammation, lymph node enlargement can be seen. Thus, lymph node characterisation is an important issue to differentiate between benign and malignant disease. It is based on size (short axis diameter) and morphologic criteria, such as 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. However, 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. However, additionally 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 characterization 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-029 08:58
B. 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 ultra-small particles of iron oxide (USPIO) have substantially improved the diagnostic accuracy of lymph node staging compared to conventional MRI. Unfortunately, USPIO are not commercially available and therefore new approaches to differentiate benign from malignant lymph nodes are required. 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 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 considerably 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 be familiar with node-specific enhanced MRI.
Author Disclosure:
H.C. Thoeny: Grant Recipient; Maiores Foundation.

A-030 09:21
C. Nuclear medicine: PET and other 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 that involvement of small nodes may be missed or the level of metabolic activity may be underestimated in small nodes. New radiotracers that target more specific pathways such as C-11/F-18 fluorocholine that targets cell membrane metabolism and Ga-68 prostate-specific membrane antigen (PMSA) that 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.

09:44
Panel discussion: When and how will imaging make diagnostic biopsy unnecessary?

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

Breast

RC 102
Breast ultrasound 2015

Moderator:
K. Kinkel; Chêne-Bougeries/CH

A-031 08:30
A. Evidence for screening in dense breasts
V. Girardi; *Brescia/IT*

Breast density has two primary implications. One implication is the effect on mammographic sensitivity that drops to 30-50% in very dense breasts. The second implication is the increase in breast cancer risk frequently discussed in the literature. Among the additional screening tests that are available, MRI and hand-hold or automated ultrasound (US) have been studied. Digital breast tomosynthesis is also under consideration. Compared to mammography and MRI, ultrasound examination is a quick test, widespread, well-tolerated, highly safe and relatively cheap. The additional cancer yield of US as added to negative mammography is about 1.8-4.1 per 1000 women, meaning that you have to screen about 550-240 women to detect one additional cancer. The majority of additional cancers found on US are smaller than 1 cm and are invasive (90% of cases). However, there are two major drawbacks to the currently available data. The first is that we do not know what is the impact of finding these additional small cancers, which may be only indirectly assumed by the low stage at diagnosis. The second drawback is that many more biopsies are generated by US screening and most of these end up being false positives. The additional invasive procedures rate is reported to be 1.9%-7.4%, that is about 10 further procedures, to detect one additional cancer. To achieve optimal results (benefit/risk trade-off of early cancer detection versus increased false positives) high level of expertise in ultrasound is required.
Learning Objectives:
1. To understand the masking effect of breast density negatively impacting 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-032 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 have 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 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.

A-033 09:30
C. Nodal staging of breast cancer: still needed?
S.C.E. Diepstraten; *Utrecht/NL (s.c.e.diepstraten@umcutrecht.nl)*

In breast cancer, axillary lymph node status is an important prognostic factor and a guiding factor in treatment decisions. Sentinel node biopsy, followed by axillary lymph node dissection in cases where the sentinel node proves to be positive, has been the standard-of-care for axillary nodal staging for more than a decade. A disadvantage of this approach is the need for two-stage surgery in patients with axillary involvement. Preoperative staging of the axilla using ultrasound with lymph node biopsy if indicated is performed in many breast clinics as a routine procedure to select women with lymph node involvement for immediate axillary lymph node dissection at the time of primary surgery. Approximately 50% of women with axillary metastases can be detected preoperatively. Results of recent studies have shown that in patients with limited axillary involvement who are undergoing breast-conversing treatment, subsequent axillary lymph node dissection does not improve overall survival or reduce local recurrence. This requires reassessment of the value of preoperative axillary staging for this subgroup of patients. Future studies investigating preoperative axillary staging should be aimed at methods that allow differentiation between limited versus extended axillary involvement or specific identification and sampling of the sentinel lymph node.
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
Pulmonary vasculitis and collagen vascular diseases

Moderator:
A. Persson; Linköping/SE

A-034 08:30
A. Pulmonary manifestations of collagen vascular diseases
S.R. Desai; *London/UK (sujal.desai@nhs.net)*

Pulmonary involvement is common in collagen vascular disease (CVD) and its manifestations are legion. Lung diseases associated with CVDs is an important cause of morbidity and mortality. The patterns of interstitial lung disease (ILD) seen in patients with CVDs mirror in type (but not necessarily in prevalence) those seen in the idiopathic interstitial pneumonias. Thus, for instance, in rheumatoid arthritis, usual interstitial pneumonia (UIP) is more prevalent than a pattern on non-specific interstitial pneumonia (NSIP) whereas the converse is true in systemic sclerosis where NSIP is the dominant ILD. Other patterns of interstitial lung 'injury' include organising pneumonia (common in patients with polymyositis/dermatomyositis) and lymphoid interstitial pneumonia (classically seen in Sjogren's syndrome), and this is to say nothing of some of the other manifestations of CVD-associated disease including pulmonary haemorrhage, obliterative bronchiolitis and iatrogenic disease. In conjunction with clinical evaluation and pulmonary function testing, imaging tests (and specifically, HRCT) are pivotal in assessment of patients with CVD. HRCT will not only confirm the presence of an ILD (or some other pathology) in the face of a normal chest radiograph but also characterise the nature of disease. More recently there has been interest in the prognostic meaning of signs on HRCT in patients with CVD-associated ILD: for example, individual signs such as traction bronchiectasis have been shown to have independent influence on survival. This presentation will deal with the issues, challenges and prospects for radiologists who regularly report imaging studies in patients with CVD-associated lung disease.
Learning Objectives:
1. To learn about the different collagen vascular diseases that affect the lung.
2. To become familiar with pulmonary abnormalities due to collagen vascular diseases.

A-035 08:52

B. Large-vessel vasculitis

J. Vilar; *Valencia/ES (vilarsamper@gmail.com)*

Pulmonary vasculitis is a challenge for radiologists for two reasons: vasculitis is a rare disease and at the same time pathologic, and radiological manifestations are very diverse. Primary vasculitis presents with different clinical scenarios and often confusing situations that may mimic other diseases. By definition vasculitis is a disorder affecting the blood vessels, which may be primary or secondary. Classification of vasculitis according to the vessel size is practical since it is related to the pathological changes, as well as to the clinical and radiological presentation. The two main large-vessel vasculitides are Giant Cell arteritis and Takayasu arteritis. Behcet disease may combine large- and small-vessel vasculitis. Imaging plays an important role in primary vasculitis. Chest radiographs are not especially useful in large-vessel vasculitis. Contrast CT and MRI further detect and especially help in the characterisation of large-vessel vasculitis. Vessel wall changes are well detected with both techniques. Contrast enhancement, distribution of vessel involvement and morphological vascular changes should be considered. Today PET/CT is the recommended imaging technique in the assessment of vessel wall inflammatory changes and in the evaluation of treatment response. Although the clinical scenario differs usually between Takayasu and Giant Cell arteritis, the radiologist should combine the imaging findings with clinical and laboratory data to suspect a specific vasculitis. Therefore, this presentation will concentrate in the basic signs and associated findings in large-vessel vasculitis, the pathologic correlation, the imaging protocols and the differential diagnosis.

Learning Objectives:

1. To learn about the different types of large-vessel vasculitis.
2. To become familiar with histopathological correlates in vasculitis.
3. To appreciate the different manifestations and imaging appearances of large-vessel thoracic vasculitis.

A-036 09:15

C. HRCT patterns in pulmonary vasculitis

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

Pulmonary involvement is common in ANCA-associated types of vasculitis such as ANCA-associated granulomatous vasculitis (AaGV, former Wegener granulomatosis), Churg-Strauss syndrome and microscopic polyangitis (MPA). In AaGV imaging features are frequently suggestive consisting of nodules with or without a halo, mostly cavitating and/or consolidations. In Churg-Strauss HRCT patterns are more aspecific consisting of transient multifocal nonsegmental consolidations and thickened interlobular septa. MPA typically presents with diffuse haemorrhage of various severities. Other types of immune-complex-mediated small-vessel vasculitis cause diffuse pulmonary haemorrhage such as in Goodpasture syndrome or cause pulmonary hypertension as seen in some collagen vascular diseases. The presentation will demonstrate the range of HRCT features generally seen in pulmonary vasculitis, and will name findings that may be suggestive for one or the other subtype and cover uncommon features such as fibrosis, obstructive lung disease or trachea-bronchitis and bronchiolitis.

Learning Objectives:

1. To learn when HRCT is of value in investigating pulmonary vasculitis.
2. To appreciate the different appearances of pulmonary vasculitis on HRCT.

A-037 09:37

D. Inflammation and remodelling

A.A. Bankier; *Boston, MA/US (abankier@bidmc.harvard.edu)*

The presentation will review the mechanism of remodelling in the human lung. It will detail how this process is triggered, what stimuli influence the process, and how it will affect the appearance of the lung in specific diseases. Finally, the presentation will show how information about remodelling can influence diagnostic decision making.

Learning Objectives:

1. To learn about the different causes of pulmonary inflammation.
2. To understand how the lung responds to inflammation.
3. To become familiar with pulmonary changes following inflammation.

Author Disclosure:

A.A. Bankier: Author; Elsevier. Consultant; Spiration, Olympus Medical.

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

Head and Neck

RC 108

Head and neck emergency: for the general radiologist or the patient?

Moderator:
M. Díez Blanco; Santander/ES

A-038 08:30

A. Findings that can't wait for follow-up

M.G. Mack; *Munich/DE (m.mack@radiologie-muenchen.de)*

Head and neck emergencies which cannot wait for follow-up are variable. Of course all traumatic injuries affecting vascular structures have to be diagnosed and treated immediately. Due to the close anatomical relationships nerves and vascular structures can direct inflammatory and tumourous lesion to the skull base and can cause severe clinical complications. It is also important to know all the dangerous spaces downwards to the mediastinum, which can also cause severe clinical problems. During this lecture efficient imaging protocols and the most relevant traumatic, vascular and infectious emergencies will be discussed.

Learning Objectives:

1. To learn about vascular head and neck emergencies.
2. To understand the variable appearances of foreign bodies.
3. To understand main pathways of skull base invasion.

A-039 09:00

B. Imaging infection: when, how and why?

M. Becker; *Geneva/CH (minerva.becker@hcuge.ch)*

Patients often present in the emergency situation with a variety of infectious head and neck conditions. Computed tomography (CT), magnetic resonance imaging (MRI) and occasionally ultrasonography (US) play a major role for the correct diagnosis of these potentially life-threatening conditions. The purpose of this lecture is to familiarise the radiologist with the most common types of infectious emergencies in the head and neck. A systematic review will include key radiologic features of otomastoiditis, complicated sinusitis and sialadenitis, suppurative lymphadenitis, infected branchial cleft cysts and pyolaryngoceles, paratonsillar, retropharyngeal, parapharyngeal and other neck abscesses, cellulitis, myositis, necrotising fasciitis, osteomyelitis, thrombophlebitis and septic deep venous thrombosis. Associated complications affecting the mediastinum and lung, meninges and brain will be discussed with emphasis on the early detection of lesions. Typical spread patterns of infection within the neck will be summarised. The detection of foreign bodies as a cause of secondary infection, as well as pitfalls and limitations of individual imaging techniques will also be addressed. Major emphasis will be put on what the clinician needs to know and why, what is the most appropriate imaging modality in which clinical situation, how should imaging be performed in an optimal fashion and how to report the findings in a structured and comprehensive way.

Learning Objectives:

1. To learn how to choose and tailor imaging techniques according to the clinical presentation.
2. To become familiar with neck spaces and spread of infection.
3. To be able to recognise complications.

A-040 09:30

C. Where medical history and previous images help to rule out tumour

D. Farina; *Brescia/IT (nappaje@yahoo.it)*

As a general rule, detailed knowledge of the patient's clinical history is essential before any imaging study is performed, to evaluate the appropriateness of the indication, tailor the acquisition protocol and correctly interpret the study. In head and neck imaging, this rule particularly fits in the emergency setting. In certain circumstances, the swelling and enhancement of soft tissues produced by infectious lesions may mimic a neoplasm. Even more so, in patients already treated with surgery or chemoradiation. In these patients, the challenge is double: to identify any abnormality in the new anatomy produced by treatment and to discriminate amongst inflammation, complication and relapse. These can be very difficult without knowledge, for example, of the reconstructive procedure after surgery. Previous images are extremely useful, not only because they help detect abnormalities, but also because through indirect information on the growth rate of the lesion they are crucial for correct interpretation of findings.

Learning Objectives:
1. To understand the importance of medical history and previous images.
2. To become familiar with typical post-surgical and post-radiation imaging findings.
3. To learn about less common anatomical variants without clinical consequence.

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

Genitourinary

RC 107
Stone disease: new concepts

A-041 08:30
Chairman's introduction
A. Magnusson; *Uppsala/SE (anders.magnusson@radiol.uu.se)*

Urinary tract stones are a major helath problem and approximately 15% of all men and 5% of all women will experience acute flank pain due to an obstructing ureteric stone. Radiology has always played an important role in diagnosing urinary tract stones but today radiology is contributing with much more than just finding and locating the stones. The principal imaging technique, CT, gives information about stone density and composition and plays an important role in planning all urinary stone therapy.
Session Objectives:
1. To become familiar with accurate imaging modalities in patients with flank pain or already known stone disease.
2. To learn about therapeutic algorithm of stone disease.

A-042 08:35
A. From the Stone Age to the New Age
N.C. Cowan; *Portsmouth/UK (nccowan.uro@gmail.com)*

Urinary tract stones have affected humans since civilisation began. Stones were first reported in the Aphorisms of Hippocrates and are still a major health problem. Aetiology is multifactorial. Recent advances in diagnosis and treatment have proved significant. Usual presentation is with loin pain, vomiting, fever, nonvisible or visible haematuria. They may also be asymptomatic. Standard evaluation includes a detailed medical history, physical examination, diagnostic imaging, blood analysis and urinalysis. Principal imaging techniques are ultrasonography and unenhanced CT with judicial use of contrast medium enhancement and plain abdominal x-ray. Secondary imaging techniques include excretory urography, magnetic resonance imaging, and antegrade or retrograde pyelography. The advantages and disadvantages of these techniques will be discussed. The imaging technique used depends on diagnostic accuracy, patient acceptability, availability, cost and patient safety. Diagnostic imaging is used to determine if stones are present and if present measure size, number, location and possible composition. Imaging may also be used to determine whether there has been an increase in size over a relatively short time period, indicating metabolically active stone disease or a decrease in size, indicating a response to therapy. Imaging may find an underlying anatomical abnormality predisposing to stone formation such as pelviureteric junction obstruction or tubular ectasia and may also provide essential information regarding the function of the other kidney. Construction of smart pathways of investigation uses ultrasonography and nonenhanced CT as principal diagnostic imaging techniques. Various risk factors are used to determine the selection and order of diagnostic imaging investigations. Clinical scenarios are explored.
Learning Objectives:
1. To become familiar with the symptoms, signs, risk factors and significance of stone disease in the urinary tract.
2. To understand the strengths and weaknesses of Stone Age to New Age imaging techniques for stone disease.
3. To become familiar with a state-of-the-art diagnostic imaging pathway for urinary tract
stone disease.

A-043 08:58
B. The contribution of imaging in planning urinary stone therapy
U. Patel; *London/UK (uday.patel@stgeorges.nhs.uk)*

Urinary tract stones can be treated expectantly by monitoring growth or natural expulsion; or actively by extracorporeal shock wave lithotripsy (ESWL), ureteroscopic extraction or percutaneous nephrolithotomy (PCNL).1. Size - Renal stones < 1.5 cm in size are suitable for surveillance, but if symptomatic undergo ESWL or ureteroscopic extraction. Larger stones (> 2 cm) are better treated by PCNL. Regarding ureteric stones, 68% of stones < 5 mm will spontaneously pass vs. 47% of those > 5 mm. Very small opacities may represent Randall plaques rather than true calyceal calculi. Stone size is most accurately measured on thin-section CT, using bone settings and magnified images (inter-reader variability ±1.3 mm). 2. Density/composition - Calcium stones can vary 200-1400 HU, uric acid 200-500 HU, struvite (or matrix) calculi 100-700 HU range and cytine stones around 300-400 HU. Dense stones (> 800-1000 HU) less likely to fragment Cystine stones also poorly fragment. Calcium oxalate dihydrate, uric acid and magnesium phosphate fragment easily. 3. Stone location - Lower third ureteric stones are more likely to naturally drain (75% vs. 50%). Stone fragments in a dependent calyx, calyceal diverticulum or with a strictured neck less likely to drain. 4. Collecting system anatomy - Collecting system anatomy helps surgical planning. 3D CT pyelography is ideal modality for surgical mapping. Meticulous technique is essential for a predictable intra-calyceal concentration of around 200 HU to be achieved, with a stone/contrast gradient of > 100 HU. This ensures that the majority (85%) of stones > 3 mm will be seen on a movie clip in OR.
Learning Objectives:
1. To understand how stone morphology, constituency and intrarenal anatomy influence treatment of urinary tract stones.
2. To learn about how to carry out 3D CT reconstruction of the renal collecting system, and understand key technical factors necessary for recreating accurate anatomical or surgical maps.
3. To understand what information the interventionist or urologist needs for planning urinary stone therapy.

A-044 09:21
C. Urolithiasis: changing concepts in medical and surgical approach
G. Kramer; *Vienna/AT*

"no abstract submitted"
Learning Objectives:
1. To learn about new findings in epidemiology and pathogenesis of urinary stone disease.
2. To become familiar with the usefulness of screening concepts.
3. To learn about the role of medical and new minimally invasive treatment options.
4. To learn about post-treatment imaging algorithms.

09:44
How do density and/or volume of the stone in failure dictate how to efficiently treat stone disease?

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

Neuro

RC 111
The paediatric brain and spine: not only tumours

Moderator:
T.A.G.M. Huisman; Baltimore, MD/US

A-045 08:30
A. Congenital abnormalities of the brain
B. Ertl-Wagner; *Munich/DE (Birgit.Ertl-Wagner@med.uni-muenchen.de)*

To understand congenital abnormalities of the brain, it is important to be familiar with the embryologic development. Important steps in the development of the cortex are neuronal proliferation, migration and cortical organisation. Group.i. disorders of cortical development are disorders of neuronal and/or glial apoptosis or proliferation. Amongst these are congenital microcephalies (I.A), congenital megalencephalies (I.B), and diffuse or focal cortical dysgenesis or dysplasia (I.C). Microlissencephaly is characterised by a reduced gyration and microcephaly. Hemimegalencephaly is a hamartomatous overgrowth of one cerebral hemisphere or parts thereof. Group II disorders are disorders of neuronal migration. Amongst these are periventricular (subependymal) heterotopia (II.A), lissencephalies (II.B), focal subcortical heterotopia (II.C), or disorders of terminal migration, e.g. cobblestone lissencephalies (II.D). Heterotopia are defined as areas of grey matter in an ectopic location; they are isointense to cortex. Group III disorders are disorders of postmigrational development. Amongst these are polymicrogyria with schizencephaly (III.A), polymicrogyria without clefts or calcifications (III.B), focal cortical dysplasia (III.C), or postmigrational microcephaly. In schizencephaly, there is a cleft that extends from the ependymal to the cortical surface and that is lined by dysplastic grey matter. In polymicrogyria, there are too many too small gyri and sulci. Agenesis and dysgenesis of the corpus callosum are common disorders with a wide clinical spectrum. They may be associated with other congenital abnormalities. Important infratentorial

congenital abnormalities include Chiari malformations, cystic abnormalities of the posterior fossa/the Dandy Walker spectrum, molar tooth malformations/Joubert syndrome and dysplastic cerebellar gangliocytoma/Lhermitte-Duclos syndrome.
Learning Objectives:
1. To become familiar with the typical clinical presentations of CBA.
2. To consolidate knowledge of the typical imaging patterns of the major CBA.
3. To explain the importance of a precise diagnosis in relation to potential therapy.

A-046 09:00

B. Paediatric brain neuro emergencies
M.I. Argyropoulou; *Ioannina/GR (margyrop@cc.uoi.gr)*

Brain emergencies in neonates are different depending on gestational age at birth. Premature babies suffer from brain haemorrhagic disease presenting as intraventricular haemorrhage and venous infarct. Brain haemorrhagic disease can be complicated by post haemorrhagic hydrocephalus and severe cerebellar hypoplasia. Perinatal hypoxia may give rise to parasagital lesions whilst severe asphyxia may affect grey and white matter resulting in extensive multicystic encephalomalacia, cortical lesions and atrophy of the basal ganglia. Neonatal stroke either arterial or venous (usually hemorrhagic) may also occur in full-term babies. Infectious conditions may be responsible for abscess formation or infectious infarcts and ventriculitis. Vascular malformations such as vein of Galen aneurysm and tumours may also appear as neonatal neuro-emergencies. Imaging in neonates should start with brain ultrasound and followed by MRI. Older children may suffer from either accidental or non-accidental trauma. CT scan may be used as the first imaging approach to detect fractures, subdural, epidural or intraparenchymal haematomas, oedema, herniation or even secondary ischaemia. MRI with diffusion imaging will be used to better assess the extent of lesions especially in cases of diffuse axonal injury. MRI with diffusion and perfusion imaging and spectroscopy are very useful in the diagnostic work-up of children suffering from stroke, infectious and inflammatory disorders and tumours.
Learning Objectives:
1. To become familiar with the most common PNEs.
2. To learn how to make a differential diagnosis between different PNEs.
3. To explain the diagnostic and therapeutic road map in PNEs.

A-047 09:30

C. The paediatric spine: tips and tricks
A. Rossi; *Genoa/IT (andrearossi@ospedale-gaslini.ge.it)*

The paediatric spine requires peculiar adaptations of MRI technique to the smaller size compared to adults. Scoliosis is a common indication and requires protocol modifications that include volumetric sequences with curvilinear reformats. Special sequences such as T2DRIVE or equivalent are extremely useful especially in the setting of developmental diseases. Knowledge of developmental anatomy, including neonatal bone marrow signal intensity, normal spinal cord termination, and spinal curvatures, is crucial for a correct evaluation of paediatric MR studies. Spinal malformations including dysraphism are common indications for imaging, and require knowledge of embryology for a correct interpretation. Evaluation of patients with inflammatory, neoplastic and metabolic diseases requires a complete neuraxial study (i.e., spine and brain) to assess the whole extension of disease whilst minimising repeated sedations.
Learning Objectives:
1. To learn the difference between benign and malignant paediatric spine findings.
2. To understand the imaging strategy for paediatric spine emergencies.
3. To become confident with the most common paediatric spine emergencies.

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

Molecular Imaging

RC 106

Functional and multimodality neuroimaging

Moderator:
T.H. Helbich; Vienna/AT

A-049 08:30

A. MR/PET chances and challenges
V. Schulz; *Aachen/DE (schulz@pmi.rwth-aachen.de)*

In 1997, Shao reported for the first time, the simultaneous imaging of two very powerful but complex imaging modalities: Magnetic Resonance Imaging (MRI) and Positron Emission Tomography (PET). The driver for this combination was and still is their complementarity which allows to measure a broad range of information like soft-tissue, functional, and metabolic distributions. At this time, the detector technology was simply not ready to effectively support the integration of these two modalities into a single hybrid device. In the last two decades, a solid-state sensor technology offering simultaneous operation with very faster response time is now available and highly used in commercial and research systems: The so-called Silicon Photomultiplier (SiPM). Several prototype scanners have been developed by various research groups with the goal of simultaneous operation facing all kind of challenges in this interdisciplinary field. In parallel to this, another challenge appeared at the horizon of MRI-PET: MR-guided attenuation, scatter, and motion correction techniques. Although heavily addressed by a large number of groups, reliable and stable techniques are still not yet available. In this course, we will give a short introduction about the involved technology challenges with a description of the current developments for simultaneous MRI-PET. In particular, we will talk about modality interference and pitfalls in MR-guided attenuation correction. We will close this course with a few interesting examples of simultaneous MRI-PET.
Learning Objectives:
1. To understand the fundamentals of MR physics relevant to MR/PET imaging.
2. To appreciate the advantages of MR/PET and its complementary role in diagnostic neuroimaging.
3. To learn about the benefits and challenges of combined MR/PET.

A-050 09:00

B. Advanced MR neuroimaging techniques
M. Smits; *Rotterdam/NL (marion.smits@erasmusmc.nl)*

Functional MR imaging (fMRI) and diffusion tensor imaging (DTI) are used extensively in the research arena to study an infinite number of questions regarding the brain's function and structure under normal conditions, as well as with neurological and psychiatric disease. The clinical use of these techniques, however, is by comparison fairly limited. The current main indication is the presurgical assessment of the relationship between the brain tissue to be resected and functionally eloquent brain tissue. In the context of brain tumour surgery, the aim is maximum tumour resection, whilst at the same time avoiding functional deficit. With tumour localisation in or near presumed eloquent brain areas, such as the motor or language areas, additional fMRI and DTI may be advantageous to guide the neurosurgical approach, shorten surgery duration and obtain prognostic information prior to surgery. fMRI is used to localise eloquent cortex, which is particularly useful when normal anatomy is obscured by tumour mass effect or in cases of cortical plasticity. With DTI the anatomy and involvement of white matter tracts may be evaluated. Inadvertent transection of white matter tracts during surgery leads to severe neurological deficit. DTI-tractography offers attractive visualisation of the major white matter tracts such as the corticospinal tract and the arcuate fasciculus, and offers valuable preoperative information on their relationships with the brain tumour to be resected. As well as providing such anatomical information, colour-coded eigenvector maps obtained with DTI can be used to categorise involvement of the white matter tracts by brain tumour.
Learning Objectives:
1. To learn about functional MRI (fMRI) and diffusion tensor imaging (DTI).
2. To understand the application of these techniques in the study of the healthy and diseased human brain.
3. To learn about the brain's activity and its connections.

A-048 09:30

C. Clinical applications of PET/CT in neurology

A.H. Jacobs; *Münster/DE (ahjacobs@uni-muenster.de)*

Positron Emission Tomography (PET) is being used together with various radiotracers to investigate alterations of metabolism and neurotransmission in various neurological diseases. Target structures for PET imaging comprise neurons (e.g. glucose or oxygen consumption; enzyme activity; receptor density); glial and endothelial aminoacid transporters; microglial function; and interstitial protein deposits. Together with MRI, PET helps to delineate (i) the penumbra in stroke; (ii) inflammatory activity in multiple sclerosis; (iii) epileptogenic foci in epilepsy; (iv) protein deposits and altered glucose consumption in Alzheimer's disease; (v) altered dopaminergic transmission in Parkinson's disease; and (vi) increased uptake of radiolabeled amino acids in gliomas. The lecture will outline the additional value of PET/CT imaging in the various most common neurological diseases to specifically increase the diagnostic accuracy and to help in the establishment of imaging-guided therapy paradigms. In addition, an outlook will be given from the clinical research programme of the 7th FW EU INMiND project (*Imaging Neuroinflammation in Neurodegenerative Diseases*; http://www.uni-muenster.de/InMind/).

Learning Objectives:

1. To become familiar with the role of PET/CT in neurology.
2. To learn about radiotracers that can be used in neuroimaging.
3. To understand PET/CT applications in relationship to disease presentations.

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

Cardiac

RC 103

Hybrid cardiovascular imaging: where should we go?

Moderator:
G. Feuchtner; Innsbruck/AT

A-051 08:30

A. PET/CT: present state and future prospects

S.G. Nekolla; *Munich/DE*

The clinical success of PET/CT in oncological imaging has opened opportunities for applications in cardiology. Embedded CT systems with 64 or 128 slices are now readily available and offer similar performances with respect to temporal and spatial resolution as well as reduction in ionising radiation as their stand-alone siblings. Thus, performing non-invasively coronary angiography to delineate coronary lesion severity and plaque morphology can be integrated with functional measurements such as absolute myocardial perfusion using a variety of flow tracers. The latter is of high relevance as changes in myocardial blood flow and flow reserve allow the assessment of pathological changes in the microvasculature prior to alterations of the epicardial vessels. But also use of non-perfusion tracers such as FDG or NaF for the characterisation of inflammatory processes within coronary plaques may help to identify patients being at high-risk for developing acute ischaemic syndromes. However, extensive future use of these two imaging approach will depend on the prospective validation of this complex yet comprehensive technique in larger patient populations. Finally, the third major application targets the characterisation of myocardial viability in patients with advanced CAD and heart failure. The quantitative nature of this imaging approach is very well-suited to monitor new metabolic therapy strategies. For viability imaging, the requirements with respect to the CT components are relatively low. In conjunction with the fact that many of these patients already have implanted devices excluding them from MR imaging makes this a robust clinical tool.

Learning Objectives:

1. To become aware of the present state of PET/CT in cardiovascular imaging.
2. To become familiar with appropriate indications for PET/CT studies of the heart.
3. To learn about technical innovations in PET/CT imaging.

A-052 09:00

B. SPECT/CT: is it just PET/CT's little brother?

M. Hacker; *Vienna/AT (marcus.hacker@meduniwien.ac.at)*

Appropriate diagnosis and therapy of coronary artery disease (CAD) frequently require information about both the morphological and functional status of the coronary artery tree. Thus, combined imaging consisting of invasive coronary angiography (ICA) plus SPECT myocardial perfusion imaging (MPI) is practised in clinical routine diagnostic of patients with stable angina since many years and can therefore be accepted as the reference standard in the diagnosis of haemodynamically relevant coronary artery stenoses. Both morphological and functional information are mandatory for the decision of performing an interventional therapy or initiating/maintaining medical treatment in numerous symptomatic patients. The haemodynamically relevance of coronary artery lesions is a major condition to decide whether an interventional therapy should be performed or not. A non-invasive concept providing both information could provide accurate allocation of perfusion defects to their determining coronary lesion and specific morphological and functional classification of patients with coronary artery disease. In symptomatic patients, a normal stress MPI confers a very low short-term risk for cardiac death and/or acute myocardial infarction. However, a normal MPI does not exclude the presence of underlying coronary atherosclerosis, which may be extensive although not yet flow-limiting. In this regard, CT will unmask a sizeable subgroup of patients with coronary atherosclerosis who should receive more intensive antiatherosclerotic intervention than would have been indicated by MPI results alone. Knowledge regarding the presence and extent of subclinical coronary atherosclerosis in patients who do not have ischemia by MPI can be of importance in patient management.

Learning Objectives:

1. To appreciate the scope of information a SPECT/CT cardiac study can deliver.
2. To become familiar with protocols of SPECT/CT studies.
3. To learn a structured approach to performing and reporting a SPECT/CT study.

A-053 09:30

C. MR/PET: do we really need it?

H.H. Quick; *Essen/DE (Harald.Quick@uni-due.de)*

Following PET/CT and SPECT/CT, MR/PET hybrid imaging is the most recent addition to the palette of hybrid imaging modalities. MR/PET synergistically combines the excellent soft tissue contrast and detailed image resolution of MR with metabolic information provided by PET. Integrated MR/PET systems furthermore, offer the ability to acquire hybrid imaging data simultaneously. This can be applied for MR-based motion correction of PET data. These features open up several cardiac applications, e.g. evaluation of cardiac function and viability and also diagnosis of cardiac inflammatory and tumorous diseases. To fully assess the diagnostic potential of MR/PET, however, several technical challenges have to be considered: attenuation correction (AC) of the patient tissues in MR/PET has to be based on MR-images and is currently hampered by a limited number of tissue classes and undercorrection of bone tissue. Cardiac radiofrequency coils and ECG gating equipment are currently not considered in AC. Consequently, quantification of PET data therefore might be biased. The clinical workflow is rather complex and needs to be tailored to cardiac examinations. Few research groups currently explore this new hybrid imaging modality in selected cardiac applications. Cardiac MR/PET: Do we really need it? Considering the sparse but increasing clinical experience that is available today, it is quite early to answer this question yet. However, once the remaining technical hurdles are overcome and the diagnostic potential can be fully exploited clinically, the answer is most likely positive.

Learning Objectives:

1. To learn about technical requirements for performing cardiac MR/PET studies.
2. To learn if cardiac MR/PET can be successfully performed in clinical routine.
3. To become familiar with the principal advantages/disadvantages of MR/PET compared to other hybrid imaging technologies.

Author Disclosure:
H.H. Quick: Research/Grant Support; Siemens Healthcare Sector.

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

Interventional Radiology

RC 109
Image fusion for image-guided interventions

A-054 08:30
Chairman's introduction
V. Bérczi; *Budapest/HU (Berczi@hotmail.com)*

There are a number of ways how image fusion can help interventional radiological procedures. Cone-beam CT considerably improves DSA technique, especially those including embolisation (chemoembolisation, radioembolisation). It helps to perform a more selective embolisation following precise target lesion specification and is also useful in determining variant anatomic structures. With its help, non-target embolisation can be reduced, even in the newest, meticulous techniques such as prostate artery embolisation. Static or real-time image fusion between US and CT as well as US and MRI enables more accurate interventional procedures, especially in the abdomen. Clinical applications can be used in the brain, breast, liver, prostate, kidney, and musculoskeletal system; endoscopic ultrasound and CT or MR have also been tested. Electromagnetic needle tracking (magnetic sensor embedded in the needle) has been shown to work in many studies. Conventional image-guided procedures are usually based on 2D imaging; it becomes 3D only in the operators' mind. Stereotaxy and robotics may at least partially solve these problems. The Panel Discussion at the end of the session will answer questions concerning the practicality and the financial aspects of these relatively new image-guided therapies.

A-055 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 IR 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; Biocompatibles UK, Surefire. Consultant; SIRTeX Medical Europe. Speaker; Siemens Healthcare.

A-056 08:58
B. US image fusion
C. Ewertsen; *Copenhagen/DK (caroline.ewertsen@dadlnet.dk)*

Image fusion between ultrasound (US) and CT, MRI or PET can be done with either static or real-time images. In both cases at least two 3D volumes of image data are needed. Most high-end US scanners have incorporated software for fusion of real-time US images with previously recorded CT, MRI or PET datasets. The software works in combination with a magnetic positioning system based on a magnet placed beside the patient and magnetic sensors attached to the transducer. Alignment can be done by semi-automatic methods, where a special device is attached to the skin before acquiring the CT dataset, or by manual alignment of common points or planes. The different methods of alignment, their accuracies, advantages and limitations will be explained based on the available literature and illustrated by cases. By means of the magnetic positioning system also electromagnetic needle tracking, where the needle tip is tracked, is possible. An electromagnetic sensor is embedded in the needle tip and the route of puncture marked electronically on the US screen. This may enable more accurate intervention in areas in the abdomen with limited overview. Recent publications on image fusion involving real-time US will be summarised with focus on the abdominal setting. Potential and limitations will be discussed and clinical examples of the method shown.
Learning Objectives:
1. To learn about the technologies used to fuse CT/US and MRI/US images.
2. To understand how to use them in clinical practice.
3. To understand the indications for these technologies in difficult cases.

A-057 09:21
C. How can we improve targeting in image-guided interventions: stereotaxis, robotics and advanced techniques
R. Bale; *Innsbruck/AT (reto.bale@i-med.ac.at)*

The success of image-guided percutaneous tumour ablation depends on accurate planning, guidance and control of the ablation necrosis. In large tumours, a geometric overlap of ablation spheres is required to achieve an adequate treatment volume. However, conventional CT-US guidance techniques still do not deliver the RF ablation electrode into a precise configuration of overlapping volumes. The 3D map has to be mentally constructed by an experienced operator. Recently, different targeting technologies for percutaneous ablative therapy, including ultrasound navigation, stereotaxy with manual and automatic (robotic) aiming devices have been described. 3D-navigation systems allow tracking the position of a surgical tool, which is projected in real time in the patient's corresponding CT, MRI, PET and SPECT images. Virtual flights along the planned trajectory may visualise critical anatomic structures and obstacles along or in close vicinity to the path. Special RFA planning software may visualise virtual treatment zones based on mathematical ablation models. Image-to-patient registration is usually based on skin fiducials or automated registration methods ('modality-based registration'). During 3D-navigated puncture, deviation distance and angles of the tracked surgical tool from the surgical path are given in real time. In stereotactic radiofrequency ablation (SRFA), a manual or robotic aiming device is used for rigid and precise tool guidance. For ablation of lung and liver tumours compensation of respiratory motion is essential. Computer-assisted volumetric planning and tool tracking may aid in precise and safe delivery of an RF ablation electrode into a target to cover the tumour and including a safety margin.
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.
Author Disclosure:
R. Bale: Equipment Support Recipient; iSys, Perfint. Patent Holder; Atlas aiming device. Speaker; Covidien.

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

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

Emergency Radiology

RC 117

Polytrauma: comprehensive management guidelines for imaging

A-058 08:30

Chairman's introduction: management priorities in patients after polytrauma

M. Stajgis; *Poznan/PL (stajgis@gmail.com)*

The rationale of the very first emergency procedures in polytrauma patients is based on time factor as one of the most important in saving life of the patients (golden hour). Therefore, modern and fast diagnostic imaging plays an continuously increasing role in management of these patients. All 3 lectures in this refresher course session are dedicated to requirements for advanced imaging in emergent clinical scenarios, management priorities and practical approach in diagnostics and early treatment of trauma victims.

A-059 08:35

A. Chest and abdomen

M. Scaglione; *Castel Volturno/IT (mscaglione@tiscali.it)*

Thoraco-abdominal injuries are a significant cause of death in the polytraumatised patients. Early recognition and communication of life-threatening thoraco-abdominal injuries is the major task of the radiologists involved in the emergency room. Although most of these patients reach the hospital alive, lethality continues to remain high. Heart, thoracic great vessels, trachea, bronchus, pleura, lung, diaphragm, abdominal/retroperitoneal, vascular and solid organ injuries are potential cause of death. Any appropriate surgical/interventional management approach must be carried out "around the clock", before thoraco-abdominal injuries reach the level of clinical evidence. On the other hand, non-operative management has actually become the standard of care for the most serious thoraco-abdominal injuries. These goals become feasible if a correct contrast-enhanced MDCT diagnosis, in a dedicated facility in which the trauma team works effectively 24 h a day, 7 days a week, is performed. Thus, in this lecture, the most serious thoraco-abdominal injuries will be illustrated, with special emphasis on vascular/injuries as well as the value of post-processing techniques, protocols, pitfalls, tips and tricks. Furthermore, the importance of a rational and integrated imaging approach will be pointed out and, finally, the role of the radiologist in the emergency room will be emphasised.

Learning Objectives:

1. To understand the impact of imaging findings on patient management.
2. To learn about common classification and trauma scoring systems.
3. To be familiar with the most common, typical and atypical imaging findings.

A-060 08:59

B. Spine and pelvis

F.H. Berger; *Amsterdam/NL (fhberger@gmail.com)*

Major trauma is often a life-threatening event due to multiple concomitantly occurring injuries to multiple organ systems. The mechanism of trauma relates to the pattern of injuries sustained, making history of great importance for further evaluation. A motor vehicle collision, a fall from height, a struck pedestrian and more specific details like ejection from a car or a seatbelt sign, will guide the radiologist in image interpretation. To maximise chances of survival and minimise morbidity for years after the incident, timely diagnosis and treatment is paramount. In the so-called 'golden-hour' after a traumatic event, the window of optimal treatment options, imaging studies should be undertaken promptly and only when needed. Interpretation of imaging examinations should focus on detecting injuries that urgently change management. Knowing which patterns of injury occur based on mechanism of trauma helps to find otherwise potentially overlooked injuries. A systematic approach will increase efficiency in the chaotic situation that workup of a trauma patient usually entails. Knowing associated injuries of skeletal trauma of the spine and pelvis will facilitate timely and complete evaluation of images of a trauma patient. Speaking the local common language within the trauma team (including IR colleagues) could be based on grading schemes. Mechanism of trauma, associated injuries and grading schemes commonly used to facilitate communication between team members, will be discussed in this presentation, such as those applied to the thoracolumbar spine and pelvis.

Learning Objectives:

1. To understand the pathomechanisms and practical classifications of spinal and pelvic trauma.
2. To become familiar with image interpretation rules in the traumatised spine and pelvis.
3. To learn about posttraumatic findings in CT and MR imaging.

A-061 09:23

C. Extremities

U. Linsenmaier; *Munich/DE (Ulrich.Linsenmaier@helios-kliniken.de)*

Background, etiology and outcome of extremity injuries after polytrauma. Management of patients with extremity injuries - patient triage, logistics,- the role of modern emergency radiology, -differentiation in soft tissue, blood vessels, nerve and bone and joint injuries, - primary imaging protocols: MDCT, the limited role of CR, US,- secondary imaging procedures: MR, MRA, DSA. Results of patients with etremity injuries in polytrauma- major findings that need immediate interventions, - clinical findings and findings from WBCT determine how to proceed, - first things first: algorithm for priorities in concurrent findings, - differentiation of vascular, soft tissue, nerves and bone and joint injuries, - differentiation of vascular lesions: bleeding dynamics, operational and interventional therapies,- overview of important classification schemes and their therapeutic impact of limb and joint injuries, - help by intervention?

Learning Objectives:

1. To be familiar with life-threatening injuries and current classifications systems.
2. To learn about imaging strategies and the role of different imaging methods.
3. To comprehend imaging findings and their impact on patient management.

09:47

Panel discussion: How to speed up the diagnosis and further management of polytrauma patients

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

Paediatric

RC 112

Autoimmune disorders in children

Moderator:
V. Donoghue; Dublin/IE

A-062 08:30

A. The joints in juvenile idiopathic arthritis

L.-S. Ording Müller; *Oslo/NO*

JIA is the most common rheumatic entity in childhood and includes a subset of childhood arthritis all of which are characterised by chronic synovitis with a potential risk of progressive joint destruction. Radiological investigations in JIA should ideally be able to determine the presence and degree of active inflammation, precursors of bony destructions and established erosions. However, there are many pitfalls in the interpretation of joint pathology in children. Ultrasonography is often the initial tool in the assessment of arthritis and can depict joint fluid, and synovitis. Erosions and cartilage destruction of small joints may also be seen. The major problem is to standardise the imaging technique and the lack of normal standards of anatomy on US in children. Radiographs can show bone erosions and may depict cartilage loss indirectly through joint space narrowing but are insensitive to inflammation and early joint destruction. MRI is the only imaging modality that can assess all relevant anatomical structures in joint inflammation and is sensitive to early inflammation and destruction. However large variations in the amount of joint fluid, bone marrow oedema-like lesions and changes resembling erosions are seen in children, even in healthy individuals. The differentiation between true pathology and normal findings on MRI in children remains a challenge, particularly in early disease. In this lecture the role of radiographs, ultrasound and MRI and the typical radiological findings in joint pathology in JIA will be presented. Current knowledge on validity and reliability of the different imaging techniques in JIA will be discussed.

Learning Objectives:

1. To learn about the different joint lesions in JIA.
2. To understand when to use US or MRI.
3. To learn how to recognise the typical imaging patterns.

A-063 09:00

B. The digestive tract

E. Alexopoulou; *Athens/GR (ealex64@hotmail.com)*

Inflammatory bowel disease (IBD) is a range of diseases, which includes Crohn disease, ulcerative colitis, and IBD unclassified. The combined effects of four basic components seem to result in the disease: environmental changes, genetic factors, intestinal microbiota alterations and immune system deregulation. In children with unknown IBD, US is considered to be the first-choice imaging technique which is performed before endoscopy. Bowel wall thickening, location and length of the disease, echogenicity of the bowel wall, the presence or not of normal stratification, ulcers, bowel stiffness, stricture or distention can often be detected with US. Additional information about the surrounding fat and the presence of mesenteric nodes can be obtained. The absence of bowel wall thickening has a strong negative predictive value. MR enterography is the technique of choice in children with known IBD, as it is a reproducible and well-tolerated examination, lacking radiation and providing excellent information about bowel disease. MR enterography clearly illustrates a) bowel loop appearance (fixed, dilated, strictured, pseudosacculation appearance), b) bowel wall (thickness, focal lesions such as ulceration, pseudopolyps and mural abscess, type of signal on T2-W sequences and pattern of enhancement after iv contrast injection), c) extramural signs (fibrofatty proliferation, "comb sign", fistula, abscess, mesenteric nodes). CT should be kept in cases that MRI is contraindicated or in acute-emergency situations, when US is inadequate. It remains also an examination of choice for abscess drainage, to depict its exact extension and select the most appropriate access route.

Learning Objectives:

1. To learn the basics of mechanisms related to autoimmune enteritis.
2. To appreciate the role of US, CT and MRI.
3. To become familiar with imaging findings useful in the diagnosis.

A-064 09:30

C. Multiple sclerosis in children

C. Adamsbaum, B. Husson, K. Deiva, M. Tardieu; *Le Kremlin-Bicêtre/FR (c.adamsbaum@bct.aphp.fr)*

The recent criteria for paediatric MS (Mult Scler 2013, 19, 1261-7) and the revised McDonald criteria for adults and adolescent MS allow the diagnosis of MS at the time of the first demyelinating clinical event. Brain MRI plays an important role in those criteria, as it can demonstrate the classical dissemination in time and space and helps earlier diagnosis, which is of major importance since the present recommendation in children is to start immunomodulating treatments as soon as diagnosis is established. Amongst paediatric MS, 14% begin before the age of 6 years and 30% before the age of 10 years, frequently with an ADEM presentation in young children as initial manifestation of MS. However, only 20% of the ADEM indicates MS onset and the most predictive factors should be known, i.e. periventricular, deep white matter, corpus callosum high T2 signal lesions and black holes on T1 sequences. MRI evaluation is also instrumental in differential diagnoses such as nonrelapsing ADEM, vasculitis, immunogenetic diseases and occasionally leucodystrophies. Finally, brain MRI is useful to evaluate the risk of more severe MS.

Learning Objectives:

1. To understand the difference between children and adults.
2. To become familiar with imaging findings.
3. To learn about the principle differential diagnosis.

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

E³ - ECR Academies: Interactive Teaching Sessions

E³ 221

The treated breast: what you need to know

A-065 10:30

A. Imaging after treatment of benign breast conditions

J. Camps Herrero; *Valencia/ES (juliacamps@gmail.com)*

Breast radiologists need to be familiar with post-treatment imaging findings in patients with breast cancer but often, patients are also imaged after a diagnosis of benign entities which are treated surgically (fibroadenomas, radial scars, papillary lesions) or after a percutaneous diagnosis of a high-risk lesion which has to undergo a surgical biopsy to avoid underestimation (atypical ductal hyperplasia, lobular neoplasia or flat epithelial atypia). These procedures will leave an imprint on the breast, which can be a cause of concern due to the surgical scar left. Furthermore, imaging findings after plastic surgery for mastopexy, reduction mastoplasties, implants or auxilliary techniques (lipofilling, hyaluronic acid) are becoming frequent in our daily practice and have their peculiarities that can overshadow breast cancers. Interventional percutaneous procedures can also be a cause of tissue distortion. There are advanced systems for biopsy (BLES) and for percutaneous removal of benign lesions (fibroadenomas, papillomas), which use large gauge needles and have to be accounted for due to their trace in the breast tissue.

Learning Objectives:

1. To understand common features related to breast surgery.
2. To recognise changes related to non-surgical treatments.

A-066 11:15

B. Imaging after treatment of breast cancer

M.H. Fuchsjäger; *Graz/AT (michael.fuchsjaeger@medunigraz.at)*

Imaging after treatment of breast cancer is for confirmation of lesion removal, identification of post-procedural fluid collections, detection of residual or recurrent cancer and screening for metachronous cancers. Post-therapy changes, which include fluid collections, edema, skin thickening, architectural distortion, scarring and calcifications, are mainly due to surgery, axillary dissection and radiotherapy. The greatest treatment-related changes occur 6-12 months after therapy, and mammographic stability is achieved after two to three years. For mammography, pre- and all post-therapeutic images have to be compared. Ultrasound is the method of choice for evaluation of fluid collections. MRI is for problem solving (i.e. differentiation between scar and relapse) and should not be performed prior to 12 months after therapy to avoid false-positive diagnoses. Dystrophic calcifications may develop in areas of fat necrosis mimicking malignancy. Fat necrosis predominantly occurs at the treated site; however, it can develop anywhere in the ipsilateral breast. Its appearance may be indistinguishable from cancer at all imaging modalities. To differentiate between fat necrosis and other common post-treatment changes from relapse, it is important to know the timeline when these changes occur and schedule follow-up imaging accordingly. Mammography serves as the basis for post-operative surveillance. Ultrasound is helpful in the early post-operative phase, whereas MRI is the method of choice, especially for differentiation of scar and relapse in the later post-operative phases.

Learning Objectives:

1. To understand common features related to breast surgery.
2. To recognise changes related to non-surgical treatments.

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

E³ - The Beauty of Basic Knowledge: Breast Imaging

E³ 25 A

Breast ultrasound: a primer

Moderator:
J. Camps Herrero; Alzira/ES

A-067 12:30

Breast ultrasound: a primer

A. Tardivon; *Paris/FR (anne.tardivon@curie.fr)*

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 (objective 1: review of indications of breast US). Along a defined scanning protocol (objective 2: how to do and how to image US lesions), 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, elastography techniques). 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 multiple clinical cases (use of BI-RADS lexicon items) from easy to difficult ones (objective 4: how to find lesion at US and validate lesion concordance between the different imaging modalities, how to detect subtle US lesions, place of US-guided interventional procedures).

Learning Objectives:

1. To review the technical issues tied to a state-of-the-art US exam and new developments.
2. To learn how to deal with the most common clinical situations where breast US is involved.
3. To know the basic semiology of US lesions.

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

E³ - The Beauty of Basic Knowledge: Skeletal Radiology

E³ 24 A

Plain radiographs: analysis and interpretation

Moderator:
V. Cassar-Pullicino; Oswestry/UK

A-068 12:30

Plain radiographs: analysis and interpretation
I.W. McCall; *Devon/UK (mccalli832@btinternet.com)*

The radiograph remains an inexpensive imaging modality. Factors to evaluate include the thickness and outlines of cortical bone, the density and pattern of trabecular bone and the periosteal appearance. The position of lesions within the bone, their outline, size and margin and whether they are single or multiple also provide important diagnostic information. Adjacent soft tissues are affected by many conditions particularly, trauma and infection and are integral to image interpretation. While MRI is essential for internal joint structures, radiographs demonstrate subchondral bones, alignment, erosions and surrounding soft tissues. Knowledge of normal radiographic anatomy and variants is essential. In trauma subtle changes in bone alignment, discontinuity of bone outline or alteration in density of trabecular bone may indicate injury. Generalised increased or decreased bone density indicates imbalanced bone creation or loss due to systemic diseases and may be difficult to recognise at an early stage but are more recognisable when localised in comparison to unaffected bone. Localised reduced density may result from hyperaemia, disuse or from replacement by cysts and sclerotic reaction by trauma and infection, while primary and secondary bone tumours may result in either response. Other features such as cortical expansion or scalloping, bone response at the margins, internal calcification will refine the diagnosis. Periosteal new bones in differing patterns result from local insult or more generalised metabolic and haemodynamic changes while soft tissue swelling, alterations in muscle and ligament outline or the presence of calcification and all provide vital clues to disease recognition and diagnosis.
Learning Objectives:
1. To learn about the current role of plain radiographs.
2. To appreciate the strengths and weaknesses of plain radiographs in musculoskeletal disease.
3. To understand methods for analysing radiographic abnormalities and an approach to their correct interpretation.

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

GI Tract

RC 401

Misses and difficulties in abdominal imaging

A-069 16:00

Chairman's introduction
J. Stoker; *Amsterdam/NL (j.stoker@amc.uva.nl)*

Identification of diseases can be difficult in many areas of abdominal imaging and, therefore, misses are easily made, also by the more experienced radiologist. Obviously, prior knowledge of the normal anatomy and imaging findings in abdominal diseases is mandatory for optimal reading but even then misses are made. Under-reading and satisfaction of search are common causes of misses as well as faulty reasoning, satisfaction of report and certain more difficult disease locations and manifestations. Fatigue and multiple tasking play a role while one should be aware that attention often decreases at certain moments (e.g. end of the morning and end of the afternoon). Misses are intrinsically linked to human reading, but optimising working conditions and tools like structured reporting can help to reduce misses.
Session Objectives:
To briefly present how imaging diagnosis can be challenging in patients with peritoneal or mesenteric masses, occult GI bleeding or bowel dilatation.
Author Disclosure:
J. Stoker: Consultant; Robarts Clinical Trials.

A-070 16:05

A. Mesentery and peritoneum
D. Akata; *Ankara/TR (dakata@hacettepe.edu.tr)*

Imaging findings of neoplastic or inflammatory diseases within the peritoneal cavity and the mesentery sometimes overlap and cause difficulties in interpretation. Even disease processes in the peritoneum, mesentery or omentum may not be recognised on radiological examination, causing major difficulties in the management. Peritoneal anatomy and physiopathology of peritoneal diseases must be well understood for better evaluation. CT is the best modality to assess the whole cavity. MR is equally sensitive with better contrast resolution; however, both modalities have advantages and limitations. Ultrasound has a complementary role in evaluating the peritoneal fluid content. The presence of lace-like mobile thin septa is highly significant for tuberculosis. For better diagnosing the pathology, systematic approach is needed such as assessing the presence or absence of fluid in the peritoneal cavity, its character and location, accompanying soft tissue densities and their location. Some inflammatory or infectious causes, such as acute pancreatitis and tuberculosis, involve typically parietal peritoneum and certain peritoneal reflections. Peritoneal carcinomatosis involves typically both visceral and parietal peritoneum as well as subdiaphragmatic space. Contrast enhancement patterns of the peritoneal membranes and the mesentery also have a complementary role in differentiating a variety of diseases.
Learning Objectives:
1. To learn about the imaging characteristics of peritoneal and mesenteric masses and their differentials.
2. To appreciate the great potential, as well as the limitations, of imaging techniques in the detection of such lesions.
3. To understand the common pitfalls in diagnosis.

A-071 16:28

B. Occult GI bleeding
A. Filippone; *Chieti/IT (a.filippone@rad.unich.it)*

Patients with persistent, recurrent, or intermittent bleeding from the gastrointestinal tract for which no definite cause has been identified by initial oesophagogastroduodenoscopy, colonoscopy, or conventional radiologic evaluation are considered to have an occult gastrointestinal bleeding (OGIB). The management of OGIB is clinically challenging, since the causes of such a bleeding frequently arise in the small bowel (SB), until now considered as the "dark continent". Conventional barium contrast studies allow only a limited evaluation of SB, whereas angiographic diagnosis is strictly related to active bleeding. The introduction of capsule endoscopy (CE) as well as of cross-sectional imaging dedicated to the SB visualisation, such as multidetector-row computed tomography enteroclysis (CTE) and magnetic resonance enteroclysis (MRE), represents significant technological advances that have overcome the limitations of older diagnostic tests. Although CE is recommended as a first-line investigation in OGIB patients, CTE or MRE are alternative diagnostic tools when CE is contraindicated due to suspected/known obstruction or stricture. Moreover, in patients in whom a tumour is suspected, CTE or MRE may be the preferred initial test. Therefore, radiologists have to be familiar with CTE and MRE techniques, in terms of bowel distension, scanning parameter selection, contrast administration as well as with specific imaging findings. Similarly, they have to be aware of the potential pitfalls such as suboptimal bowel distension, artefacts due to peristalsis or breathing, intraluminal food debris and previous surgery.
Learning Objectives:
1. To understand the causes of GI bleeding and underlying pathophysiology.
2. To appreciate the strengths and limitations of the imaging techniques used in diagnosis.
3. To learn about common pitfalls in diagnosis.

A-072 16:51

C. Bowel dilatation
E. Danse; *Brussels/BE (etienne.danse@uclouvain.be)*

Patients with bowel dilatation frequently require imaging procedures, mainly in case of admission in the emergency room as well as in the early post-operative period. Plain films, sonography and CT contribute to the management of bowel dilatation. At the present time, CT takes the major place in this setting when available with a continuously reducing role of plain films. Sonography is an alternative method when CT is not recommended (in childhood, pregnant patients, morbidly obese patients or not-transportable patients). The questions of Henri Mondor in "Les diagnostics urgents, Masson editors, 1947" were clearly pointed out before the advent of cross-sectional imaging; these are still valid and have to be answered: 1) is this a true occlusion (and then how to differentiate it from adynamic ileus) 2) does the obstruction concern the small bowel or the colon (impact for the decision to operate or not and for the differential diagnoses) 3) what is the cause of the obstruction 4) are there signs of bowel ischemia? The key points to avoid missing imaging diagnoses in

bowel dilatation are to make the distinction between true mechanical obstruction and adynamic ileus (which can be an early sign of mesenteric infarct) and to detect signs of strangulation leading to ischemia: imaging findings of ischemia are present despite normal blood tests. In this setting, CT is the preferred technique; if it is not available, plain films and sonography can help for an optimal medical decision.
Learning Objectives:
1. To become familiar with the normal appearances of the bowel and the physiological causes of bowel dilatation.
2. To learn about the different imaging techniques to diagnose bowel dilatation and their limitations.
3. To understand common pitfalls in diagnosis.

17:14
Panel discussion: What have I learned from misses? Can improvements be made to reduce misses?

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

Special Focus Session

SF 4
Pancreatic lesions - the solid, the cystic, and the diffuse: benign or malignant?

A-073 16:00
Chairman's introduction
C. Matos; *Brussels/BE (cmatos@ulb.ac.be)*

Despite the use of more and more sophisticated imaging modalities (CEUS, EUS, MDCT, MRI, PET-CT), the diagnosis of pancreatic lesions remains a challenge. As for other organs and disease entities, no single test can provide the answer. Differential diagnosis and management decisions are based on a mixture of clinical information, cross-sectional imaging findings, tumour markers and cytologic evaluation. In this session, the panelists will aim to emphasise multidisciplinary teamwork and the central role of clinical radiology to achieve the correct diagnosis and determining options for patient management.
Session Objectives:
1. To address how imaging helps make the differential diagnosis of solid, cystic and diffuse benign and malignant lesions of the pancreas.
2. To discuss the role of diagnostic imaging modalities in determining options for patient management.

A-074 16:05
The solid pancreatic lesion
R. Manfredi; *Verona/IT (riccardo.manfredi@univr.it)*

Pancreatic adenocarcinoma is the most common pancreatic exocrine neoplasm and accounts for 75-85% of all pancreatic malignancies. Detection of pancreatic adenocarcinoma relies on direct signs: mass in the pancreatic parenchyma, hypovascular responsible of infiltration of adjacent structures; and indirect signs such as dilatation of the upstream main pancreatic duct and infiltration of the Intrapancreatic segment of the common bile duct, when located in the head. At diagnosis, only 10% to 30% of patients with pancreatic adenocarcinoma have resectable disease at the time of presentation; therefore, it is crucial to detect these small tumours and to identify patients eligible for surgical resection. Preoperative planning needs the evaluation of the infiltration of peripancreatic vessels, namely the superior mesenteric vein and artery and the celiac trunk. Furthermore, liver metastases should be excluded and peripancreatic lymph nodes should be classified. Neuroendocrine neoplasms are very heterogeneous with different biological behaviour: benign, borderline and malignant lesions.The medical need is represented by detection and specially characterisation of the lesions, since the treatment and the prognosis may differ considerably from pancreatic adenocarcinoma. Diagnostic imaging findings suggestive of tumour grading will be also analysed.
Learning Objectives:
1. To learn about the common and uncommon imaging presentations of solid lesions of the pancreas.
2. To understand the role of imaging in the detection and differentiation of solid lesions of the pancreas.
3. To explain when imaging features indicate surgical management.

A-075 16:28
The cystic pancreatic lesion
J. Wessling; *Münster/DE (weslingj@uni-muenster.de)*

Cystic pancreatic neoplasms are often an incidental finding, the frequency of which is increasing. The understanding of such lesions has increased in recent years, but the numerous types of lesions involved can hinder differential diagnosis. They include, in particular, intraductal papillary mucinous neoplasms (IPMN), serous cystic neoplasms (SCN), and mucinous cystic neoplasms (MCN). Knowledge of their histological and radiological structure, as well as distribution in terms of localisation, age, and sex, helps to differentiate such tumours from common pancreatic pseudocysts. Several types of cystic pancreatic neoplasms can undergo malignant transformation and, therefore, require differentiated radiological management. To learn to develop a broader understanding of the pathological and radiological characteristics of cystic pancreatic neoplasms and to learn to provide a guideline for everyday practice based on current concepts in the radiological management of the given lesions.
Learning Objectives:
1. To describe the main imaging features and diagnosis of cystic lesions of the pancreas.
2. To discuss the differential diagnosis of cystic lesions of the pancreas with the emphasis on imaging signs of malignancy.
3. To explain when imaging features indicate surgical management.

A-076 16:51
The diffuse pancreatic lesion
C. Triantopoulou; *Athens/GR (ctriantopoulou@gmail.com)*

Pancreas may be diffusively involved by various disorders. Some of them are quite common as acute pancreatitis, while others are very rare like sarcoidosis or amyloidosis. Neoplastic infiltration is the first to be excluded (lymphoma, leukaemia, diffuse neuroendocrine tumours, metastases, plasmacytoma, even carcinoma). In the differential diagnosis, infiltrative disorders (amyloidosis, sarcoidosis, lipomatosis, lipomatous pseudohypertrophy, haemochromatosis, cystic fibrosis), infections (TBC, abscesses, virus) and inflammatory diseases (acute pancreatitis, autoimmune pancreatitis) should be considered. In fact, any pathologic process that involves the pancreas focally can also cause diffuse involvement. Imaging is of great importance to demonstrate the pattern and extent of pancreatic involvement. The pancreas could be enlarged, atrophic or of normal size. Additional intra-abdominal or extra-abdominal findings may facilitate the diagnosis specifically in systemic diseases. The sensitivity of MRI is comparable to that of CT, except for detection of calcification. MRI and MRCP, however, can be advantageous for detection of deposition diseases. Characteristic changes in signal intensity may help to narrow the differential diagnosis while the evaluation of associated ductal changes is mandatory. Unfortunately, some diffuse diseases present with atypical of overlapping imaging features. Therefore, clinical and laboratory parameters are needed to exclude or reinforce the presumed diagnosis by imaging. On the other hand, imaging can guide invasive techniques (FNA) in equivocal cases. The discrimination between medically treatable cases or surgical ones should be the main goal, so that unnecessary resections could be avoided. Concerning screening, when clinically applied and post-therapy follow-up, imaging is very important to demonstrate resolution, recovery, or recurrence.
Learning Objectives:
1. To learn about the pathological entities resulting in diffuse pancreatic lesions.
2. To describe the common and uncommon imaging features that allow differentiation between Inflammation and cancer.
3. To compare the advantages and drawbacks of MR imaging compared to CT for the workup of diffuse pancreatic lesions.

17:14
Panel discussion: Pitfalls and problems in pancreatic lesions

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

Professional Challenges Session

PC 4b

What are the concrete benefits of structured reporting?

A-077 16:00

Chairman's introduction

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

Radiologists increase their operability when they can provide patients and referring physicians alike with clear, straightforward reports. Although narrative reports afford radiologists creative freedom to describe findings exactly as they see fit, that freedom comes at a price. Referring clinicians often find it difficult to wade into densely written text to find actionable elements in a report, decreasing efficiency and possibly affecting the speed with which proper care is provided to patients. Radiologists must determine how to reposition themselves as the focal point of patient care, and the use of standardised language in structured reports can make them an invaluable addition to the healthcare team. The structured report could be an excellent tool to achieve the goal of having our reports standardised, comprehensive, easily managed and "readable" to humans and machines alike. In this session we will discuss the concrete benefits of structured reporting from different perspectives: Patients, Referring Physicians, Radiologists and Scientific Societies.

Session Objectives:

1. To learn about the importance of structured reporting (SR) in daily practice.
2. To understand its role in the radiologist workflow.
3. To appreciate its benefit as a communication tool.

A-078 16:05

For the radiologist

P. Mildenberger; *Mainz/DE (peter.mildenberger@unimedizin-mainz.de)*

Reporting is an issue in radiology for more than 100 years, up to now most of the radiological reports are presented with little or as none structured prose text. This could create difficulties in understanding the message, in precision and also in scientific work-up. Structured reporting could improve the value of radiological reporting due to several facts. Based on the structured templates for dedicated examinations, there is a lower likelihood to miss something relevant. The presentation of the content is clearer and enables better and faster access to information from priors. The integration with evidence reports from modalities (e.g. measurements at workstation, MR or ultrasound devices) could automatically fit into the templates and would avoid additional transcription with potential errors. Finally, structured template can be linked with ontologies and databanks for diagnoses, measurements, etc. This would improve the possibilities for data analysis markedly.

Learning Objectives:

1. To explore the impact on reporting workflow.
2. To learn about the value for follow-up studies.
3. To understand how to develop one's own templates.

A-079 16:23

For the referring physician

J.M.L. Bosmans; *Ghent/BE (janbosmans@telenet.be)*

Surveys among referring physicians have shown consistent support for structured radiology reports throughout almost 15 years. The definition of a structured report has been, and still is, a subject of discussion. Several models implying a mere reordering of the information contained in free text reports have been proposed, such as sectional reports, tabular or itemised reports. Although low-level structuring according to a preset model would certainly meet some of referring clinicians' preferences, much more is to be gained from the combination of preset templates and an underlying coded lexicon. The theoretical advantages of such reports are obvious: improved follow-up of chronic patients, easy retrieval of pertinent information enabling clinical and translational research, integration of the information in imaging biobanks, automatic translation, etc. The RSNA RadReport and RadLex initiatives are providing instruments that enable the development of radiology information systems with advanced structured reporting features. Through an agreement with RSNA, ESR members can now translate or adapt templates or propose new ones. This promising collaborative effort should not overshadow other existing and ongoing structured reporting initiatives, as those may serve as positive models to convince sceptics that structured reporting, one way or the other, is often the better alternative to free text reports. Several examples of such real-life applications will be presented and referring clinicians' reactions elucidated.

Learning Objectives:

1. To understand the needs of referring clinicians concerning content and presentation of imaging results.
2. To become familiar with existing initiatives to meet referring clinicians' requirements.
3. To learn about clinicians' evaluations of SR in real life.

A-080 16:41

For the patient

C.E. Kahn; *Philadelphia, PA/US (charles.kahn@uphs.upenn.edu)*

Structured reporting - in which radiology reports are organised consistently and use well-defined vocabulary - can provide concrete benefits to patients. The increasing availability of electronic health record (EHR) patient portals has increased patients' awareness of and interest in their radiology reports. Patients with cancer or other chronic conditions will follow their reports closely to better understand their condition. Structured reports can make it easier for patients to find information, such as the size of a nodule being followed, and to understand that information through glossaries and other tools. "Secondary use" of report information aggregates data for quality improvement and clinical research. Systems for computer-aided reporting can be integrated with structured reporting system to help radiologists incorporate the most appropriate recommendations for patient care. "Global assessment" codes (analogous to BI-RADS assessment codes) can help radiologists communicate more effectively with patients and assure appropriate follow-up care. This presentation describes current and next-generation structured radiology reporting approaches that improve patient care.

Learning Objectives:

1. To explore the impact of SR on patient care.
2. To learn about its role in supporting quality improvement and patient safety.
3. To describe how it enables clinical and translational research.

A-081 16:59

The ESR/RSNA structured reporting initiative

O. Ratib; *Geneva/CH (osman.ratib@hcuge.ch)*

ESR eHealth and Informatics Subcommittee has decided to engage in a joint effort with RSNA working group on the 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 clear and consistent report templates. These report templates are "structured" in the sense that they 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. They are free and not subject to license restrictions on their reuse. Report templates will comply with the IHE "Management of Radiology Report Templates" (MRRT) profile (http://www.ihe.net/uploadedFiles/Documents/Radiology/IHE_RAD_Suppl_MRRT.pdf) based on HTML5 format. Templates will be submitted in MRRT format to the "Open" template library. A web-based template authoring tool is expected to be available by early 2015 to help radiologists create and edit MRRT templates. RSNA and ESR will invite submissions to the reporting template library from their members. The ESR eHealth and Informatics Subcommittee decided to encourage National Societies to contribute to the submission and translation of templates and participate in the Subspecialty and Allied Sciences Societies to create reporting templates. A letter was sent to all European Radiology Societies as well as subspecialty societies to solicit their participation by nominating a local representative to become a contact person for coordination and promotion of this new initiative. 57 National and Subspecialties and Allied Societies were invited: 44 societies named a representative.

Learning Objectives:

1. To understand the concept of SR using the MRRT IHE standard.
2. To review the current status of the ESR/RSNA joint initiative.
3. To learn about the ESR/RSNA technical setup and how to participate in and benefit from it.
4. To learn about new trends in multilingual syntax management and translation.

17:17

Panel discussion: What are the concrete benefits of structured reporting?

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

Neuro

RC 411

Imaging findings in treated brain tumours

Moderator:
B.F. Schuknecht; Zurich/CH

A-082 16:00

A. How to perform imaging in the postoperative patient: imaging protocols, normal and abnormal findings after surgery
M.A. Lucic; *Sremska Kamenica/RS (milos.a.lucic@gmail.com)*

Tenacious clinical urge in neurooncology to acquire as many answers as possible in regard to the tumour type and grade, to determine the most appropriate and maximally individualised surgical and/or non-surgical therapy modality for the brain tumour patient, but also to obtain the most accurate assessment of the post-treatment tumour behaviour and status, places the neuroradiologists in rather intricate position nowadays. Since the main tenet of current brain tumour treatment is founded on surgical resection, and that the awareness that the expected survival rate directly increases with the extent of malignant brain tumour resection is fully present and it is utterly understandable that the monitoring of postoperative results by available imaging techniques plays the crucial role both in patient prognosis and follow-up. Introduction of the various, technically constantly evolving neuroimaging techniques, especially those derived from MRI, enabled the rapid transition from a solely morphoanatomical diagnostic tool to one that integrates structural, functional, and metabolic tumour characteristics. Expertise of postoperative brain tumour behaviour, internal transformation, and infiltration of surrounding structures has been made possible by observing and estimating the tumour invasiveness, necrosis, cellularity and cyto-architectonics, mitotic activity, tissue microstructural derangement, pathological angiogenesis, microvasculature haemodynamics, and capillary permeability. Thus, the appraisal of tumour recurrence and overall neurosurgical therapeutic response estimation, as well as early detection of treatment failure and other neurooncological response assessment criteria monitoring by use of a variety of currently available biology-driven, structural, functional, metabolic, molecular and quantitative neuroimaging techniques, are of utmost importance in clinical follow-up after neurosurgery.
Learning Objectives:
1. To show the diagnostic protocol in post-operative brain tumours.
2. To learn how to differentiate between tumoural and non-tumoural disease using different sequence.
3. To consolidate knowledge on how to combine different acquisitions.

A-083 16:30

B. Understanding radiation- and chemotherapy-induced changes after treatment of brain tumours
Y. Özsunar; *Aydin/TR (yeldaozsunar@gmail.com)*

Surgery, radiation therapy, and chemo-therapy are three standard types of treatment methods in patient with brain tumours. Radiation therapy and chemotherapy are important components of treatment in high-grade gliomas. Typically, patients begin radiation treatment within 2 to 4 weeks following tumour resection. In many cases, distinguishing recurrent glial tumour from radiation necrosis can be challenging in follow-up (Magnetic Resonance Imaging) MRI. Therefore, understanding differential diagnosis of recurrent tumour versus radiation necrosis becomes important in management of these tumours. Due to low sensitivity of conventional MRI, perfusion MRI is advised to be used routinely especially in irradiated postoperative brain tumours. Because of the critical importance of using perfusion imaging, understanding principals, applications, and pitfalls of various perfusion imaging techniques as well as the radiological findings of post-chemotherapy changes are crucial.
Learning Objectives:
1. To understand why perfusion imaging is routinely needed for post-operative brain tumours evaluation.
2. To become familiar with principles, applications, and pitfalls of various perfusion imaging techniques.
3. To consolidate knowledge of MR imaging to understand post-therapy changes.

A-084 17:00

C. Treated brain tumours: progression or pseudoprogression?
P.C. Maly Sundgren; *Lund/SE (Pia.Sundgren@med.lu.se)*

Maximal safe resection, radiation therapy and temozolamide chemotherapy are the current standard of care for newly diagnosed high-grade gliomas. However, despite improvements in surgery, radiation- and chemotherapy, the high-grade gliomas have a poor survival rate. A contributing factor to the poor survival is the inability of currently available imaging techniques to accurately delineate the tumour which results that targeted focal treatment may not be effective. Conventional imaging is not able to give an early assessment of the effectiveness of radiation and/or chemotherapy. In addition, conventional imaging has difficulties in differentiating pseudo-progression which is a common phenomenon in conventional chemo-radiation therapy from true progression. Pseudo-progression is presented as increased enhancement on conventional contrast-enhanced MRI within the first 3 to 6 months after combined chemo-radiation therapy and earlier than traditional radiation injury. Early identification of patients who suffer from tumour recurrence can be of great advantage: it provides the opportunity to adjust individual more rapidly, and sparing patients unnecessary morbidity, and delay in initiation of other maybe more effective treatment. In this lecture, different advance MR and CT imaging methods used to support differentiation between pseudo-progression and true tumour progression during monitoring to assess treatment response will be discussed. Finally, the aim of the lecture is to consolidate the present knowledge and novel ideas in brain tumour imaging for assessment of pseudo-progression versus true tumour progression future and the possibility and limitations for future individualisation of cancer therapy.
Learning Objectives:
1. To understand the challenges and limitations of routine MRI in monitoring brain tumour treatment.
2. To become familiar with the role of advanced imaging biomarkers for early assessment of treatment response.
3. To learn how to integrate routine and advance MRI into clinical practice after tumour therapy.
Author Disclosure:
P.C. Maly Sundgren: Research/Grant Support; Cancerfoundation, Sweden, American Cancer foundation, Swedish research Council grant, SUS hospital funding, Sweden.

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

Musculoskeletal

RC 410

Trauma to the paediatric skeleton

Moderator:
K. Rosendahl; Bergen/NO

A-085 16:00

A. Pelvis/hips
N. Boutry, E. Amzallag-Bellenger; *Lille/FR (nboutry@gmail.com)*

Traumas to the paediatric pelvis and hip include traumatic dislocations of the hip, fractures of the femoral neck, fractures of the pelvic ring, acetabular fractures and apophyseal avulsion fractures. Traumatic dislocations of the hip, fractures of the femoral neck, fractures of the pelvic ring and acetabular fractures are rare in children (less than 5% of paediatric fractures), as compared with adults. These fractures are commonly the result of high-energy trauma. Imaging is based on plain radiographs but CT and MRI are very useful to precisely assess bone (CT) and cartilage and soft tissue (MRI) lesions. Imaging enables accurate diagnosis, appropriate treatment and detection of potential complications (femoral head osteonecrosis, premature physeal closure …). In contrast with the previous injuries, apophyseal avulsion fractures of the hip and pelvis are common in children and adolescents, usually associated with athletic activities. In most cases, these fractures are of good prognosis and can be treated conservatively when minimally displaced. Plain radiographs confirm avulsion injuries to ossified apophyses but MRI and ultrasound are the modalities of choice to demonstrate injuries to nonossified apophyses and to assess apophyseal displacement.
Learning Objectives:
1. To become familiar with the types of injuries seen in the paediatric pelvis/hips.
2. To understand the strengths and weaknesses of different imaging modalities.

A-086 16:30

B. Elbow
K.J. Johnson; *Birmingham/UK*

The elbow is a very common site for fractures in a child. The challenge for the radiologist is to differentiate normal variants of growth from possible injury and this is usually achieved by having good quality radiographs and an understanding of normal growth. It is important to recognise those fractures which require surgical intra-operative treatment. In a small number of cases, when assessing for vascular integrity, intra-articular extent and injury to

cartilaginous structures, ultrasound and MR imaging have a valuable role. This lecture will give an overview of the radiographic appearance of fractures, highlight the features which require orthopaedic intervention and illustrate the use of additional imaging modalities.

Learning Objectives:

1. To become familiar with the types of injuries seen in the paediatric elbow.
2. To understand the strengths and weaknesses of different imaging modalities.

A-087 17:00

C. Spine

L.B.O. Jans; *Ghent/BE (lennartjans@hotmail.com)*

The diagnosis of C-spine injury is more complex in children than in adults. Early diagnosis is crucial since delayed diagnosis results in high morbidity and mortality. Leading mechanisms of paediatric C-spine trauma are motor vehicle accidents, sports and pedestrian injuries. Due to their anatomy, children are prone to different types and locations of injuries. Children < 10 years of age are more likely to injure the spinal cord itself, are prone to dislocations and to high (C1-C4) bony injuries. Children > 10 years of age more often sustain C-spine fractures. In children under the age of 2 years, radiographs are rarely helpful. AP and lateral radiographs are helpful in children aged between 2 and 8 years old. In children aged > 8 years old, addition lateral and odontoid views are obtained. Anatomical variants such as pseudosubluxation of C2-C3, widening of the atlantodental interval and ossification centers may appear concerning on imaging but are normal. Abnormal radiographic findings require additional imaging to differentiate them further with CT on the area of concern. MRI is mandatory if signs of atlantorotary subluxation and spinal cord injury without radiologic abnormality (SCIWORA) are present. MRI identifies injuries to the spinal cord that are not apparent with other modalities, and should be used when a child presents with a neurologic deficit but normal radiographs on CT scan.

Learning Objectives:

1. To become familiar with the types of injuries seen in the paediatric spine.
2. To understand the strengths and weaknesses of different imaging modalities.

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

Professional Challenges Session

PC 4a
Radiologist: imager or doctor?

A-088 16:00

Chairman's introduction

J.A. Reekers; *Amsterdam/NL (j.a.reekers@amc.uva.nl)*

The question if a radiologist is an imager or a doctor brings up the important question: what is in 21th century the added value of a radiologist for the hospital? In the last decade more and more clinicians have started to learn about the images in their subspecialty territory, and through courses and experience, they have less fear to start making their own interpretations and diagnosis. They combine their subspecialty clinical knowledge, patient information and image interpretation. To be at the same level, first of all the radiologist 2.0 should be clinically involved in the same subspecialty. But also, radiology should be leading in imaging and initiate new imaging opportunities, before clinicians ask for it. Radiology should be leading in multidisciplinary teams and organise digital medical rounds at the radiology department. Radiology should set the agenda and time lines for these MDTs. The radiology should be a teacher, a subspecialty spokesperson, an initiator of science and a radiology union person in one. The radiologist 2.0 should build clinical-diagnostic units around medical subspecialties. This means that our future radiology departments should consist of many clinical-diagnostic units. By adopting this model with clinical-diagnostic units in the hospital, radiology can stay of added value and at the same token be supportive, but this time not only to the clinician but now also directly to the patient. A radiologist is an excellent imager and a subspecialist doctor in one.

Session Objectives:

1. To learn how radiology can become future-proof.
2. To understand how radiology can be more visible in the hospital.
3. To learn how teleradiology might threaten radiology.

A-089 16:05

Which type of radiologist is future proof?

N.H. Strickland; *London/UK (nicola.strickland@imperial.nhs.uk)*

No radiologist is future proof. We can only become 'future proof' by actively making ourselves indispensable: by adding essential value to patient care and to our clinical colleagues. All radiologists are first trained as doctors. The observational and interpretative skills of a radiologist should add more value than those of a non-medical person attempting to perform the same work as a radiologist, because the radiologist can draw upon his/her deep understanding of anatomy, physiology and disease process to add value and pertinence to his/her report in the context of each particular clinical scenario. Our rigorous professional training in image observation and interpretation also adds value compared with our purely clinical colleagues who have not developed these skills to the same extent. We must keep ourselves at the forefront of knowledge concerning modern imaging technology (including imaging modalities, digital imaging informatics and software) so that it is we, as radiologists, who can best advise on its optimal application in current and future medical practice. Maintaining our clinical imaging expertise requires lifelong personal professional development. Keeping abreast of new understanding of disease and therapeutic developments in our own subspecialty organ system areas enables us to apply our imaging observations and interpretations with maximum relevance to patient management. We must foster a high on-site hospital profile so we are regarded as integral to the clinical team in multidisciplinary team meetings, presenting imaging at Staff Rounds, being available for discussion of imaging findings in complex clinical cases. Future-proofing must be earned and deserved!

Learning Objectives:

1. To understand that radiology is changing.
2. To learn about these changes.
3. To discuss possible the solutions.

A-090 16:23

Is subspecialisation the answer?

J.A. Reekers; *Amsterdam/NL (j.a.reekers@amc.uva.nl)*

Radiology has hugely expanded over the last decades and new imaging technology has been leading in clinical progress. Imaging now plays a central and crucial role in medicine. Not only has radiology broadened the medical landscape but also contributed to medical subspecialisation. General radiologists will quickly disappear and be replaced by subspecialised radiologists, just because it is not possible anymore to have a profound knowledge and overview on the whole spectrum of imaging options. To be able to provide high-level imaging service a radiologist now should subspecialise in one or two field of radiology. An important new aspect of radiology will be the direct communication and discussions with clinicians about patient-related diagnostic problems. The radiologist should be able to understand the problems of the clinicians. Also for that reason subspecialisation is unavoidable. The future radiologist should therefore leave his safe place behind the screen and go into the hospital and be visible. Remote reporting without direct contact to clinicians, daily round, patients' discussions and direct visibility will make radiologist redundant. Teleradiology is therefore not serving the true needs of the clinicians and will therefore be a threat to the future of radiology and clinical subspecialisation. Although subspecialisation is the future of radiology, this is not without risks. The general radiologist will disappear and for small hospitals this might create a problem.

Learning Objectives:

1. To understand the potential outcomes of subspecialisation.
2. To learn how subspecialisation can be of added value.
3. To appreciate that advantages of subspecialisation also come with risks.

A-091 16:41

Is teleradiology a threat to radiology?

A. Palkó; *Szeged/HU (palkoand@gmail.com)*

Teleradiology today is a fact of life and in itself is neither more nor less than a technical opportunity provided by the connectability and accessibility of local digital image and radiology informatics system (RIS) databases via secure virtual private networks (VPN). The dilemma to define it as a friend or a foe of radiologists arises depending on where, when and how we intend to apply it, and the overall function of future radiology (medical act versus commodity) is greatly influencing our attitude. All radiologists of the digital image era have experiences with reporting imaging examinations from a remote workstation and as long as this type of activity does not separate us from our patients and partner clinicians, we may consider it as a potential to better organise and to improve the quality of our professional performance. Using teleradiology as a tool for consultation, training, subspecialist support, or a solution for temporary shortage of personnel should not be rejected, however, using it to expel and continuously replace local radiologists, to reduce the reimbursement of local services, to separate radiology from its clinical environment and to degrade radiology to a commodity have to be fiercely confronted. Teleradiology cannot be eliminated from our routine in the future but we have to do our best to shape them according to the professional principles of radiology to provide the best service to our patients and to maintain the standards of good clinical practice of our specialty.

Learning Objectives:
1. To understand what teleradiology really is.
2. To learn how teleradiology might replace hospital radiology.
3. To appreciate the risks and benefits of teleradiology.

Author Disclosure:
A. Palkó: Advisory Board; Euromedic Intl.

A-092 16:59

Radiology training for the future

B. Ertl-Wagner; *Munich/DE (Birgit.Ertl-Wagner@med.uni-muenchen.de)*

Radiology as a medical specialty involves all aspects of medical imaging. The performance and reporting of radiological procedures and of image-guided interventions are a clinical act, in which only appropriately trained physicians should embark on. The European Training Curriculum for Radiology recommends a five-year training period, consisting of Level I training for the first three years followed by two years of a more flexible Level II training scheme with potential special interest rotations during the last two years. Its content is based on knowledge, skills, competences and attitudes. The European Diploma in Radiology (EDiR) can be undertaken after a five-year training period in radiology. In addition to the Level I and II curricula of the ETC, level III curricula for subspecialty training and an undergraduate (U level) curriculum are currently being developed. An important aim of the European Training Curriculum in Radiology is to harmonise training across Europe to prepare young radiologists for the future.

Learning Objectives:
1. To understand what the ESR training curriculum is.
2. To learn how this curriculum can be used for training radiologists in Europe.
3. To appreciate the value of uniform training and diploma accreditation.

17:17

Panel discussion: How do radiologists stay relevant and what is the role of the ESR?

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

Breast

RC 402

Radio-pathological correlation: more important than you thought

A-093 16:00

Chairman's introduction

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

Radiological findings need to be verified by pathological examination and good cooperation is essential for accurate correlation. New imaging techniques and new pathological methods create new challenges. The radiologist needs to be familiar with imaging methods for preoperative staging and understand the need for imaging-guided needle sampling and localisation for a tailored surgery particularly with regard to surgical guidelines for treating breast cancer. An appreciation of different imaging techniques for intraoperative specimen evaluation and orientation is important with good communication with the surgeons and pathologists. The panel will discuss how to enhance the interaction between radiologists and pathologists.

Author Disclosure:
F.J. Gilbert: Grant Recipient; Research grant from GE. Speaker; Bracco.

A-094 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, in order 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. For all of the mentioned tasks, MRI is the most powerful method. 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-095 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 in order to achieve an 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 peroperative 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 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.

A-096 16:51

C. Radiologist meets pathologist

B. Ingold-Heppner; *Berlin/DE (Barbara.Ingold-Heppner@charite.de)*

Pathology and radiology are the core disciplines of cancer diagnosis. Radiology identifies and localises the suspicious lesions and contributes to clinical staging, whereas pathology characterises the specific histological and molecular patterns of tumour samples. Therefore, both contribute essentially to diagnosis and prognosis as well as patient management and treatment decisions. However, their workflows or reporting systems usually have no direct linkage. Therefore, it is essential that there is sufficient knowledge of the other specialty, which helps to detect uncertainties and avoid misdiagnosis. At interdisciplinary tumour boards-an important quality assurance tool and cornerstone of quality breast care-information about clinical history, suspected diagnosis and sampling accuracy should be discussed. Correlation of breast imaging findings with pathology results is essential to avoid sampling errors and enable short-term follow-up or re-biopsy, if not concordant. Vice-versa, it is important to have a basic knowledge about the pathology workflow of handling breast cancer samples, with emphasis on the most frequent immunohistochemical stainings and molecular techniques. This course will walk through breast cancer cases of a typical radiology-pathology conference, showing examples, in which careful interaction has a direct impact on patient management.

Learning Objectives:
1. To understand what pathologists would always know from radiologists.
2. To learn about the most frequent breast-associated immunohistochemical markers and their interpretation.
3. To learn about the most applied techniques in pathology, including gene expression tests.

17:14

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

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

Chest

RC 404

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

A-097 16:00

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 need for defining patterns to improve radiological HRCT diagnoses.

Author Disclosure:

H. Prosch: Advisory Board; Boehringer, Novartis.

A-098 16:05

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, perilymphatic predominance is often associated with sarcoidosis. 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-099 16:28

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-100 16:51

C. GGO opacities and consolidation

I.E. Tyurin; *Moscow/RU*

Air space consolidation and ground glass opacity (GGO) represent the most frequent radiological patterns of lung diseases. Both patterns are non-specific and may be the result of numerous pathologic conditions. Both patterns may be focal and diffuse. Combination with other CT patterns (micronodules, reticulation, cavities) may be important. Air space consolidation as a focal disease may represent wild spectrum of pulmonary infections as well as aspiration disease and lung neoplasm, especially adenocarcinoma. Diffuse pattern include some specific interstitial lung diseases, such as cryptogenic organizing pneumonia, drug-inducted lung disease and some others. Diffuse ground glass opacities may represent acute lung infections, particularly, PCP and viral pneumonia, as well as pulmonary edema or eosinophilic pneumonia. Hypersensitivity pneumonitis and interstitial pneumonias except usual interstitial pneumonia are key points in patients with subacute/chronic disease. Clinical presentation and disease history have an outstanding importance in differential diagnosis of both patterns. In patients with acute disease (community acquired pneumonia, cardiac failure) chest radiography may be the only tool for diagnosis and follow-up. High-resolution CT and contrast-enhanced CT have some important advantages in comparison with chest radiography in differential diagnosis. CT can detect lung abnormalities in patients with clinical symptoms but normal chest radiography in some specific clinical conditions, such as dyspnea in interstitial lung disease and cancer history, or febrile neutropenia in immune-compromised patients. In general, integration of clinical and radiographic findings may narrow the differential diagnosis and improve the diagnostic accuracy.

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.

17:14

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

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

Head and Neck

RC 408

The orbit: you can't see what you haven't learnt

Moderator:
Ü.Y. Ayaz; Mersin/TR

A-101 16:00

A. Anatomy and commonly encountered postoperative findings

N. Hosten, P.-C. Krueger; *Greifswald/DE (hosten@uni-greifswald.de)*

Examination techniques like T1W images, use of contrast ages and the role of DWI are discussed initially in this talk. Emphasis is on T1W SE with good anatomical delineation. Role of fat-saturation for detection of CE is discussed. DWI has a role but may be difficult to acquire. Pathological processes of the eye and orbit are determined in their appearance by anatomy. This determination may be more or less prominent. The presentation aims at highlighting anatomical facts which influence the appearance of relevant tumours, inflammatory or traumatic processes. The orbit is structured into compartments by septa; pathology often starts in one compartment. To recognize which compartment is involved is often the key to differential diagnosis. After treatment, anatomy may be altered. Examples are shown and the value of CE is discussed.

Learning Objectives:

1. To become familiar with the examination technique according to the clinical presentation.
2. To learn about the anatomic compartments of the orbit.
3. To understand post-treatment imaging findings.

Author Disclosure:

N. Hosten: Author; Springer. Equipment Support Recipient; Siemens. Research/Grant Support; Bayer Schering. Shareholder; Siemens, BASF. Speaker; Bayer Schering.

A-102 16:30

B. Congenital and inflammatory disease

T.A. Ferreira; *Leiden/NL (T.A.Ferreira@lumc.nl)*

Orbital Congenital Lesions are uncommon. They can be diagnosed prenatally, at birth or later during childhood. Several orbital components can be involved. We will focus on congenital globe lesions (such as microphtalmia, staphyloma, coloboma, persistent hyperplastic primary vitreous); on developmental cysts such as epidermoids and dermoids; on vascular malformations such as lymphangioma and arteriovenous malformation; and on vascular tumours such as the capillary hemangioma. Orbital Inflammatory and infectious lesions are on the other hand common. We will focus in inflammatory and infectious lesions of some specific regions such as the globe, optic nerve and lacrimal gland and give some clues for their differentiation. We will also look at lesions that are multicompartimental or transspatial like pseudotumour, Graves disease, granulomatous diseases and infectious diseases. Orbital pseudotumour can involve any area of orbit, being one of the great mimickers in the orbit. If located in the orbital apex and/or cavernous sinus will be called Tolosa-Hunt syndrome. Among infections we will address orbital cellulitis in the immunocompetent patient mostly secondary to a sinusitis, but also in the immunodepressed patient where invasive funghal sinusitis is an important issue. And finally the role of the radiologist is also to assess both the orbital and intracranial complications of infection.

Learning Objectives:

1. To appreciate imaging findings in congenital globe and orbit disease.
2. To learn about inflammation and infection.
3. To become familiar with the complications and pathways of orbital infections.

A-103 17:00

C. Benign and malignant neoplastic tumours

W.S. Müller-Forell; *Mainz/DE (wibke.mueller-forell@unimedizin-mainz.de)*

As more than 100 pathologies can be seen in the orbit, a systematic approach is very important to come to the right diagnosis. The main and most helpful criteria of differential diagnosis of any orbital pathology is the knowledge of orbital anatomy followed by definition of the affected orbital compartment, as some tumours may only or preferentially involve specific orbital structures. The criteria of the most frequent masses of the globe, malignant melanoma and retinoblastoma are presented as well as those of cavernoma and lymphoma, the main representatives of intraconal tumours. There are numerous extraconal neoplasms, only few arising from the nasal sinuses, and only a little number of tumours of the optic nerve. The presentation will include the most frequent as well as rare, but important tumours (i.e. primary neuroblastoma of the orbit).

Learning Objectives:

1. To become acquainted with the differential diagnoses of orbital masses.
2. To learn an approach to differentiating orbital tumours.
3. To appreciate the typical imaging findings of benign and malignant orbital neoplasm.

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

Genitourinary

RC 407

Prostate imaging: how I do it

A-104 16:00

Chairman's introduction

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

Prostate cancer has become the most frequent cancer in men in the industrialised countries and is accordingly associated with high medical and socio-economic impact. The conventional way of establishing the diagnosis and making individual treatment decisions relies mainly on the PSA serum level and the pathologic Gleason score established from systematic TRUS biopsy samples. In prostate-confined cancers, radical prostatectomy has been proven to prolong survival, but avoidable morbidity and costs are feared due to overdiagnosis and overtreatment in a selective but so far unpredictable patient group. Dependent on tumour stage other treatment options are available, like Radiotherapy and focal treatments, e.g. termal ablation with laser or HIFU. In early stage cancer, even active surveillance without therapy is initially possible. Accordingly, patient stratification for choosing the best individual treatment becomes increasingly challenging. Multiparametric MR imaging has been proven to be remarkably advantageous in this context for detecting cancer, characterising its heterogeneity and aggressiveness, targeting the most aggressive part (the dominant intraprostatic lesion, DIL), guiding the biopsy needle to that area and evaluation of local tumour spreading. 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. This course will provide detailed knowledge of how multiparametric MR imaging can be used for the complex management of prostate cancer patients.

Session Objectives:

1. To learn how to perform and interpret multiparametric MRI for best possible detection and biologic characterisation of cancer foci within the prostate.
2. To become familiar with the current options of image-guided biopsy.
3. To understand the clinical relevance of multiparametric MRI for treatment decision-making during active surveillance and after initial therapy.

A-105 16:05

A. Detection and assessment of aggressiveness

P.A. Puech; *Lille/FR (puech@dicomworks.com)*

This presentation will teach you how to find prostate cancers within the gland by knowing their sites of predilection and their usual appearance at mp-MRI (T2+DWI+DCE). You will also learn avoiding common false-positive images (pitfalls), and understand why mp-MRI still has false negatives. MRI "biomarkers" of aggressiveness will be in detail to help you report this examination at its best.

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-106 16:28

B. Image-guided biopsy and staging

F. Cornud, C. Escourrou, N.B. Delongchamps; *Paris/FR (frcornud@imagerie-tourville.com)*

The accuracy of multiparametric MRI for localizing PCa makes possible a TRUS-MR image registration which consists of overlaying an MRI onto a TRUS image to target a prostate biopsy towards a suspicious area. Sensor-based registration consists of tracking in real time the TRUS probe with a magnetic device, achieving a global positioning system which overlays in real time prostate image on both modalities. Organ-based registration (Koelis) does not aim to track the TRUS probe, but the prostate itself to compute in a 3D acquisition the TRUS prostate shape, allowing for a registration with the corresponding 3D MRI shape. Pros and cons of each technique and the rationale for a targeted-biopsy only policy are discussed.The development of new treatments aiming at ablating the tumor itself while preserving the rest of the organ (focal therapy) has reinforced the need for an accurate local staging. Established T3 disease is excluded from focal therapy or active surveillance while confined tumors or tumors with a focal extracapsular extension are good candidates. Mp-MRI has thus the objective to differentiate these three types of tumors. Some sites of local extension (apex, base, midline) require a critical evaluation and will be detailed. A high SNR is mandatory to achieve this goal to acquire images with a thin slice thickness (2.5 mm). The use of 3 T platforms or of a rectal coil at 1.5 T is mandatory. The incremental value of functional MRI will be discussed.

Learning Objectives:

1. To understand the techniques of prostate biopsy.
2. To become familiar with the MR-guided and MR/TRUS fusion approach.
3. To learn about the optimal imaging protocol for the staging of prostate cancer.

A-107 16:51

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 < 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, as increase of tumor size and/or increasing Gleason score. With the improvement in MRI, it seems like multi-parametric MRI (mpMRI) can provide the information that is necessary to follow these patients after the initial work-up (PSA, DRE, TRUSI) upon which the decision on treatment arm is taken. Such an approach will reduce the number of biopsy 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 tumor 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.

17:14
Panel discussion: How can multiparametric MRI be implemented as clinical standard across multiple centres?

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

E³ - ECR Academies: Hybrid Imaging (basic)

E³ 418

Scanners and tracers

Moderator:
G. Antoch; Düsseldorf/DE

A-108 16:00

A. Hybrid imaging: what systems are available and how do they work
T. Beyer; *Vienna/AT (thomas.beyer@meduniwien.ac.at)*

Hybrid (aka combined, aka dual-modality) imaging has been around since the late 1990s for clinical applications. Today, three major tracks of hybrid clinical imaging are pursued commercially: PET/CT, SPECT/CT and PET/MR. Main objectives of hybrid imaging include the co-registration of complementary functional, metabolic and anatomical imaging, leveraging a diagnostic benefit from the synergistic combination of imaging information and, if possible, providing a logistical benefit to patients. This presentation will review briefly the origins of clinical hybrid imaging, introduce the main concepts of each of the three modalities above and outline main methodological and clinical issues.
Learning Objectives:
1. To understand the basic design of hybrid imaging systems.
2. To become familiar with scanner technology.
3. To learn about different approaches to PET attenuation correction.
Author Disclosure:
T. Beyer: Consultant; cmi-experts GmbH.

A-109 16:30

B. Radionuclides for PET/CT and MR/PET
M. Hacker; *Vienna/AT (marcus.hacker@meduniwien.ac.at)*

The clinical success of [18 F]-FDG PET has resulted in the wider acceptance of nuclear medicine imaging, and PET in particular, as a means to provide biological signals as an integral part of disease management. However, FDG PET has its limitations in specificity, as not only tumour cells show increased glucose metabolism, but also a wide variety of cells in the context of the cellular immune response to different kind of therapies. Real-time functional imaging like PET/CT or PET/MRI may improve and guide personalized treatment decision by selection of specific biomarkers for in vivo tissue characterisation of tumours and their microenvironment. These techniques enable a non-invasive serial assessment of the whole body for visualisation of multiple lesions or different tumour regions and, thus, a better understanding of tumour biology or its microenvironment in vivo. By selection of different imaging biomarkers, biological issues such as vascularity, cellularity, metabolism, proliferation, apoptosis or hypoxia can be visualised and quantified. It is the main purpose of the nuclear medicine community to make a wider range of biomarkers available for PET imaging by the development of small cyclotrons and the use of cassette systems or "kit-like", but GMP conform synthesis of PET tracers.
Learning Objectives:
1. To understand the principle of FDG in oncology.
2. To become familiar with non-FDG radionuclides and their indications.
3. To consolidate knowledge of tracer kinetics.

A-110 17:00

C. Radiopharmaceuticals for SPECT/CT
J.R. Ballinger; *London/UK (james.ballinger@gstt.nhs.uk)*

Radiopharmaceuticals are the basis of the functional image obtained with SPECT and co-registered with CT. SPECT uses radionuclides which emit gamma photons, the most commonly used radionuclides being technetium-99m (half life 6 h), iodine-123 (12 h) and indium-111 (66 h). The radionuclide should optimally have a photon energy of 100-300 keV; that is, high enough energy to get out of the body without too much attenuation or scattering, yet low enough to be efficiently detected. SPECT has limited temporal resolution due to the time required to acquire an image. Thus, SPECT requires a relatively static distribution of the tracer and cannot cope with rapid tracer kinetics. However, SPECT also depends on clearance of non-targeted radiotracer from the circulation and organs adjacent to the target prior to the image being acquired. Two of the largest areas of nuclear medicine are bone scintigraphy and myocardial perfusion imaging. Bone scanning uses Tc-99m phosphonate complexes which exchange at the surface of bone in proportion to metabolic activity. Myocardial perfusion studies use radiotracers which are trapped in the myocytes in proportion to regional perfusion, whether at rest or following exercise or pharmacological stress. Co-registration of SPECT and CT images provides a number of advantages, including anatomical localisation for greater confidence in diagnosis or for surgical guidance, for characterisation of lesions, or for evaluation of novel radiotracers. Hybrid SPECT/CT has relatively quickly become the modality of choice in many indications.
Learning Objectives:
1. To learn about the basic radionuclides for SPECT/CT.
2. To understand tracer kinetics in SPECT.
3. To appreciate SPECT tracers and their indications.

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

Interventional Radiology

RC 415

Basic principles of varicose vein diagnosis and endovascular treatment

Moderator:
D. Karnabatidis; Patras/GR

A-111 16:00

A. Diagnostic cross-sectional imaging
H. Hoppe; *Berne/CH (hanno.hoppe@gmail.com)*

Duplex ultrasound is an adequate modality diagnosing venous valvular incompetence. Preferably, multi-frequency 4- to 7-MHz 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. Furthermore, automated rapid inflation and deflation cuffs may be used for a more standardised type of stimulation. 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 including chronic changes in deep and superficial veins following deep venous thrombosis. Quantification of 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 frequencies for reliable noninvasive identification of post-thrombotic changes and venous outflow obstruction and for interventional 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 a state-of-the-art lower limb venous ultrasonograhic study.
3. To learn how to extrapolate ultrasonographic findings into endovascular treatment.

A-112 16:30

B. Saphenous vein ablation
A. Rampoldi; *Milan/IT (antonio.rampoldi@ospedaleniguarda.it)*

Surgical ligation and stripping of varicose veins has been the accepted treatment for almost a century but within the last decade, this has been challenged by endovenous thermal and chemical ablation methods. Ultrasound-guided foam sclerotherapy, endovenous laser ablation (EVLA) and radiofrequency (RFA) ablation have been consistently proving to be at least as beneficial as surgery, with less post-procedure morbidity and faster recovery. EVLA and RFA treatments cause thermal damage of the vein wall, resulting in destruction of the intima, subsequent collagen denaturation of the media and eventual fibrotic occlusion of the vein. Sclerotherapy uses chemical irritation to cause inflammation and subsequent fibrosis of the vein. These mini-invasive endovascular techniques are nowadays recognised internationally as an

acceptable standard for dedicated venous practice in a cost-effective environment. To perform the correct endovascular techniques, avoiding complications and reducing the relapse risk, it is crucial for an accurate pre-operative ecocolor Doppler study of the superficial and deep venous system to assess the anatomical and haemodynamical pattern of the patient. Although more long-term prospective comparative trials are desirable, many centers are now conducting studies testing with the latest endovenous device technologies to support the development of contemporary pathways of care.

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-113 17:00

C. Ultrasound guided sclerotherapy

J. Brookes; *London/UK (jocelyn.brookes@uclh.nhs.uk)*

Ultrasound guided sclerotherapy for truncal ablation of varicose veins is an alternative to endovenous thermal ablation as recommended in the NICE guidelines (UK) of July 2013. It was developed from liquid sclerotherapy treatment for branching varices and venous flares, an adjunct to varicose veins proceduresm, into a primary technique for the treatment of truncal reflux. The key development was the "foaming" of the sclerosant, limiting the flow from the target vein into the deep venous system, increasing the area and duration of wall contact. Sclerosant choice is limited by the ability to create stable foam and is chiefly between Sodium Tetradecyl Sulphate and Polidocanol. The method requires US-guided puncture of the refluxing truncal vein at its lowest point of reflux and the instillation of foamed sclerosant. To avoid excessive thrombosis, blood is drained from the target veins by elevating the leg. The progress of the sclerosant along the venous trunk is monitored in real-time by ultrasound, allowing control of the instilled flow according to foam bolus proximity to deep venous anastomoses i.e. perforators and saphenofemoral/popliteal junctions. Compression is applied and the technique requires no anaesthetic tumescence. Venous recanalisation, inflammatory pigmentation of the overlying skin and thrombophlebitis in superficial veins are the commonest adverse outcomes. Rare consequences of sclerosant escape into the deep venous system have also been reported. Although the primary closure rates are commonly less than those achieved by the endovenous thermal ablation techniques, the secondary closure and long-term clinical success rates are similar.

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 MB 2**

Cardiac

RC 403

Quantification of myocardial perfusion: which test is the best (PET, MRI, MDCT)?

Moderator:
M. Williams; Edinburgh/UK

A-114 16:00

A. PET for evaluation of perfusion, absolute myocardial blood flow and coronary flow reserve

S. Kajander; *Turku/FI (sami.kajander@gmail.com)*

Positron emission tomography, PET, provides tools to assess myocardial perfusion by non-invasively quantifying myocardial blood flow (MBF) and coronary flow reserve, CFR. These measures not only give invaluable data about the functional consequences of epicardial coronary artery lesions, but look deeper into the pathogenesis of coronary artery disease (CAD). Such information has proved particularly useful in multivessel CAD. Quantification of the actual flow enables one to detect impaired flow also in cases with uniformly reduced myocardial flow (balanced disease), often difficult to assess. Assessment of MBF provides not only a more accurate method to estimate the extent of flow-limiting epicardial disease, but also gives insight into various other conditions, sometimes subclinical, affecting myocardium in cases without significant epicardial disease. In early stages of atherosclerosis or microvascular dysfunction, absolute measures of MBF may be used as a surrogate marker of vascular health, and later to monitor lifestyle changes or therapeutic response. There are now several tracers available to evaluate myocardial perfusion and blood flow with PET. Of them, a cyclotron is needed for the production of 15O-water and 13N-ammonia whereas 82Rb is produced in a generator. Phase III studies of 18 F-flurpiridaz are currently undergoing. Practically, all new PET cameras are currently hybrid PET/CT devices with the added capability to visualise the coronary arteries in the same session. Such hybrid imaging further adds value by giving even more comprehensive information about the disease.

Learning Objectives:

1. To understand the molecular tracers used to asses myocardial perfusion by PET.
2. To appreciate the strengths and limitations of PET in evaluating myocardial perfusion.
3. To become familiar with its role in different clinical scenarios.

A-115 16:30

B. Stress perfusion CT imaging for the detection and quantification of relevant coronary stenosis

F. Bamberg; *Tübingen/DE (fabian.bamberg@uni-tuebingen.de)*

Besides the visualisation of coronary morphology, the major interest of cardiac computed tomography (CT) has shifted towards the assessment of myocardial perfusion to identify haemodynamically relevant coronary stenosis and myocardial perfusion defects. Currently, there are two different approaches to CT-based myocardial perfusion imaging: (a) one-time single-shot acquisitions and (b) dynamic, sequential acquisitions over a predefined period of time. Both are generally acquired under pharmacological stress. The presentation will cover basic concepts of both approaches and highlight protocol details and findings of these protocols. Also, emerging scientific results with respect to diagnostic accuracy, the detection of haemodynamically relevant coronary stenosis and prognostic implications will be discussed.

Learning Objectives:

1. To learn about protocol setup and interpretation of stress myocardial perfusion CT.
2. To understand the prognostic implications and therapeutic considerations of CT perfusion parameters.
3. To appreciate the value of stress myocardial perfusion CT for the detection of significant coronary stenosis.

Author Disclosure:

F. Bamberg: Speaker; Bayer Healthcare, Siemens Heathcare.

A-116 17:00

C. Analysis of myocardial perfusion using MRI

R. Manka; *Zurich/CH (robert.manka@usz.ch)*

Over the last decade, cardiovascular magnetic resonance imaging (CMR) is increasingly established as an important method in the diagnosis of coronary artery disease (CAD). Many studies have shown the equality or even superiority of CMR compared to other imaging modalities. CMR offers important advantages like the absence of ionising radiation, high spatial resolution, and the combination of perfusion imaging with tissue characterisation. The main clinical applications in the assessment of CAD include ventricular function, myocardial viability and perfusion. In clinical routine, myocardial perfusion is determined by contrast-enhanced first-pass perfusion techniques during pharmacological stress using coronary vasodilators (e.g. Adenosine) or β-adrenergic agents (e.g. Dobutamine). In many studies on the prognostic value of CMR in CAD assessment, normal stress perfusion CMR was highly predictive for a good prognosis, thus, able to identify patients in whom invasive angiography can be deferred safely.

Learning Objectives:

1. To learn about protocol setup and interpretation of stress myocardial perfusion CT.
2. To understand the role of CMR perfusion imaging as a tool for diagnosis and prognosis of coronary artery disease.
3. To discuss how CMR perfusion can be utilised in the assessment of microvascular disease.

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

Interventional Radiology

RC 409

Basic principles of percutaneous tumour ablation

A-117 16:00

Chairman's introduction

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

Chairman's introduction. Clinical experience of Image-guided ablation of small-size tumor started 20 years ago in the liver. Today ablation techniques have developed in various direction even if thermal ablation is the most common technologies including RFA, MWA and cryoablation. Ablation is nowadays used in liver, lung, kidney and bones but is not yet part of standard of care. Higher level proof of benefit are needed to include ablation in standard of care.

Author Disclosure:

T. de Baère: Advisory Board; Covidien. Consultant; Covidien, Terumo.

A-118 16:05

A. Thermal ablation with RF

V. Válek; *Brno/CZ (vlvalek@med.muni.cz)*

Radiofrequency devices use oscillating electrical current to produce resistive heating within the tissues surrounding an electrode, which is inserted in proximity to, or inside pathological lesions. Electrically charged particles are forced to move with high frequency from one pole to the other and frictional heat is produced. In monopolar systems the highest density of current is near the needle electrode, tissues farther away are heated primarily by thermal conduction. A second, dispersive electrode, when placed properly, has very low current density and has no or limited thermal effect on patient´s skin. In bipolar systems a second electrode, forming an electrical circuit, is inserted near the first electrode or is part of one bipolar electrode, resulting in the benefit of more homogenous energy deposition. Following energy application, tissues in areas surrounding the RF antennas undergo coagulation necrosis caused by temperatures between 60° and 100°. Due to moderate rate of temperature rise, the final shape of coagulation necrosis is significantly changed by blood flow (heat sink effect and perfusion-mediated cooling). Considering dual blood flow of the liver, lesion diameter of less than 35 mm is generally recommended for RF ablation by conventional techniques. On the other hand, RF is technology which is well-understood, widespread, and familiar to interventional radiologists, thus leading to safe procedures and reliable results. The most commonly treated populations are patients with colon cancer liver metastases and patients with small HCC, but also instances of lung, renal and bone radiofrequency ablations is rising.

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.

A-119 16:23

B. Microwave ablation: what is the difference?

P.L. Pereira; *Heilbronn/DE*

The field of image-guided interventional tumour therapies 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 tumors 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. 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 tumors closed to large vessels, tumours with cystic changes and tumors 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; Terumo, BTG, Medtronic, Bayer, Siemens, BTG. Consultant; Terumo, BTG, Medtronic, Bayer, BTG, Angiodynamics, Celonova. Equipment Support Recipient; Siemens, Terumo, Angiodynamics, Covidien, Amica HS. Grant Recipient; BTG, Siemens, Celon Olympus, celonova. Investigator; BTG, Terumo, Siemens. Speaker; BTG, Terumo, Angiodynamics, Celonova, Microsulis.

A-120 16:41

C. Cryoablation: ice can be better than heat

D.J. Breen; *Southampton/UK (David.Breen@uhs.nhs.uk)*

Percutaneous tumour ablation must employ a robust and sealable ablative energy that is appropriate to the organ environment in which it is being utilised. Cryoablation achieves tumour destruction by the induction of a "therapeutic" ice-ball within perfused tissues. The cell-lethal isotherm is usually taken to lie at ~-30C. The clear benefit of cryoablation over heat-based devices is the gradual induction of an iceball which is readily resolved by all current imaging modalities, and in particular, CT and MR. The phase change to ice can be controlled by the number of cryoprobes placed and the flow of cryogenic gas, usually argon. This also permits the operator to "morph" (or shape) the iceball in a timely manner during the procedure. All these features permit careful image-guided titration of the cryoablation treatment which far exceeds the ability to control the heat-based techniques during the course of the procedure. There is also largely anecdotal evidence to suggest that cryoablation induces less post-procedural pain. In addition, the beneficial immuno-regulatory effects of in situ tumour ablation have been cited by a number of authors. Cryoablation appears to be particularly effective at enhancing the presentation of cancer antigens which in turn stimulates natural killer and/or CD-8 cytotoxic T-cells. This may prove beneficial in stimulating a specific, systemic anti-cancer response. Cryoablation appears particularly suited to renal, bone and possibly lung tumour ablation but its large-volume application in the liver has been limited by a reported 1% incidence of 'cryoshock', which can induce multi-organ failure.

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-121 16:59

D. Irreversible electroporation: principles, technique and clinical applications

A. Nilsson; *Uppsala/SE (anders.nilsson@akademiska.se)*

Irreversible electroporation (IRE) is a new method for tumour ablation that does not involve heat, as in to RFA or microwaves, or cold as in cryoablation. Instead, electric pulses of a high voltage but relatively low energy are sent between needle-shaped electrodes placed around the tumour. A minimum of 2 and up to 6 electrodes may be used for each ablation. The electric pulses will create small pores in the cell membranes and if the current is set correctly, these pores will remain open even after the treatment pulses have stopped. This will cause cell death, apoptosis, in the area chosen by the needle placement. However, contrary to other ablation techniques and because there is no heat involved, the tissue structure remains unchanged and e.g. the collagen skeleton of a vessel remains undamaged and the vessel stays open. Thus tumours growing around critical structures like bile ducts, blood vessels etc. can be treated without any effect other than cell death, killing the tumour but leaving the tissue structure intact. This potentially means that primary tumours/metastases that cannot be surgically removed, treated with radiation or ablated with RFA or microwaves still can be accessed in an attempt to make the patient tumour-free.

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 MB 4**

Emergency Radiology

RC 417

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

Moderator:
S. Wirth; Munich/DE

A-122 16:00

A. Children
V. Miele; *Rome/IT (vmiele@sirm.org)*

Main causes of children's access to the emergency department are, in order of frequency: abdominal or pelvic pain, intestinal obstruction, vomiting, diarrhoea, fever, abnormal crying, masses and/or neoplasms; among the respiratory causes, dyspnea is rare, but should be considered with great caution, especially in early childhood. Imaging, therefore, plays a very important role in the diagnosis. In planning the diagnostic steps, we must always keep in mind the need to avoid as much as possible the radiation exposure of the child, in accordance with the ALARA principles. So, ultrasound (US) should always be considered as the first step in the study of the abdomen. Even conventional radiography (CR) still plays a role in many pathological conditions, especially in respiratory diseases and in the acute abdomen in the newborn, when congenital anomalies predominate. CT should be reserved instead in very selected cases, when the results of the RX and US are inconclusive or nondiagnostic. In any case, indiscriminate use of CT as the first diagnostic technique should be avoided. The main gastroenteric system diseases to be studied, with reference to the most significant diagnostic pictures, are: acute appendicitis and other common causes of intestinal obstruction, such as intussusception, volvulus, complications of Meckel's diverticulum; among the genito-urinary tract diseases pyonephrosis, renal vein thrombosis, adrenal haemorrhage, torsion/rupture of ovarian cyst, hydrometrocolpos. The radiologist must be familiar with the main diagnostic findings that are useful to guide therapeutic decisions, and should consider the signs that aid in the differential diagnosis.
Learning Objectives:
1. To be 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 be aware of the impact of imaging findings on patient management.

A-123 16:30

B. Pregnant patients
H. Alkadhi; *Zurich/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.
Learning Objectives:
1. To be 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-124 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 6.1 times more likely to be classified as a comprehensive ED level of service. 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 for the time factor; one of the most important factors 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 be 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 MB 5**

Paediatric

RC 412

Imaging of foetus and infant

Moderator:
D. Prayer; Vienna/AT

A-125 16:00

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. development characterise. 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 characterize 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 at various gestational weeks.
2. To highlight the complementary role of brain MRI to prenatal ultrasound for various indications, with a particular focus on the problem of ventriculomegaly.
3. To familiarise oneself with the MRI features of the main congenital malformations and clastic injury affecting the foetal brain.

A-126 16:30

B. Foetal body imaging
M. Cassart; *Brussels/BE (mcassart@ulb.ac.be)*

Foetal disease encompasses a wide range of conditions that can involve nearly every structure encountered in the foetal body. US and MRI are complementary imaging tools that help in the diagnosis and characterisation of these anomalies. US is the first-line imaging modality as used in routine follow-up of pregnancies. MRI helps for better characterisation of an anomaly discovered on US examination and therefore, allows the establishment of a more precise diagnosis and prognosis. Various developmental anomalies may be encountered including malformations of the thoraco-abdominal wall, abnormal development of the lungs (pulmonary malformations) or the digestive tract (duplication, atresia, perforation, etc). Tumours or pseudo-tumours can

also affect almost all the thoraco-abdominal organs, more frequently, the liver, the peritoneum and retroperitoneum (adrenal glands) and the genital organs. In the lung tumours, the differential diagnosis can most often be made prenatally between adenomatoid malformation, sequestration or bronchial tree malformation. In the abdomen, imaging also helps in defining the level of a digestive tract occlusion or in the characterisation of a suspected anorectal/cloacal malformation. Foetal imaging also better defines the exact topography and nature of a tumour (hepatic tumours, retroperitoneal tumours, etc). or of an abdominal cystic mass (choledocal cyst, mesenteric cyst, duplication, ovarian cyst, etc). thanks to the information obtained on the basis of topography and content. Accurate prenatal diagnosis is crucial for optimal parents counseling and management of the pregnancy and newborn.

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-127 17:00

C. Foetal and neonatal urinary tract imaging

C. Garel; *Paris/FR (catherine.garel@trs.aphp.fr)*

The urinary tract undergoes changes throughout pregnancy. The cortical echogenicity is compared with the liver and the spleen. The cortex is respectively hyperechoic, isoechoic and slightly hypoechoic during the three trimesters of pregnancy and at birth. The corticomedullary differentiation is visible from 18 weeks of gestation. The length of the kidney progressively increases throughout pregnancy and is approximately, equivalent to 1.1 x number of weeks of gestation. Obstruction may involve the uretero-pelvic or ureterovesical junctions. Obstruction is responsible for dilatation of the renal cavities with possible impact on the renal parenchyma, reduction in thickness, hyperechogenicity and decreased corticomedullary differentiation. Reflux may generate a similar pattern and as both phenomenons may be associated, they may be difficult to differentiate. Particularly, in case of a duplex kidney, ectopic insertion of the ureter of the upper moiety must be carefully searched for. It may be associated with a multicystic dysplastic kidney, which may also result from marked and early obstruction. Identification of a hyperechoic kidney during fetal life or at birth needs to clarify some points: uni or bilaterality, size of the kidneys and the cavities, corticomedullary differentiation, involvement of the cortex or the pyramids and presence of cysts. Unilateral echogenic kidneys are usually small, poorly or not differentiated and are dysplastic kidneys. Bilateral echogenic kidneys may be enlarged and are usually observed in the setting of cystic diseases, the most common causes being TCF2 mutations and dominant and recessive polycystic kidney diseases.

Learning Objectives:

1. To learn about the changing appearance of the urinary tract throughout pregnancy and at birth.
2. To become familiar with the main causes of obstruction and their possible impact on the kidneys.
3. To learn about the main causes of hyperechoic kidneys.

Thursday, March 5

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

E³ - ECR Academies: Interactive Teaching Sessions

E³ 521

What to look for after treatment of lung cancer

A-128 08:30

A. Imaging of surgically treated lung cancer

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

About 1/4 of early post-operative complications are life-threatening and require invasive surgical, radiologic, or endoscopic treatment. Immediate detection might be vital, therefore, radiologists should be aware where to look at besides of the typical "lines and wires" assessment. Also the normal and expected change in anatomy has to be known to enable radiologists to differentiate these from unwanted development including tumour recurrence. Therefore, sequences of chest x-ray, CT, and MRI are shown to demonstrate early, intermediate, and late findings after lung surgery and during follow-up. Adequate imaging settings with their typical "problem-zones" after surgery are discussed and hints for long-term follow-up are provided.

Learning Objectives:

1. To appreciate the complications after surgery for lung cancer.
2. To understand the anatomic changes which occur after surgery for lung cancer.

Author Disclosure:

C.P. Heussel: Consultant; Schering-Plough, Pfizer, Basilea, Boehringer Ingelheim, Novartis, Roche, Astellas, Gilead, MSD, Lilly, Intermune, Fresenius. 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; AstraZeneca, Lilly, Roche, MSD, Pfizer, Bracco, MEDA Pharma, Intermune, Chiesi, Siemens, Covidien, Pierre Fabre, Boehringer Ingelheim, Grifols, Novartis, Gilead, Essex, Schering-Plough.

A-129 09:15

B. Imaging of non-surgical treatment of lung cancer

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

Lung cancer is the leading cause of death related to cancer. Most patients are inoperable as they present with advanced stage disease or even a localized tumour associated with poor general condition, limited cardiopulmonary function, or a too high surgical risk. According to the stage of the disease, chemotherapy, radiotherapy and percutaneous ablation therapies are the current therapeutic options for inoperable patients. It is important that radiologists are familiar with the various response and complication imaging patterns related to those treatments. The timeline modifications after radiation therapy and percutaneous ablation will be reviewed. This presentation will summarize the current evidence and how to detect early recurrences after those treatments.

Learning Objectives:

1. To learn about sequelae after radiotherapy.
2. To learn about sequential changes after percutaneous ablation of lung tumours.

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

Abdominal Viscera

RC 501

The many faces of benign liver lesions

Moderator:
L. Grenacher; Heidelberg/DE

A-130 08:30

A. Vascular

M. Karcaaltincaba; *Ankara/TR (musturayk@yahoo.com)*

Benign hypervascular focal liver lesions include haemangioma, focal nodular hyperplasia, hepatic adenoma, angiomyolipoma, nodular regenerative hyperplasia and haemangioendothelioma. Tips for differentiation of benign and malignant hypervascular liver lesions will be presented. US, CT and MRI findings will be summarised with emphasis on typical and atypical findings. Liver imaging is important for noninvasive diagnosis of hypervascular benign liver lesions and confidence in diagnosis can obviate biopsy in routine clinical practice.

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-131 09:00

B. Cystic-Biliary

G. Brancatelli; *Palermo/IT (gbranca@yahoo.com)*

Cystic liver lesions can be classified based on their nature as benign and malignant. In the benign category are, among others, developmental and infectious/inflammatory cysts, while neoplastic cyst can be subdivided into primary and secondary. Developmental cysts originate from abnormal ductal plate malformation and consist of hepatic (bile duct) cyst, bile duct hamartomas, Caroli's disease and polycystic liver disease. Infectious/inflammatory cysts include, among others, abscesses (pyogenic and amoebic) and hydatid cysts. Primitive neoplastic cystic lesions are cystoadenoma and cystoadenocarcinoma. Secondary lesions can originate mostly from mucinous tumours such as colon and ovary. The role of cross-sectional imaging in the detection and characterisation of these entities will be discussed with an emphasis on the differential diagnosis with CT and MR Imaging.

Learning Objectives:

1. To understand the features of congenital and infectious cystic liver lesions.
2. To learn how to differentiate between benign and malignant cystic lesions.

A-132 09:30

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)). Cirrhotic regeneration and neoplasia exceed the scope of this lecture. FNH and HCA comprise the vast majority of benign solid lesions in noncirrhotic liver. Diagnosing these entities is important to differentiate them from malignant lesions with more onerous implications. HCA, while a benign lesion, can be the cause of symptoms or have complications such as bleeding or malignant degeneration that requires their diagnosis and treatment, unlike FNH. While small FNH and HCA often appear similar, larger lesions often can be differentiated based on imaging criteria (FNH: lobular shape, homogeneous enhancement rapidly becoming isodense/intense with liver and central fibrous scar; HCA: heterogeneous enhancement, some with delayed washout and some with retention, mosaic appearance often with surrounding capsule). Small homogeneous FNH/HCA are difficult to differentiate at imaging but can usually be differentiated using liver-specific hepatobiliary MR contrast agents, with substantial retention on delay imaging in FNH, and predominate washout in HCA. Genotyping and phenotyping have become important tools for HCA management with strong correlations in predicting lesions at risk for bleeding and for malignant degeneration. MRI in particular 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.

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.

Author Disclosure:

R.L. Baron: Speaker; Philips HealthCare past speaker support.

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

Special Focus Session

SF 5
Advanced applications in ultrasound

A-133 08:30
Chairman's introduction
T. Fischer; *Berlin/DE (thom.fischer@charite.de)*

Various new sonographic techniques have recently become available to improve image quality, contrast, and image evaluation. Important new approaches are Elastography, ultrafast Doppler and Contrast-enhanced US (CEUS). Tissue elasticity is an important biological property that is affected by aging and disease processes such as infections or malignant tumours. Elasticity refers to the amount of pressure that needs to be applied to a tissue to achieve elastic deformity, more specifically the ratio of the pressure applied relative to the resulting elongation. Since malignant breast lesions are typically stiffer than normal tissue, determination of tissue elasticities is an interesting new approach for differentiating focal lesions detected by ultrasound. New ultrafast Doppler techniques, effectively separates flow signals from overlaying tissue motion artefacts preserving even the subtlest low-flow components with unmatched detail and definition. The real-time Application capability allows the system to identify and remove global motion signals in real-time while preserving subtle low-flow components. CEUS has been used to examine the liver, the kidneys and the pancreas. The quantitative evaluation uses time-intensity curves (TIC) to evaluate focal liver perfusion in the early phase after antiangiogenetic treatment. In addition, we use ultrasound contrast agents to characterize focal pancreatic lesions, to evaluate lymph nodes, and to monitor neoadjuvant therapy as well as for molecular imaging. The aim of this session is to discuss state-of-the-art ultrasound techniques and applications in daily practice.
Session Objectives:
1. To understand the physics and clinical potential of advanced ultrasound applications such as CEUS, shear wave elastography or ultrafast Doppler.
2. To learn in detail about the clinical use of CEUS in pancreatic diseases, molecular imaging and antiangiogenic treatment.
3. To appreciate the potential clinical utility of shear wave elastography and new Doppler techniques.

A-134 08:35
Contrast-enhanced ultrasound of the pancreas
M. D'Onofrio; *Verona/IT (mirko.donofrio@univr.it)*

Ultrasound is often the first examination in patients with abdominal diseases. The introduction of contrast-enhanced ultrasonography (CEUS) has led to great improvements in the diagnostic capabilities of ultrasound (US). CEUS is less-expensive compared to CT or MRI and less-invasive compared to endoscopic ultrasound. CEUS is able to improve the accuracy of US, allowing a better characterisation of pancreatic lesions already visible at US. The most common pancreatic masses can be differentiated at CEUS. Ductal adenocarcinoma: poor enhancement, appearing hypoechoic to the adjacent normally enhancing pancreatic tissue. CEUS improves characterisation and loco-regional and hepatic staging. Endocrine tumours: high enhancement, appearing hypechoic to the adjacent normally enhancing pancreatic tissue. Mass-forming pancreatitis: parenchymographic enhancement, meaning nearly to isovascular so more or less isoechoic mass with respect to pancreatic parenchyma. Pseudocyst: no intralesional enhancement at CEUS. Mucinous cystc neoplasm: CEUS helps in the identification of parietal nodules and septa by demonstrating the enhancement of these intratumoural structures, essential for the differential diagnosis with pseudocysts. The greater accuracy of CEUS compared to baseline US can immediately result in better diagnostic workup and treatment planning. The immediate use of CEUS in the workup of a pancreatic lesion detected by means of ultrasound may be therefore proposed to save time (i.e. faster diagnosis of ductal adenocarcinoma). As a result, the first recommendation in the 2011 European guidelines for pancreatic application of CEUS IS: focal pancreatic lesions identified with US can be studied with CEUS to improve the characterisation of ductal adenocarcinoma.

Learning Objectives:
1. To learn the appropriate protocols and settings for contrast-enhanced ultrasound (CEUS) examination of the pancreas.
2. To describe the technique for CEUS of the pancreas.
3. To detail the clinical use of CEUS in the evaluation of pancreatic pathologies.
4. To know the best indications for CEUS in the main pancreatic diseases.
5. To describe CEUS findings for the characterisation of focal pancreatic masses.
6. To compare CEUS to CT and MRI findings in studying pancreatic pathologies.
7. To discuss the possible different role of CEUS in the diagnostic work-up of focal pancreatic lesions.
Author Disclosure:
M. D'Onofrio: Advisory Board; Siemens. Consultant; Bracco, Siemens. Speaker; Bracco, Siemens.

A-135 08:53
Molecular ultrasound and dynamic contrast-enhanced US for antiangiogenic therapy monitoring
N. Lassau; *Villejuif/FR (nathalie.lassau@gustaveroussy.fr)*

Contrast-enhanced Ultrasound (CEUS) has proved to improve the detection and characterisation of pathologies compared to conventional ultrasound, CT and MRI in a number of indications. Ultrasound contrast agents (UCA), which are purely intravascular, do not show any interstitial diffusion or glomerular filtration like iodinated complexes or Gadolinium chelates. Dynamic Contrast-Enhanced Ultrasound (DCE-US) allows to display the enhancement of a lesion with a high frame-rate after bolus or infusion administration of UCA and to compare enhancement profiles between normal and abnormal tissue. Quantification of DCE-US is useful to quantify tumour enhancement and to limit intra- and interobserver variability. DCE-US has shown to be of interest after antiangiogenic therapies as it allows an earlier evaluation of tumour response than usually done with CT and MRI, which remain mainly based on the RECIST criteria. In clinical applications, several mono-centric and multi-centric DCE-US studies evaluating anti-angiogenic drugs have demonstrated the relevance of this technic with a significant correlation with PFS and OS in different type of tumours (HCC, metastatic RCC, colon cancer, breast cancer, GIST and melanoma). two consensus papers have been recently published by EFSUMB and AIUM/WFSUMB (European and World Federation of the Societies for Ultrasound in Medicine and Biology), providing recommendations in DCE-US. The development of targeted contrast agents open the area of molecular ultrasound. An overview on clinical potential of molecular imaging will be proposed including new markers with ultrasound.
Learning Objectives:
1. To understand physics and clinical potential of molecular imaging and new markers with ultrasound.
2. To understand technologies of dynamic contrast-enhanced ultrasound (DCEUS) and ways of quantification.
3. To describe the protocols and results of a large multicentre study performed with quantitative DCEUS.
4. To discuss application in routine clinical practice and future outlook.

A-136 09:11
State-of-the-art ultrasound technologies: elastography and microvascular imaging - are they useful?
A.K.P. Lim; *London/UK (a.lim@imperial.ac.uk)*

There have been significant advances in Ultrasound Elastography technology where the different methodologies of Strain and Shearwave measurements will be discussed. These techniques have been been shown to be useful in distinguishing benign from malignant breast masses, such that it is now included in the BiRads lexicon. One other significant clinical utility is with the characterisation of chronic diffuse liver disease where a non-invasive method for quantifying the degree of liver fibrosis has proved invaluable. The technology does vary across manufacturers and there has been a drive by QIBA to maintain uniform standards of measurement. Other areas where elastography has shown promise is in distinguishing malignant from benign thyroid nodules and many groups have also been researching its clinical utility in tendinopathic assessment. One other area which has recently seen a significant improvement is Doppler where the latest development by Toshiba Medical Systems, Superb Microvascular Imaging (SMI), allows imaging of the microvasculature employing an advanced Doppler algorithm without the need for contrast enhancement. The sensitivity and finer detail of the microvessels which can be visualised appears significantly better when compared with Power Doppler, and rivals that depicted with contrast enhancement. Early data, shows that this technology has been beneficial in detecting low-grade inflammation in musculoskeletal imaging and with lower frequencies can detect the presence of a blood supply to a tumour without the need for contrast administration. Its potential clinical applications will be illustrated. There are however, pitfalls to these advancing technologies which will also be outlined.

Learning Objectives:
1. To understand the physics and technologies of elastography and microvascular imaging.
2. To describe the differing elastography techniques and microvascular imaging.
3. To detail the potential clinical utility of elastography and microvascular imaging.
4. To discuss the evidence for the use of these technologies in routine clinical practice.

Author Disclosure:
A.K.P. Lim: Advisory Board; Toshiba Medical Systems.

A-137 09:29

ShearWave elastography, ultrafast Doppler and image fusion

J.-M. Correas; *Paris/FR (jean-michel.correas@nck.aphp.fr)*

Recent technical advances in UltraSonography (US), such as ShearWave Elastography (SWE), UltraFast and UltraSensitive Doppler (UFD and USD) and Image Fusion are changing the diagnostic pathway and improving US diagnosis performance, by adding novel information and enabling multi-parametric/multi-modality imaging. Together with Contrast-Enhanced UltraSound (CEUS), US has become a multi-parametric imaging modality that combines not only anatomical 2D and 3D information, but also novel workflow and functional information such as blood flow micro-vascularisation with advanced Doppler techniques (UFD and USD) and tissue stiffness assessment with SWE. SWE provides absolute quantitative tissue elasticity measurements to visualise organ stiffness changes in the case of diffuse disease progression (such as liver fibrosis) or brings a new parameter for focal lesion detection and characterisation (such as breast, thyroid, and liver masses). Advanced Doppler techniques such as UFD and USD are bringing Doppler imaging to a much higher level of sensitivity and quantification. These breakthroughs enable, at the same time, micro-vascular blood flow architecture visualisation and parametric blood flow imaging. Today, premium US systems can also retrieve and display CT and MRI volumes and fuse them with real-time US images. This new functionality enables multi-parametric/multimodality imaging, which improves diagnosis performance and provides better guidance for interventional procedures, including biopsy, drainage and percutaneous tumour ablation.

Learning Objectives:
1. To understand the physics and technologies of shearwave elastography and ultrafast Doppler.
2. To describe the differing elastography techniques.
3. To detail the potential clinical utility of elastography and image fusion.
4. To discuss the evidence for the use of these technologies in routine clinical practice.

Author Disclosure:
J.-M. Correas: Advisory Board; Philips US. Equipment Support Recipient; Toshiba MS, SuperSonic Imagine. Investigator; Bracco, Guerbet SA. Research/Grant Support; Fondation de l'Avenir. Speaker; Bracco SA, General Electric, SuperSonic Imagine, Philips US, Toshiba MS.

09:47
Panel discussion: How could these technologies improve clinical routine?

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

Joint Session of ESR and EFSUMB

Advances in diagnostic ultrasound: better results through integration

Moderators:
G. Mostbeck; Vienna/AT
P.S. Sidhu; London/UK

A-138 08:30

Diagnosis, characterisation and staging of tumours of the female pelvis

A.G. Rockall[1], D. DeFriend[2]; [1]*London/UK*, [2]*Abbotskerswell/UK*
(a.rockall@imperial.ac.uk)

Despite new imaging technologies, transvaginal ultrasound remains the primary imaging modality to detect and characterise adnexal masses. Differentiating benign from malignant ovarian tumours is important to help inform which patients require surgery, the surgical approach and need for subspecialist expertise. Most adnexal masses are benign and most can be adequately characterised by ultrasound. The ultrasound features that help make a confident diagnosis of a benign lesion will be discussed and the features that are most useful to predict malignancy will be emphasised. Features concerning for malignancy include thick, vascularised septa, papillary nodules and solid elements, with solid components being the most important predictor of malignancy. Ultrasound findings are usually considered in conjunction with other factors including age, menopausal status and tumour markers (serum CA 125 levels) to guide management. Various scoring systems have been used to try and improve diagnostic performance of transvaginal ultrasound but subjective assessment by an experienced ultrasound practitioner remains superior. "Simple" ultrasound rules developed by the International Ovarian Tumour Analysis (IOTA) group may be helpful to enable less experienced examiners to reliably distinguish benign and malignant masses in most cases. Where findings remain indeterminate on ultrasound, further imaging may be required. MRI is established as a second-line imaging test that has a high specificity in the characterisation of sonographically indeterminate adnexal masses. Conventional T2, T1 and T1 fat saturated images provide morphological information and determine the presence of fat or blood. Perfusion and diffusion weighted images allow further characterisation of solid parts of a complex mass.

Learning Objectives:
1. To appreciate the respective roles of US, MR and CT in patients with ovarian and uterine tumours.
2. To understand when US can be considered a definitive examination and when CT and/or MR are needed to characterise pelvic masses.
3. To recognise when a US examination can be useful after MR and/or CT identification of a tumour of the female pelvis.

A-139 09:00

Diagnosis, characterisation and staging of renal tumours

S. Freeman[1], N. Grenier[2]; [1]*Plymouth/UK*, [2]*Bordeaux/FR*
(simonfreeman@nhs.net)

Detection of a renal mass is an everyday occurrence for most radiologists. The majority are simple renal cysts can be confidently characterised, but others are of more concern. Most small renal cancers are now identified as incidental findings on imaging studies for non-renal indications; in this situation, general abdominal cross-sectional imaging protocols are unlikely to be suitable for definitive characterisation and further imaging will be required. Cystic masses identified on ultrasound that are not simple or minimally complex cysts require additional investigation by CT to characterise them according to the Bosniak classification. When questionable, MRI may be useful and contrast-enhanced US can add further information when it remains equivocal CT and/or MRI. Solid renal masses detected by ultrasound also require CT to confirm diagnosis, to characterise them as either angiomyolipoma or indeterminate solid tumour and to stage the disease. Multiparametric MRI is now able to help for this characterisation and in a few cases of venous invasion, for staging. Percutaneous biopsy will be required when determining the nature of an indeterminate mass could have an impact on its management. When a mass remains indeterminate as solid or cystic on CT/MRI (equivocal enhancement), contrast-enhanced ultrasound is usually useful. Planning nephron sparing surgery may also require CT or MRI for global multiplanar evaluation. Finally, follow-up is generally based on CT or MRI according to renal function, not on ultrasound. This lecture will describe the complementary strengths and limits of each technique for each purpose.

Learning Objectives:
1. To appreciate the respective roles of US, MR and CT in patients with renal tumours.
2 To understand when US can be considered a definitive examination and when CT and/or MR are needed to characterise renal masses.
3. To recognise when a US examination can be useful after MR and/or CT identification of a tumour of the kidney.

A-140 09:30

Diagnosis, characterisation and staging of liver tumours

H.-P. Weskott[1], A. Ba-Ssalamah[2]; [1]*Hannover/DE*, [2]*Vienna/AT*
(weskottHP@t-online.de)

Advantages of CEUS are its high temporal, contrast and spatial resolution, especially when using novel pulse inversion techniques. No radiation, iodine or renal side effects characterise US contrast agents. Valuable criteria for characterising focal liver lesions are imaging the tumour vessel course, its architecture and density, displaying intra and peri-tumoural shunts and to follow the wash in and out behaviour. The late phase is best suited to discriminate between benign and malignant lesions and the most sensitive phase for detecting liver metastases down to 3 mm. Limitations are unfavourable scanning conditions, like highly attenuating liver tissue. Under favourable scanning conditions, CEUS and CT show no significant differences in the detection rate of liver metastases. Due to its high temporal resolution, breezing artefacts or tissue motion-like cardiac pulsation are less hindering compared to other modes. The vascular patterns and contrast kinetics depend on their differentiation; Most HCC show an early arterial enhancement, in the majority with a centripetal filling. Only a small number of small HCC remain iso-enhancing in all contrast phases and thus, behave like regenerative or dysplastic nodules in a cirrhotic liver. Low-differentiated HCC will wash-out quicker than high-differentiated ones; Sonozoid™ -available in Japan and

South-Korea- is more stable in the acoustic field and will be taken up by Kupffer cell. Especially, highly differentiated small HCC may benefit from using Sonazoid™. CEUS helps in evaluating the effect of chemotherapy at an early time of treatment and is recommended for monitoring follow-up after ablation therapy.

Learning Objectives:

1. To appreciate the respective roles of US, MR and CT in patients with liver tumours.
2. To understand when US can be considered a definitive examination and when CT and/or MR are needed to characterise hepatic masses.
3. To recognise when a US examination can be useful after MR and/or CT identification of a tumour of the liver.

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

Physics in Radiology

RC 513

Artefacts and pitfalls in tomography

Moderator:
J. Damilakis; Iraklion/GR

A-141 08:30

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 learn about aliasing, beam hardening, effects of metal and of motion, photon starvation, sampling artefacts, and linear and non-linear partial volume effects.
3. To get an idea of the most important correction methods.
4. To find out what artefact correction techniques are actually provided by the CT vendors in their systems.

A-142 09:00

B. PET/CT

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

In this presentation, we will discuss origins of imaging pitfalls in clinical PET/CT. Causes and solutions to most common image distortions will be reviewed interactively with the audience (i.e. presenting a case, providing multiple-choice questions, discussing responses and providing explanations for the causes). Solutions will be provided that are applicable to routine PET/CT imaging.

Learning Objectives:

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

Author Disclosure:
T. Beyer: Consultant; cmi-experts GmbH.

A-143 09:30

C. MR/PET

H.H. Quick; *Essen/DE (Harald.Quick@uni-due.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 the MR and the 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 frequent artefacts in MR and PET imaging.
2. To understand the physical origin of and methods to resolve artefacts in MR/PET imaging.
3. To understand the interrelation of MR artefacts and bias in PET quantification in MR/PET imaging.

Author Disclosure:
H.H. Quick: Research/Grant Support; Siemens Healthcare Sector.

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

E³ - ECR Academies: Image-Guided Interventions in Oncology

E³ 519

Hepatic primary tumours: 'prime time' for interventional radiologists?

A-144 08:30

Chairman's introduction

M. Bezzi; *Rome/IT (mario.bezzi@uniroma1.it)*

The role of interventional radiology in the treatment of HCC is well established and several minimally invasive treatment options are available. Local ablation therapies are currently advocated for early-stage HCC that is unresectable because of co-morbidities, the need to preserve liver function, or refusal of resection. Among the various local ablation therapies, the most commonly used modalities include radiofrequency ablation and microwave ablation. Image-guided intraarterial therapies also play an important role in the treatment of patients with intermediate HCC. These therapies provide the dual benefit of reduced systemic toxicity and effective local tumour control. As a result, procedures such as transarterial chemoembolisation and radioembolisation are fully accepted for the treatment of patients with intermediate-stage disease. Current trends consisting of combining intraarterial approaches with systemically administered targeted agents are also evolving. It is important that procedures are undertaken in and postprocedure imaging is reviewed by centres with accredited hepatobiliary units and patients are discussed within multidisciplinary teams. This is when the best outcomes are achieved. Advances in tumour biology and in technology will continue to expand the role of interventional radiology in the treatment of HCC in the future.

Session Objectives:

1. To learn about the role of interventional radiology in the therapeutic strategies for hepatocellular carcinoma.
2. To understand the added clinical value of image-guided interventions in different stages of hepatocellular carcinoma.
3. To become familiar with the several image-guided techniques available.

A-145 08:33

A. Percutaneous techniques: the clinical value of minimally invasive options

B. Gebauer; *Berlin/DE (bernhard.gebauer@charite.de)*

Percutaneous ablative techniques play an important role in the treatment of small hepatocellular carcinomas (HCCs) as reflected in the actual Barcelona Clinic Liver Cancer (BCLC, Forner-A, J Hepatol 2012) and in the Hong Kong Liver Cancer Staging (HKLC, Yau-T, Gastroenterol 2014). In the BCLC system local ablation is indicated in "early stage (A)" HCCs with 2-3 nodules ≤ 3 cm not suitable for transplantation or "very early stage (0)" HCCs (single HCC < 2 cm) with increased portal pressure or bilirubin. HKLC recommends ablation in "early tumours" with ≤ 5 cm in diameter and ≤ 3 tumour nodules, no

intrahepatic venous invasion and no candidates for liver transplant. Besides low compilation rate one, of the major advantages of local ablation compared to resection in HCCs is the reduced loss of liver tissue in these predominately cirrhotic patients. Radiofrequency and microwave ablation are the most frequently used techniques for local ablation in HCCs. The guidance used for ablation depends on physician's preference and skills and on local environment. Recently, it could have been shown that survival of percutaneous approach is equal to open approach in radiofrequency ablation of malignant liver tumours (Wong J, HPB 2013). Most interventionists prefer computer tomography (CT) guidance for ablation, because all liver segments could equally be reached by CT, auxiliary techniques such as gas or hydrodissection could easily be performed and possible complications such as bleeding, pneumothorax could immediately be detected and treated.

Learning Objectives:

1. To understand when percutaneous ablation is indicated (BCLC guidelines).
2. To understand when radiofrequency ablation (RFA) and when microwaves ablation (MW) are indicated and which guidance is recommended.
3. To consolidate knowledge of results from the literature.

Author Disclosure:

B. Gebauer: Speaker; BARD, Cook, AngioDynamics, Siemens, St. Jude, Parexcel.

A-146 09:02

B. Intra-arterial therapies 2.0: the embolising techniques in the era of the micro-beads

A. Denys; *Lausanne/CH (Alban.Denys@chuv.ch)*

Chemo-embolisation is an old technique that has evolved recently with the advent of drug eluting beads. These embolisation particles can load either at their surface or in their chemotherapy matrix and release it in a sustained matter. Most of the experience published so far has been obtained with DC beads from BTG (Farnham, UK). Randomised trial comparing DC beads to conventional TACE failed to reach the main objective of the study which was improvement of progression-free survival at 6 months. Recent publication, however, suggests excellent long-term results in term of survival from non-randomised study. Because of the release profile of chemotherapy, systemic exposure to doxorubicin is reduced, thus reducing systemic complications such as alopecia.

Learning Objectives:

1. To understand when intra-arterial treatments (transarterial bland embolisation, conventional chemoembolisation, drug-eluting beads chemoembolisation) are indicated (BCLC guideline).
2. To learn about essential technical issues.
3. To consolidate knowledge of results from the literature.

Author Disclosure:

A. Denys: Advisory Board; terumo, BTG, Medtronic.

A-147 09:31

C. Intra-arterial therapies 2.0: radioembolisation as a common daily practice

J.I. Bilbao; *Pamplona/ES (jibilbao@unav.es)*

Radioembolisation (RE) is a well-established endovascular treatment, success of which is supported by the good interaction of a multidisciplinary team. At this moment RE is a two-step procedure because the Y90 dose is calculated once the information from SPECT-CT with Tc99 MAA has been obtained. Recent reports have outlined the possibility to perform the evaluation and the treatment in the same day. Hepatocarcinoma (HCC) has a wide variety of angiographic patterns and the underlying cirrhosis may alter the arteriovenous network of the non-tumoral liver, both circumstances may facilitate the passage of the microparticles towards the pulmonary circulation. The pre-treatment work-up should also focus on the study of the arterial peculiarities and the operator must adapt to the vessels and select the places for the delivery of the dose. In most of the cases, the vascular pattern can be predefined with a careful evaluation of the information given by angio-CT. The operator needs to be trained for having a thorough knowledge of the arterial anatomical variations and the extrahepatic branches that may feed the tumour and also the changing haemodynamics of the liver vessels. RE has demonstrated its efficacy in a wide range of clinical presentations of HCC. Reports have shown its utility in BCLC-A patients in whom curative treatments cannot be applied, but is for BCLC-B cases and some BCLC-C (lobar-segmental portal invasion) to which the treatment can be specially recommended with improving in time to progression and overall survival when compared with other intra-arterial or systemic treatments in similar cohorts.

Learning Objectives:

1. To understand when transarterial radioembolisation is indicated (BCLC guideline).
2. To learn about technical and anatomical considerations for transarterial radioembolisation.
3. To consolidate knowledge results from the literature.

Author Disclosure:

J.I. Bilbao: Speaker; Sirtex medical europe, Terumo.

08:30 - 10:00 **Studio 2015**

E³ - Rising Stars Programme

Basic 1: Breast imaging

A-148 08:30

Mammography

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

Mammography is essential in the diagnosis of breast cancer and is the most commonly used imaging tool. Breast density classifications will be discussed together with density as a risk for breast cancer. The 5th edition of the ACR guidelines new breast composition categories are: A - the breasts are almost entirely fatty, B- there are scattered areas of fibroglandular density, C - the breasts are heterogeneously dense which may obscure small masses, D - the breasts are extremely dense which lowers the sensitivity of mammography. Sensitivity for the detection of cancer depends on the amount of fibroglandular breast tissue and resultant breast density with sensitivity dropping below 50% in the highest quintile of density. Mammography is the most cost effective modality in screening women in the 50-70 age group. 2D Full Field Digital mammography has replaced film screen mammography. Digital Breast tomosynthesis is used increasingly as cancer detection is increased on average by 15% with a corresponding reduction in false positive rates. The increased cancer detection is greatest in younger women under 50 years with dense breast tissue. Cancer features are typically ill defined, irregular areas of increased density with spiculations. Microcalcification is present in the majority especially where there is DCIS present. Malignant microcalcification is composed of particles which are of varying sizes and densities, have linear and branching structures and where there are > 5 in a small cluster. Asymmetry and architectural distortion are less common features of malignancy. Benign features are lesions with sharp, well defined margins which are oval or round in shape and isodense with the adjacent breast tissue.

Author Disclosure:

F.J. Gilbert: Grant Recipient; Research grant from GE. Speaker; Bracco.

A-149 09:00

Breast US

C.S. Balleyguier, S. Canale, C. Dromain; *Villejuif/FR (Corinne.BALLEYGUIER@gustaveroussy.fr)*

Ultrasonography (US) B-mode is an established 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. The main role of breast ultrasound is to differentiate cystic and solid lesions. More and more, in modern ultrasound, the role of breast ultrasound is to help to characterise benign and malignant breast nodules. An accurate technique with an adequate machine is first mandatory to examine the breast. A correct gain, with the adequate position of the focal zone is required to define a correct image. A modern basic ultrasound image now requires a combination of harmonic and compound images. These techniques may help to decrease artefacts and to increase spatial and contrast resolution. Color Doppler may also be used to help to detect malignant features, including irregular peripheral vessels in a solid mass. Nevertheless, color Doppler may not be enough to assess or exclude a malignant lesion. Elastography is another additional ultrasound technique which may be helpful to characterise lesions. New BI-RADS lexicon includes definition of normal breast tissue. BI-RADS lexicon must be known and includes different categories and specific terms to describe a lesion, including margins analysis, tissue content, tissue attenuation or associated features. Moreover, if breast US is more considered as a characterisation technique, some 3D ultrasound techniques must be known to screen automatically women with dense breast. Advantages and limits of this technique will be presented.

A-150 09:30

Breast MRI

F. Sardanelli; *San Donato Milanese/IT (f.sardanelli@grupposandonato.it)*

MRI entered screening and clinical practice, allowing for 90% sensitivity and from 75% (diagnostic) to 95% (screening) specificity. When cancer diagnosis/exclusion is required, sequences are axial/sagittal T2-weighted turboSE/STIR, 2D/3D GE dynamic series, and DWI EPI; bilateral 7-32 channel coils allow for high-quality studies. For dynamic study, in-plane resolution $< 1\ mm^2$ and temporal resolution ≤120 seconds up to 6-8th minute are recommended; high-relaxivity contrast materials are preferred (0.1 mmol/kg @2-3 ml/s plus 20-ml saline flush). When fat sat is not used, image subtraction (enhanced minus unenhanced) is performed. Three types of dynamic curves for targeted regions of interest are described: 1 (continuous increase); 2

(plateau); 3 (washout). An unenhanced 3-plane study with dedicated sequences is required for evaluating implant integrity. Indications for contrast-enhanced MRI include: high-risk screening; preoperative; monitoring/evaluating the effect of neoadjuvant chemotherapy; occult primary breast cancer; difficult cases at conventional imaging when needle biopsy cannot be performed, including suspected local recurrence; nipple discharge; and evaluation of lesions with uncertain malignant potential (" high-risk" or B3 lesions) at mammography-/ultrasound-guided needle biopsy. Interpretation requires integration of data from clinical examination, mammography, and ultrasound, when available. Standardised descriptors integrating morphology (e.g. focus, mass, non-mass) and dynamics and diagnostic categories, such as the ACR BI-RADS®, are recommended: 0 = incomplete (additional imaging needed); 1 = negative, no abnormalities; 2 = benign; 3 = probably benign (short-term follow-up recommended; biopsy in special cases, e.g. patient request or high-risk patients); 4/5 = suspected/highly suspected malignancy (biopsy recommended); 6 = already proven cancer (staging or evaluating neoadjuvant chemotherapy effect).

Author Disclosure:

F. Sardanelli: Grant Recipient; Bracco, Milan, Itay, Bayer, Berlin, Germany. Investigator; Bracco, Milan, Italy, Bayer, Berlin, Germany. Speaker; Bracco, Milan, Italy, Bayer, Berlin, Germany.

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

State of the Art Symposium

SA 5
Rethinking ductal carcinoma in situ (DCIS)

A-151 08:30

Chairman's introduction

G. Forrai; *Budapest/HU (forrai.gabor@t-online.hu)*

In this session, the complex topic of DCIS will be discussed. New molecular pathologic knowledge help radiologists to understand the origin and the way of spread of this disease, the heterogeneity of DCIS, the radiological-pathological correlations as well as the prognostic factors and the perspectives of individualised therapy. Preoperative workup is usually performed by mammography, ultrasound and guided biopsies, but MRI has an emerging role in the detection and preoperative evaluation of this disease. A particular strength of MRI is the ability of detection non-calcified DCIS, which remains frequently occult by all other imaging modalities. High-quality image-guided interventions are the key of the preoperative workup. Therapy planning issues will be discussed in details during this State of the Art Symposium.

Session Objectives:

1. To become familiar with the state-of-the-art preoperative workup of DCIS.
2. To appreciate the degree of over- and underestimation of DCIS by imaging.
3. To understand the relevance of histological subtypes in the therapy planning.

A-152 08:34

New molecular pathologic knowledge on DCIS

T. Tot; *Falun/SE (tibor.tot@ltdalarna.se)*

Breast cancer is a lobar disease in the meaning that the structures of the tumour develop most often in a single lobe of the breast. The sick lobe deviates from the healthy lobes of the same breast in its sensitivity to oncogenic stimuli and/or in number of the committed progenitor cells dispersed unevenly within the lobe. Complete malignant transformation of these progenitor cells is a result of accumulation of genetic alterations and may involve terminal ductal-lobular unit (s), a segment of the sick lobe, or the entire lobe. The malignant progenitor cells and their progenies replace the normal cells and take over their functions. In the in situ phase, these cells are able to retain the normal ductal-lobular architecture, the biphasic (epithelial-myoepithelial) differentiation of the parenchymal cells, and their complete delineation from stroma with intact basement membrane. There are two well-defined pathways in developing cancer in situ: a low-grade one characterized by ER-positivity, HER2 negativity, and loss of the 16q chromosome arm, and a high-grade one characterised by multiple chromosomal abnormalities. High-grade in situ carcinomas may belong to Luminal A, Luminal B, HER2 positive, triple negative or basal-like categories; the low-grade ones are usually Luminal A. Low-grade tumours tend to develop within the terminal units, the high-grade ones may develop within the larger ducts, sometimes distorting the normal architecture through the process of neoductgenesis. The sick lobe theory at architectural level and the progenitor cell theory on genetic level may help understanding the earliest stages of breast cancer development.

Learning Objectives:

1. To describe the molecular phenotypes of DCIS.
2. To analyse the relation of the molecular phenotype of DCIS to multifocality and radiological manifestation.
3. To evaluate the prognostic impact and therapeutic implications of phenotyping DCIS.

A-153 08:56

Diagnosing DCIS with MRI

C.K. Kuhl; *Aachen/DE (ckuhl@ukaachen.de)*

Over the past couple of years, it has become increasingly clear that MRI has a large role to play for diagnosing DCIS. Enhancement in DCIS requires Gadolinium to diffuse from the intravascular to the extra-vascular, interstitial space and then - as a second step - from the extravascular to the intra-ductal space. This explains why enhancement kinetics of DCIS differ from those of invasive cancers. DCIS enhancement rates will remain below the typical enhancement thresholds of invasive cancers. Since there is no gadolinium accumulation inside the normal milk duct, there must be a mechanism through which the intra-ductal accumulation of gadolinium chelates is facilitated. Current thinking is that intraductal cancer release angiogenic factors that induce peri-ductal vascular cuffing, and proteases which lead to a pathologically increased permeability of the milk duct's basal membrane. Both effects are important requirements also for invasive growth. Accordingly, MRi could be considered a biomarker for DCIS which have the proteomic tools to grow invasively.This is good agreement with the observation that the sensitivity of MRI for DCIS increases with nuclear grading of DCIS which, in turn, correlates with a DCIS' likelihood of progression to invasive cancer. DCIS that exhibit no enhancement on MRI may be the ones that do not or not yet have the tools to prepare invasive growth

Learning Objectives:

1. To understand the pathophysiological basis of DCIS detection in mammography and MRI.
2. To list imaging features of DCIS.
3. To appreciate current and future applications of MRI for diagnosing DCIS.

A-154 09:18

Image-guided interventions for DCIS

R.M. Pijnappel; *Utrecht/NL (r.m.pijnappel@umcutrecht.nl)*

Of all available image-guided techniques for sampling lesions, the following can be used in case a Ductal Carcinoma In Situ (DCIS) is suspected by imaging: automated core needle biopsy, vacuum assisted biopsy and radiofrequency assisted single large core. The choice of the technique used for sampling is guided by the imaging modality on which the lesion was detected. Calcifications on mammography and non-mass enhancement on MRI are classical suspicious signs of underlying DCIS. The problem of sampling lesions consisting of calcifications only is, in contrast with solid lesions, the underestimation of the real pathologic entity. The continuum from Atypical Ductal Hyperplasia (ADH) through DCIS to (micro) invasive carcinoma requires not only a representative but more still a substantial amount of tissue retracted by sampling, to facilitate the pathologist to give a diagnosis (almost) as reliable compared to the surgical specimen. Therefore, Fine Needle Aspiration (FNA) is obsolete in case of lesions with suspicion of underlying DCIS. The size of the needle used for sampling as well as the number of cores taken play a central role sampling these lesions. In case of calcifications, a specimen radiograph is obligatory to confirm the representativeness of the sample. The placement of a marker at the biopsy site makes it possible to correlate the biopsy site with the original lesion and facilitates to mark the site if surgery should be necessary. Correlation of image findings and pathology reports forms a crucial final step in the diagnostic process.

Learning Objectives:

1. To learn about underestimation in core needle biopsy in comparison with vacuum-assisted biopsy.
2. To understand the importance of pathologic proof of non-mass enhancement on MRI.
3. To become familiar with low grade versus high grade DCIS.

Author Disclosure:

R.M. Pijnappel: Advisory Board; Hologic.

09:40

Panel discussion: Patient with DCIS: how to plan her therapy in 2015?

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

Professional Challenges Session

PC 5a
Looking into the future of radiology

A-155 08:30
Chairmen's introduction
M.H. Fuchsjäger[1], G. Paulo[2]; [1]*Graz/AT*, [2]*Coimbra/PT*

Only if we understand and appreciate the changing role of radiology due to different concepts of health economy, the influence of health technology assessment on medical imaging and the importance of professional as well as technological development, our radiology will professions be prepared for the future. How the near and distant future of radiology might look like and which challenges we will have to face and overcome to be ahead of the game will be laid out and discussed in this session.
Session Objectives:
1. To learn about external factors that influence radiology.
2. To become familiar with health economics concepts.
3. To understand the changing roles of the radiology professions.

A-156 08:35
Health technology assessment (HTA)
E.J. Adam; *London/UK (drjaneadam@gmail.com)*

HTA provides a method of assessing the 'value' of what we do. It looks at the patient outcome and judges that against the cost. There are various methods for doing HTA, some very sophisticated. For interventional radiology and screening, the health outcome can be measured, and the costs calculated so the value is easier to establish than for most of diagnostic radiology where it is more difficult to establish a direct link with patient benefit. However with spiralling health costs and limited budgets radiology can also expect to come under review in order to contain costs.
Learning Objectives:
1. To learn about HTA concepts.
2. To become familiar with the role of radiology professions in HTA.
3. To understand the influence of HTA on decision-making in the field of radiology.

A-157 08:55
The influence of health economics systems on radiology
D. Katsifarakis; *Athens/GR (dikatsifarakis@gmail.com)*

Health economics are dealing with issues concerning efficiency, effectiveness, value and behaviour in the production and consumption of health care. They have been influenced by asymmetric information in the doctor-patient relationship which increases the moral hazard and the existence (or absence) subsidised prices due to insurance. Consumption of health (and imaging) services is influenced by the existence or the absence of a social security system in a nation. In nations without (or partly formed) social security systems, out-of-pocket payments are often used to provide access to radiology departments which are expected to work as for-profit service providers. In established social security systems, citizens are provided with services at zero or near-zero cost at the point of delivery. Radiology departments are expected to undertake a gatekeeper's role by making the best use of their scarce resources. Social Insurance coverage is leading to over-utilisation of services by both, patients and physicians. Government authorities develop means to restrain the morality hazards of the system, drawing social criticism. Radiology departments are converting inputs to outputs through the imaging process. When the maximum possible output has been produced from definite resources, they function efficiently. Effectiveness on the other hand is correlated with the ratio of the total accurate diagnoses to the exam total. Today radiology departments' finance tends to move from a fee-for-volume to a fee-for-value reimbursement system. By analysing their failures and by gaining the experience on how to avoid them, they develop into learning organisations.
Learning Objectives:
1. To become familiar with health economics concepts.
2. To understand how health systems models influence radiology.
3. To appreciate how to develop effective and efficient radiology departments.

A-158 09:15
Quo vadis radiology professions? A pragmatic approach
G.P. Krestin; *Rotterdam/NL (g.p.krestin@erasmusmc.nl)*

As the practice of medicine moves away from an intuitive, experience-based model to empirical, evidence-based and to personalised medicine, diagnostic precision becomes paramount to select the particular treatment that will best help each individual patient. Precision medicine means that radiologists will need to be able to move beyond their analogue world of qualitative interpretation of imaging signs, non-specific tissue contrast, and free text reports and must think in terms of structured, objective reports containing quantitative data on imaging biomarkers. 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. The convergence of imaging, pathology and laboratory tests with the help of advanced IT solutions may lead to the new concept of "integrated diagnostics". Integrated diagnostics offers increased operational efficiency and benefits to patients in terms of more rapid and accurate diagnoses. It has been suggested that a continuation of the present emphasis on image interpretation and reporting, rather than consultation and problem-solving, runs the risk that the radiology profession will become marginalised and commoditised. On the other hand, applying knowledge and wisdom to consultations with referring physicians is unlikely ever to be commoditised. Therefore, to retain their standing, radiologists have to recognise that radiology is more than just imaging and engage more directly with both patients and referring physicians.
Learning Objectives:
1. To appreciate the main pillars of professional development.
2. To become familiar with the implications of technological development in professional practice.
3. To understand the importance of teamwork for the future of radiology professions.

09:35
Panel discussion: What is the role of European societies in building a sustainable model for radiology?

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

Oncologic Imaging

RC 516
Gastro-entero-pancreatic neuro-endocrine tumours (GEP-NET): a multidisciplinary update

A-159 08:30
Chairman's introduction
A.E. Sundin; *Uppsala/SE (Anders.Sundin@radiol.uu.se)*

Imaging of neuroendocrine tumours employs a combination of morphological and molecular techniques. The developments in CT has rendered this technique the basic anatomical imaging tool. MRI has during recent years become more available but generally it is used as a problem-solving tool when CT does not suffice, when intravenous iodine-based contrast agents cannot be administered and for repeated imaging in young patients. The proper use of intravenous contrast media and proper contrast-enhancement technique is mandatory both in CT and MRI to visualise hypervascular and hypovascular tumour lesions. Contrast-enhanced US offers excellent characterisation of liver lesions and is also important to guide the needle for biopsy. Endoscopic US is the optimum method to diagnose small pancreatic NETs and also allows for biopsy. The mainstay for somatostatin receptor imaging is still somatostatin receptor scintigraphy by will over the coming years be replaced by PET/CT with 68Ga-labelled somatostatin analogues with higher tumour to normal tissue contrast, better spatial resolution and logistical advantages in a shorter examination procedure. All these techniques need to be applied optimally for the various NET imaging applications; diagnosis of the primary tumour, describing its local extent and relation to adjacent tissues, staging of regional and distant metastases, surveillance and monitoring of therapy.
Session Objectives:
1. To become familiar with the clinical and pathological aspects of GEP-NET.
2. To learn about the role of cross-sectional and nuclear medicine imaging techniques in GEP-NET.

A-160 08:35
A. Tumour biology, pathogenesis and classification
M.E. Pavel; *Berlin/DE (Marianne.Pavel@charite.de)*

Neuroendocrine neoplasms (NEN) are rare and represent a heterogeneous group of tumorus with respect to their morphology and biology. They arise from cells of the diffuse neuroendocrine cell system, most frequently of the the gut, pancreas, or bronchopulmonary system. Common features include expression of neuronal and hormonal markers and somatostatin receptors. The vast majority of NEN are sporadic, however few, especially pancreatic or duodenal NET occur in a variety of inherited cancer syndromes, such as MEN-1, VHL or

TSC-2. The latter are rather localised and slowly growing while sporadic NET are diagnosed at an advanced stage with metastases to lymph nodes and/ or liver in more than 50%, and display a variable tumour growth behaviour that is best reflected by their proliferative activity (grading). The grading (G1< 2%, G2> 2-20%, G3> 20% Ki67) is an essential component of the current WHO classification of NEN. It allows an adapted therapy approach integrating surgery and systemic therapies. In contrast, the molecular understanding of NEN is limited. Recent molecular analysis in pNET revealed MEN-1 gene mutations (45%), ATRX (alpha-thalasemia/ mental retardation syndrome, X-linked) or DAXX (death domain-associated protein) gene mutations (18% and 25%, respectively), and mutations in the mTOR pathway (14%). Genotype-phenotype correlations are still lacking; the clinical relevance of different mutations needs to be further elucidated. No common type of mutations could be identified in small intestinal NET, although mutations in several genes previously associated with cancer, were found in single cases. Actually, pathological and clinical parameters determine diagnostic and therapeutic strategies in NEN.

Learning Objectives:

1. To learn about the basic aspects of GEP-NET biology, pathogenesis and classification.
2. To understand the epidemiology and current treatment options.
3. To become familiar with rational clinical management.

Author Disclosure:

M.E. Pavel: Advisory Board; Novartis, IPSEN, Pfizer, Lexicon. Consultant; Novartis, IPSEN; Pfizer. Grant Recipient; Novartis. Speaker; Novartis, IPSEN, Pfizer.

A-161 08:58

B. The current role of nuclear medicine

S. Fanti; *Bologna/IT (stefano.fanti@aosp.bo.it)*

Nuclear Medicine procedures have been used with success for studying Gastro-Entero-Pancreatic (GEP) Neuroendocrine Tumours (NET). Tracers based on radiolabelled somatostatin analogues were introduced to study NET expressing a high density of somatostatin receptors (SSR) and gained a widespread acceptance, especially for GEP NET. SSR SPECT has been used routinely for studying carcinoids and other NETs for years, while PET tracers were introduced more recently, for the imaging of NET. FDG is not well-suited for studying NET, as most NET shows a faint uptake of FDG, because glycolisis is significantly increased only in poorly differentiated NET, usually rapidly growing and highly aggressive; therefore, a role for FDG PET may be suggested only for prognostic evaluation, in case of aggressive NET tumours. SSR PET tracers have been developed in the last decade, mainly labelled with 68Gallium and are rapidly gaining widespread use for the high diagnostic sensitivity, but problems remains for the regulatory issues related with the routine use of these tracers. The scientific literature regarding the use of SSR PET in NET is rapidly growing, and confirm the good accuracy of such approach for diagnosis, staging, evaluation of recurrence and therapy planning; it has also been demonstrated that PET/CT with radiopeptides have a relevant impact on patients' management. Other tracers have been developed to evaluate the different metabolic pathways of NETs, such as F-DOPA, C-HTP. However, these tracers are still not widely used for difficult and expensive production, limiting the diffusion of these approaches.

Learning Objectives:

1. To learn about the cellular properties and GEP-NET used in molecular imaging.
2. To become familiar with the different modalities and new tracers being used.
3. To learn about the performance of the different methods available.

A-162 09:21

C. Anatomical imaging: transabdominal US, endoscopic US, MDCT and MRI: which is the most appropriate imaging approach?

V. Vilgrain, M. Ronot, M.-P. Vullierme, P. Ruszniewski; *Clichy/FR (valerie.vilgrain@bjn.aphp.fr)*

Gastroenteropancreatic neuroendocrine tumours (GEP-NETs) are a heterogeneous group of neoplasms that arise from cells of the diffuse neuroendocrine system and may present with a wide spectrum of clinical presentations. Their prognosis is mainly related to their biology, proliferation and differentiation. The main goals of imaging are the diagnosis and the staging of these tumours. Diagnostic challenge is very different in functional tumours where clinical presentation and laboratory parameters are of utmost importance and in non-functional tumours where imaging may show characteristic features such as hypervascularisation and calcifications. Staging is also essential as locoregional involvement and distant metastases (such as liver metastases) may change the therapeutic approach and are major prognostic factors. Multimodal work-up including morphological imaging modalities with CT, MR imaging, and endoscopic ultrasound being the most useful and functional tools such as PET using 68Ga and 18 F-DOPA. Imaging may also play a role in assessing prognosis in combination with tumour differentiation and tumour proliferation obtained from pathologic examination. Last, imaging is useful in evaluating tumour response after treatment. Although surgery remains the only potentially curative therapy for patients with primary GEP-NETs, other available treatments include chemotherapy, interferon, somatostatin analogues, and targeted therapies. Imaging criteria rely not only on changes in tumour size but also on internal tumour changes.

Learning Objectives:

1. To learn how to recognise the specific imaging features of GEP-NET.
2. To learn about the strengths and weaknesses of the different imaging modalities.
3. To understand the optimal use of the different imaging modalities in relation to tumour location and staging.

09:44

Panel discussion: The future of hybrid imaging

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

Professional Challenges Session

PC 5b

Imaging biobanks: from genomic to radiomic in the era of personalised medicine

A-163 08:30

Chairmen's introduction

G. Frija[1], E. Neri[2]; [1]*Paris/FR*, [2]*Pisa/IT*

A major area of interest of the ESR is the development of imaging biobanks which requires interoperability and standardisation. There is a need for a European project in this area, as many imaging data are currently not comparable; moreover, there is a need for semantic interoperability through a unique taxonomy and coding. One of the major challenges is how to link imaging biobanks to existing tissue biobanks. Currently heterogeneous data are used for tumour profiling, thus the development of interoperable databases is of key importance. An essential component of imaging biobanks are the imaging biomarkers (quantifiable parameters of normal and pathologic tissues), not yet been included in the landscape of European biobanks. However, there is a great and urgent need to do so, since imaging repositories are dealing with big data and have specific technical requirements in terms of codification, standards and interoperability. Strategies for cost recovery and sustainability should be defined. In addition, imaging biobanks should be integrated into other biobanks to facilitate exchange of information and data, as combining various sources of information will improve individualised treatment selection and monitoring. Moreover, programmes for new knowledge extraction from these data, as performed in the new field of radiogenomics, should be developed. Such programmes are needed for biobanks in general; however, imaging has very specific requirements due to the type and amount of data to be handled.

Session Objective:

1. To briefly introduce the concepts and the link between them: quantitative imaging, biomarker, radiomic, imaging biobank, personalised medicine.

A-164 08:33

The biobanks: genomic, moleculomic and proteomic - Which link to radiomics?

M. Borro, G. Chillemi, M. Simmaco; *Rome/IT (maurizio.simmaco@uniroma1.it)*

Personalised Medicine (PM) is becoming and will remain the focus of interest in medical research and health-care policy in the next future. Molecular signatures have been far now the main resource of PM, to uncover the "personal traits" affecting development and progression of diseases, as well as to predict the individual response to treatments. However, identification of PM with molecular medicine is misleading, and the main challenge of the coming years is the personalisation of treatments through high level integration of both clinical and non-clinical data. Among these, imaging data would represent a main information as it provides individual assessment of the location and extent of an abnormality, and in the future it will prove fundamental to almost all aspects of PM. The establishment of standardised database, including high complex patient's data and linked to high-quality bio-banks, is the fundament to speed-up the development of knowledge and methods in PM. A pilot study between Cineca (the largest Italian computing centre) and the Sant Andrea hospital of Rome is aimed to build up a bioinformatic pipeline that, from an Automatic Image Analysis Procedure of radiological data, analyses correlation between radiological data and genomic/phenotypic variables by means of supervised learning models such as Support Vector Machine to create predictive models of disease and response to treatments. Such platform will

represent a step toward the development of new automated techniques which integrate "all -omics data", allowing real-world actuation of PM.
Learning Objective:
1. To report the rationale of linking genomic, moleculomic and proteomic (the so called "omics") with radiomic.

A-165 08:51

Radiomic: report from the ESR Working Group on Imaging Biobanks
H.-U. Kauczor; *Heidelberg/DE (Hans-Ulrich.Kauczor@med.uni-heidelberg.de)*

Imaging biobanks are defined as organised databases of medical images and associated imaging biomarkers (radiology and beyond) shared amongst multiple researchers, which should be linked to a biorepository. The already existing biobanks are designed to give access to large collection of patient/subject samples and data to researchers. Biobank group human biological material of healthy subjects (population-based) and/or patients with specific pathologies (disease-oriented), of which the most frequent are cancer-related. Most biobanks allow only for the collection of genotype data, but do not simultaneously come with a system to gather the related clinical or phenotype data (such as imaging biomarkers). Modern radiology and nuclear medicine can provide multiple imaging biomarkers using quantitative data derived from CT, MRI, PET, SPECT, US, etc. Moreover, other types of images can be collected from endoscopy, microscopy, surgery, etc. also providing measurable personalised data. All this information should be considered the phenotypic expression of biobanks. Such data should be available to the research community opening the novel field of radiomics which strives to link imaging biomarkers with genomic, biochemical and metabolic markers to understand how a biological process is reflected in imaging phenotype. The ESR Working group on Imaging Biobanks will promote the implementation of IBs in Europe and advance the development of intelligent tools for the analysis and processing of imaging biomarkers. This process requires standardisation, validation and benchmarking of the imaging data in IBs. The WG will further support the linking of existing image data repositories, IBs and other biobanks.
Learning Objective:
1. To report the rationale of the Imaging Biobanks Working Group and the stage.
Author Disclosure:
H.-U. Kauczor: Equipment Support Recipient; Siemens, Philips. Speaker; Siemens, Bracco, Bayer, Boehringer, Novartis.

A-166 09:09

Existing imaging biobanks
A. Jackson; *Manchester/UK (Alan.Jackson@manchester.ac.uk)*

The biobank has become a standard part of modern medical research. The ability to collect fluid and tissue samples from large numbers of normal individuals or patients with specific diseases has revolutionised our ability to study the biological processes of disease and, particularly, genetic and proteomic aspects. There is now a growing movement to compile imaging biobanks to support similar large-scale population-based studies. A number of international initiatives in the USA, UK and Europe have begun the prospective collection of imaging data from normal individuals in whom personal and clinical information together with fluid and tissue samples have already been initiated. This talk will briefly introduce the concept of the normal tissue biobank, discuss the imaging components that have been chosen for inclusion and also briefly discuss the concept of biobanking clinical images, collected for patient management, and the ethical and legal implications involved in doing so.
Learning Objective:
1. To report the experience carried out with the existing imaging biobanks (i.e. UK Biobank).

A-167 09:27

Extraction and analysis of biomarkers from medical images
B. Gibaud; *Rennes/FR (bernard.gibaud@univ-rennes1.fr)*

Imaging biomarkers are biological characteristics of the patient which are objectively measured from image data using some image processing. They will play a major role in patient management in the future, to assist medical decision such as early diagnosis, staging, prognosis, choice of therapy and assessment of patient response. Imaging biomarkers will be more and more quantitative, and will be used in formal models of decision, implemented in decision support systems. Though it primarily concerns cancer today, this evolution will ultimately affect most medical specialties. In this context their development and qualification require an adequate methodology and a suitable infrastructure to reliably produce, share and compare them. Such infrastructure should be provided by the imaging biobanks being deployed in many countries at regional or national levels. Semantic web technologies and especially ontologies are being developed to provide the necessary standard vocabulary that is needed to model and categorise imaging biomarkers, e.g. specify what they actually measure and how they have been produced (provenance). The semantic web technologies will facilitate the interoperation of imaging biobanks in federated systems as well as interoperation with regular (tissue) biobanks. The latter is essential with respect to imaging biomarkers' validation, as well as emitting new hypotheses about pathophysiology and underlying biological phenomena. Moreover, the use of formal models such as ontologies is particularly relevant with regard to the perspective of using imaging biomarkers (together with regular biological biomarkers) in knowledge-based decision support systems.
Learning Objective:
1. To describe how we can extract the relevant information from medical images and how these can be analysed and correlated with other kinds of information (lab values, genotypes, etc).

09:45
Panel discussion: Future strategies for the development and the federation of biobanks, definition of standards, etc.

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

Chest

RC 504
COPD, airways disease and beyond

A-168 08:30

Chairman's introduction
P.A. Grenier; *Paris/FR (philippe.grenier@psl.aphp.fr)*

Use of CT in the evaluation of patients with COPD has made it clear that individuals with identical GOLD stages may have different morphologic appearances. Visual characterisation of emphysema and airway abnormality associated with quantitative CT assessment permits categorisation of COPD into distinct defined subtypes. Beyond COPD, various diseases may affect the airways. Consequently, the radiologists have to know the indications and techniques of expiratory CT. Currently, emerging new MR techniques offer new perspectives in the assessment of chronic airway diseases, particularly, in patients with cystic fibrosis.
Session Objectives:
1. To learn about the role of HRCT in the classification of COPD.
2. To learn tips for getting the most out of CT techniques for the morphological and quantitative evaluation of COPD and airway diseases.
3. To become familiar with the future growing role of MRI in the assessment of lung disease.

A-169 08:35

A. COPD in HRCT: what should we report?
N. Sverzellati; *Parma/IT*

The potential for high-resolution computed tomography (HRCT) to uncover several morphological subtypes that come under the umbrella term chronic obstructive pulmonary disease (COPD) is now more familiar to both radiologists and specialist respiratory physicians. A complete approach to the classification of COPD would ideally assimilate several parameters through a combined visual-quantitative HRCT analysis. The insight that some subjects given the label of COPD have "pure" airways diseases or emphysema can be readily provided by a simple visual evaluation. The emphysema subtypes-centrilobular, panlobular, and paraseptal emphysema can be reliably distinguished on HRCT images. The visual assessment of bronchial abnormalities and accompanying smoking-related interstitial lung disease may also complete the phenotypic classification of COPD. Furthermore, it is now possible to objectively quantify the global extent of emphysema, gas-trapping, bronchial metrics by two types of software which are now increasingly available on latest CT workstations.
Learning Objectives:
1. To learn about the classification of COPD.
2. To appreciate the role of HRCT in COPD.

A-170 08:58

B. Airways disease: The role of expiratory CT
A. Devaraj; *London/UK*

This presentation will examine the role of expiratory CT in the diagnosis of small and large airways diseases. Small airways disease or air trapping may be a feature of asthma, COPD or hypersensitivity pneumonitis and is typically characterised by a mosaic attenuation pattern on CT. Meanwhile, tracheobronchomalacia and excessive dynamic airway collapse (EDAC) are large airways diseases that may be recognised by tracheal narrowing on inspiratory and/or expiratory CT. The typical clinical and CT manifestations of these conditions will be reviewed. Additionally, a number of important caveats

with regards to CT in small and large airways disease will be discussed: 1) the comparative strengths and limitations of CT, bronchoscopy and lung function testing in making the diagnosis. 2) The overlap in appearances that exists between disease and healthy individuals. 3) The variability in definitions of conditions such as tracheobronchomalacia. The optimal CT technique for imaging of airways disease, including the role of dynamic expiratory CT, will also be reviewed.
Learning Objectives:
1. To become familiar with different diseases that affect the airways.
2. To learn when inspiratory and expiratory CT may be of value in patients with lung disease.

A-171 09:21

C. Is there a role for MRI?
M.O. Wielpütz; *Heidelberg/DE (mark.wielpuetz@med.uni-heidelberg.de)*

Magnetic resonance imaging (MRI) has emerged as a new modality for lung imaging only recently, with airway diseases being the most accepted indications for clinical routine imaging. Beyond being a substitute for X-ray and computed tomography (CT), MRI combines morphologic and functional information more consequently than any other technology. Morphological sequences in Proton-MRI suitable for airways disease will be introduced, but the focus will be on functional techniques that have been introduced into clinical routine imaging, or are most advanced in scientific studies. These are dynamic contrast-enhanced perfusion MRI, T1-mapping in combination with inhalative oxygen as a contrast media, and non-contrast Fourier-decomposition MRI, which allow for a regional analysis of lung function. It has been shown that MRI may sensitively detect changes in lung morphology related to large airways disease such as airway wall thickening, bronchiectasis, mucus plugging or tracheobronchomalacia with lower resolution than CT, but with equal clinical impact. Moreover, ventilation changes attributable to small airways disease have been discovered with functional MRI techniques. Because of the effect of hypoxic pulmonary vasoconstriction, ventilation abnormalities are closely linked to subsequent perfusion changes, which can be sensitively detected by dynamic contrast-enhanced perfusion MRI. Oxygen-enhanced and Fourier-decomposition MRI deliver complementary and partially overlapping information. By a combination of morphological with functional techniques, MRI has the potential to specifically differentiate reversible from irreversible lung changes especially in airway diseases such as COPD and cystic fibrosis. This makes MRI an important modality for non-irradiating regional disease monitoring and therapy follow-up.
Learning Objectives:
1. To learn about different MRI techniques used to assess pulmonary disease.
2. To appreciate when MRI may be of value in patients with pulmonary disease.

09:44
Panel discussion: When should we do expiratory CT, and when should we consider doing an MRI?

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

Head and Neck

RC 508

Pitfalls in interpretation of head and neck disease

Moderator:
M.M. Lemmerling; Ghent/BE

A-172 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 get insight into the great variability of head and neck anatomy.
2. To be able to recognise pseudolesions.

A-173 09:00

B. Anatomical variants posing surgical risks
T. Beale; *London/UK (timothy.beale@uclh.nhs.uk)*

The lecture will concentrate on the commoner anatomical variants in the head and neck that pose a surgical risk in particular, in the sinonasal and temporal bone regions. The lecture will highlight when and why these variants are relevant to mention in the clinical report and how to recognise them in particular, the rarer but clinically important variants. In the temporal bone region, the lecture will include vascular variants such as the aberrant internal carotid and stapedial arteries, jugular variants such as dehiscent hypotympanic and high riding jugular bulbs, variants in the sigmoid sinus anatomy (both lateralised and dehiscent) and in the petrous roof (tegmen tympani and mastoideum). How variants in temporal bone pneumatisation affect the surgical approach will be discussed. Anatomical variants are the norm in the sinonasal region. I will highlight those variants that need to be mentioned in the report and explain why including those in the anterior skull-base such as the cribriform plate, the sphenoidal region (sphenoethmoidal air cells and dehiscent sphenoid sinus wall adjacent to the internal carotid artery, maxillary and optic nerves), the hypoplastic sinuses and frontal-ethmoidal aircells. I will also demonstrate variants in the cervical vascular anatomy that can cause confusion. Finally, I will reinforce the lecture with some clinical cases demonstrating how the particular head and neck anatomical variants altered the surgical management.
Learning Objectives:
1. To learn about structures at risk during functional endoscopic sinus surgery (FESS).
2. To become familiar with vascular variants in head and neck.
3. To appreciate surgical anatomical landmarks in head and neck.

A-174 09:30

C. Distinct head and neck disease or systemic disease?
B.F. Schuknecht; *Zurich/CH (bschuknecht@MRI-roentgen.ch)*

Systemic diseases that may present with H&N manifestations 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: IgG4-related disease (IgG4-RD) and inflammatory myofibroblastic tumour (IMFT). IgG4-RD originally described in the pancreatobiliary system has been recognised as systemic disease in 2003, the H&N being the second most common site. IMFT is another rare fibrous mesenchymal tumour that usually involves the lungs. H&N IMFT account for 14-18% of extrapulmonary sites. 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, myeloproliferative disorders and melanoma. H&N manifestations of systemic disorders consist furthermore of granulomatous lesions (Wegner`s, sarcoidosis, Behcet) and infections of viral (HIV, herpes), bacterial (tuberculosis, cat scratch disease, necrotizing fasciitis), or fungal (mucormycosis) origin. Localised amyloid deposition is usually not associated with myeloma and systemic amyloidosis. 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, rarely perfusion MR and increasingly PET to stage for systemic disease locations. In conjunction with clinical and laboratory findings, certain imaging features and manifestation patterns may prompt the inclusion the aformentioned disease categories into in the differential diagnosis, thus facilitating further diagnostic procedures and appropriate clinical management.
Learning Objectives:
1. To recognise head and neck manifestations of systemic disease.
2. To understand patterns of spread.
Author Disclosure:
B.F. Schuknecht: Speaker; European Society of Neuroradiology, European Course of Neuroradiology, European Society of Head and Neck Radiology.

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

Neuro

RC 511

Cerebrovascular disease

Moderator:
M.P. Wattjes; Amsterdam/NL

A-175 08:30

A. Vascular distribution territories: arterial and venous
A. Dörfler, T. Engelhorn; *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-176 09:00

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 vislualization 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 show 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-177 09:30

C. Cerebral perfusion studies in cerebrovascular disease: techniques, indications and applications
P.M. Parizel, F. De Belder, C. Venstermans, T. Van der Zijden, J. Huyskens, J. Van Goethem, L. van den Hauwe, M. Voormolen; *Antwerp/BE (paul.parizel@ua.ac.be)*

Cerebral perfusion imaging aims to measure blood flow to the brain, expressed in mL/100 gram of tissue/minute. In this presentation, we focus on CT perfusion (CTP), which together with CT angiography (CTA), has changed the strategy for acute stroke imaging. CTP is achieved by bolus injection of contrast, followed by a series of fast scans. Parametric maps are generated, reflecting: regional cerebral blood flow (rCBF), blood volume (rCBV), mean transit time (MTT), and time to peak (TTP). In acute stroke, CTP allows identification of potentially salvageable brain tissue, the so-called "penumbra". In chronic cerebrovascular disease, CTP is able to assess overall microcirculatory tissue perfusion, and to show differences between hemispheres and regions in the brain. Despite the undeniable merits of CTP, integrating this technique in normal workflow remains challenging. Practical prerequisites for performing CTP in daily practice include: intravenous access, power injector, fast multidetector scanner. But the biggest challenge is that acute stroke imaging requires a team of skilled CT technologists, available 24/7, and trained to perform efficient CTP and CTA studies. To date, the post-processing technique remains under discussion, and there is a need to establish thresholds that best predict clinical and radiologic outcomes. In conclusion, the combination of CTP (and CTA) provides a unique insight into the pathophysiology of the cerebral circulation. These techniques are now essential tools in the management of acute stroke and in selecting those 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.

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

E³ - ECR Academies: Hybrid Imaging (basic)

E³ 518

Imaging protocols for PET/CT and MR/PET

Moderator:
C. Pfannenberg; Tübingen/DE

A-178 08:30

A. Does it make sense to use CT contrast agents in PET/CT
G. Antoch; *Düsseldorf/DE*

When fusing CT and PET images, morphological and functional data complement one another in clinical oncology. Adding information on tumour metabolism to CT increases the diagnostic accuracy in many malignant diseases over morphology alone. One relevant question to be answered is, whether CT-contrast agents are required for PET/CT imaging. If they are, which PET/CT-indications benefit from adding CT-contrast to the PET/CT protocol? This postgraduate educational course will give an overview concerning indications of CT-contrast agents in PET/CT imaging and their limitations. Potential pitfalls and artefacts caused by highly concentrated intravenous and oral contrast are discussed and the effect of the contrast agent on PET-tracer quantification will be reviewed. At the end of the lecture the audience will be familiar with indications of CT-contrast in PET/CT and will be able to acknowledge limitations and potential pitfalls of its use in hybrid imaging.
Learning Objectives:
1. To become familiar with indications for CT contrast agents in PET/CT.
2. To understand the effect of CT contrast on PET tracer quantification.
3. To learn about contrast-associated artefacts in PET/CT.
Author Disclosure:
G. Antoch: Speaker; Bayer Healthcare, Siemens Medical Solutions, BTG.

A-179 09:00

B. PET/CT imaging protocols
A. Scarsbrook; *Leeds/UK (andrew.scarsbrook@leedsth.nhs.uk)*

Integrated positron-emission tomography-computed tomography (PET-CT) has revolutionised oncological imaging in recent years and now has a firmly established role in a variety of tumour types. PET-CT also has a growing role in neurology, cardiology and inflammatory disorders. There are a variety of different protocols which can be used in PET-CT. The purpose of this talk is to highlight how optimisation of imaging protocols can improve accuracy and efficacy of PET-CT in different clinical settings. There have been simultaneous stepwise advances in scanner technology and image reconstruction algorithms, which are yet to be exploited to their full potential. An overview of these technological developments will also be provided.
Learning Objectives:
1. To learn about different imaging protocols in PET/CT.
2. To appreciate an indication-based selection of different imaging protocols.
3. To consolidate knowledge of available image reconstruction parameters.

A-180 09:30

C. MR/PET imaging protocols
O. Ratib; *Geneva/CH (osman.ratib@hcuge.ch)*

The release of hybrid PET/MR scanners in the market has initiated a new paradigm in multimodality imaging. MR studies can provide additional diagnostic information regarding soft tissue analysis, tumour detection, tissue characterisation and functional imaging. It is not uncommon today for oncology patient to have both a PET-CT and an MRI scan in their clinical workup. It is,

therefore, reasonable to anticipate that a hybrid PET-MR scanner could be more efficient in these cases than a PET-CT scan followed by a separate MRI scan. The main limitation of MRI is the length of imaging protocols and the number of imaging sequences required for a given diagnostic task. Adding PET scanning time to full diagnostic clinical MRI protocols can be significantly longer than standard PET-CT study. Hybrid PET-MR protocols require shortening of MR acquisition protocols to limit the time of the study to clinically acceptable time. While advanced MR imaging sequences can provide relevant diagnostic information, they cannot be applied to whole body imaging and have to be restricted to organs and body sections that benefit the most from such imaging protocols. The remaining challenge of hybrid PET-MR systems is the calculation of attenuation correction maps similar to those calculated from whole body CT scans in hybrid PET-CT devices. Attenuation maps that are estimated from whole body MRI images after automated segmentation techniques of different tissues are essential for adequate quantitative measurements of PET tracer uptake (SUV) in tissues and organs.

Learning Objectives:

1. To become familiar with different imaging protocols in MR/PET.
2. To appreciate the indications for diffusion-weighted imaging in MR/PET.
3. To understand indications for contrast agents in MR/PET.

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

Vascular

RC 515

Imaging and intervention in acute ischaemic stroke

Moderator:
P. Zampakis; Patras/GR

A-181 08:30

A. Acute stroke imaging

K.-O. Lovblad; *Geneva/CH (karl-olof.lovblad@hcuge.ch)*

Stroke has become an accepted medical emergent in which imaging plays a central role. Its roles are exclusion of further pathology as well as demonstration of ischaemia. Additionally, angiographic and perfusion studies can be done. These various imaging studies can be done today both with computed tomography or MRI. While CT can clearly demonstrate hemorrhage, the superiority of MRI using diffusion techniques for ischaemia is well documented. CT can also demonstrate early signs that are more subtle but very often present. Both techniques can also demonstrate occlusion as well as states of hypoperfusion that may correspond to a salvageable tissue at risk. Thus, imaging can help directing the patients to intervention, demonstrate what can be saved and also predict outcome to some degree. Ct is slightly less time-consuming, making it the modality of choice for many centers, while MRI can provide more precise evaluation of tissue viability.

Learning Objectives:

1. To learn about parenchymal and vascular stroke imaging.
2. To become familiar with appropriate imaging protocols for all imaging modalities.
3. To learn about the pros and cons of each modality.

A-182 09:00

B. Indications for intervention

N. Kocer; *Istanbul/TR (nkocer@istanbul.edu.tr)*

Patients eligible for intravenous rtPA should receive intravenous rtPA even if intraarterial treatments are being considered (Class I; Level of Evidence A). Ia fibrinolysis is beneficial for treatment of patients with major ischaemic strokes of < 6 hours duration caused by occlusions of the MCA who arenot otherwise candidates for intravenous rtPA (I; B). As with intravenous fibrinolytic therapy, ia therapies is highly correlated with better clinical outcomes, and efforts mustbe undertaken to minimize delays to definitive therapy (I; B). Ia treatment requires the patient to be at an experienced stroke center with rapid access to angiography and qualified interventionalists (I; C). When mechanical thrombectomy is pursued, stent retrievers preferred. (I; A). The Merci, Penumbra System, Solitaire and Trevo thrombectomy devices can be useful in achieving recanalisation alone or in combination with pharmacological fibrinolysis in carefully selected patients (IIa; B). Ia fibrinolysis or mechanical thrombectomy is reasonable in patients who have contraindications to the use of intravenous fibrinolysis (IIa; C). Rescue ia fibrinolysis or mechanical thrombectomy may be reasonable approaches to recanalisation in patients with large artery occlusion who have not responded to intravenous fibrinolysis (IIb; B). The usefulness of mechanical thrombectomy devices other than the Merci retriever, the Penumbra System, Solitaire and Trevo is not well established (IIb; C). The usefulness of emergent intracranial angioplasty and/or stenting is not well established (IIb; C). The usefulness of emergent angioplasty and/or stenting, of the extracranial carotid or vertebral arteries in unselected patients, is not well established (IIb; C).

Learning Objectives:

1. To learn how to define the indication for treatment.
2. To learn about the treatment decision-making process.
3. To learn about the classification of lesions and indications for treatment.

Author Disclosure:
N. Kocer: Consultant; microvention.

A-183 09:30

C. Mechanical revascularisation

T. van der Zijden, M. Voormolen, O. d'Archambeau, F. de Belder, C. Venstermans, L. van den Hauwe, J. Van Goethem, P.M. Parizel; *Edegem/BE (thijs.van.der.zijden@uza.be)*

Acute ischaemic stroke is a major cause of death and significant disability worldwide. The main goal in primary treatment of acute ischaemic stroke is achieving as fast as possible reperfusion of the area at risk for infarction. Since the nineties, the mainstay of primary stroke treatment is the use of clot-dissolving medication. These agents can be administered both intravenously as directly via micro-catheters in brain arteries. However, several potential life threatening complications are associated with the administration of these drugs, including bleeding into the brain and other types of serious bleeding. Furthermore, some kinds of clots, e.g. emboli of cardiac origin, appear to be more resistant to the use of clot-busting agents.In the slipstream of the evolution of interventional neuroradiology, several intravascular devices have been developed for revascularisation of obstructed brain vessels. Theoretically, mechanical thrombectomy has great potential in stroke treatment, allowing superior recanalisation combined with the advantage of lower post-treatment bleeding risk compared to the use of pharmacological agents. In addition, mechanical thrombectomy seems to be more effective in retrieving large and more organised thrombi. On the other hand, the technique has not proven its superiority in terms of clinical outcome yet. Besides that, endovascular therapy has its own specific set of possible complications, e.g. embolisation to new territories, dissections, vasospasm or vessel perforation, which could have a negative impact on the course of the disease.

Learning Objectives:

1. To learn the difference between mechanical and pharmacological stroke treatment.
2. To learn about different mechanical revascularisation techniques.
3. To learn how to manage complications.

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

Cardiac

RC 503

Imaging of cardiac valves: new trends

Moderator:
F. Pugliese; London/UK

A-184 08:30

A. Echocardiography remains the reference technique
T. Binder; *Vienna/AT (thomas.binder@meduniwien.ac.at)*

Beyond doubt echocardiography remains the primary diagnostic tool in the assessment of cardiac valves. Echocardiography has a high temporal and special resolution, allows highly accurate quantification of lesions (2D/3D measurements, spectral Doppler, color Doppler) and can be performed bedside. While other imaging modalities may provide supplementary information, diagnosis, decision making and follow-up of patients with valvular lesions is universally performed with echocardiography. Echocardiography plays a key role to decide if and which surgical or interventional correction should be performed. Issues such as the severity of the lesion, over all cardiac function, rate of progression, additional cardiac pathologies and feasibility of a procedure / repair can be studied with echocardiography. Transesophageal echocardiography (TEE) increases the diagnostic yield of this technique. It is the method of choice in endocarditis and prosthetic valve dysfunction and is routinely used during valvular surgery. With the advent of new catheter based interventions TEE is increasingly used to monitor such procedures (TAVI, mitral valve valvuloplasty and MitraClip). Recent advances in echocardiography such as: improvements in image quality, miniaturisation of systems (pocket sized ultrasound), intracardiac echocardiography, deformation imaging, three-dimensional imaging, contrast echocardiography and software packages with new quantification tools will further enhance the diagnostic potential of this technique.
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.
Author Disclosure:
T. Binder: CEO; 123sonography.com – teaching platform for echocardiography.

A-185 09:00

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.

A-186 09:30

C. Does CT have a role in diagnosing valvular disease?
G. Feuchtner; *Innsbruck/AT (Gudrun.Feuchtner@i-med.ac.at)*

Aim of this course is (1) to learn "how-to" evaluate cardiac valves and valvular disease by CT, (2) to understand "when-and-why" cardiac CT is applied (e.g. valvular masses, infective endocarditis) and its scientific evidence, (3) to review cases in which CT was used as part of the multimodality concept and (4) to learn about CT and CT/PET for assessment of prosthetic valve dysfunction and infection.
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.

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

Musculoskeletal

RC 509

Percutaneous treatment of chronic back pain and sciatica

A-187 08:30

Chairman's introduction
A. Gangi; *Strasbourg/FR (gangi@unistra.fr)*

A-188 08:35

A. Sacroiliac joint syndrome
D.J. Wilson; *Oxford/UK (david.wilson@ndorms.ox.ac.uk)*

Sacro iliac joint pain may arise from a number of conditions including inflammatory arthritis, degeneration, fractures and tumours. Studies suggest a prevalence of 10% to 60% pain arising from the joint in patients with positive clinical signs. Temporary effect is provided by a mixture of local anaesthetics with steroids with a response varying between 50% and 80% in reported series. Dual blocks using agents of differing duration are considered more precise but as less often used in practice. Imaging including MR and Scintigraphy are of limited predictive value. Injections may be into the synovial joint, around the joint or adjacent to the nerve innervation of the joint. There is evidence that para-articular sources of pain are common and injection outside the joint may be more effective. SI-joint-injections are performed through a dorsal approach guided by ultrasound, fluoroscopy or by low-dose CT. Short acting agents may have lasting benefit but radio-frequency ablation has been employed in an attempt to obtain long-term response. The evidence for lasting therapeutic response to intra-articular or periarticular injection of steroids and conventional radiofrequency neurotomy is weak. There is fair evidence of long-term response to cooled radiofrequency neurotomy.
Learning Objectives:
1. To learn about relevant anatomy and clinical presentations of the syndrome.
2. To learn more about the available treatments.
3. To learn about clinical results and possible further developments.
Author Disclosure:
D.J. Wilson: Board Member; President British Institute of Radiology. Owner; St Lukes Radiology Oxford. Shareholder; European Imaging London.

A-189 08:58

B. Facet joint syndrome
A.D. Kelekis; *Athens/GR (akelekis@med.uoa.gr)*

Osteoarthritis frequently affects facet joints with resultant joint space narrowing, intra-articular vacuum phenomenon or fluid, osteophytes, synovial cyst formation and flaval ligaments hypertrophy. Patients with Facet joint syndrome complain of local paralumbar tenderness occasionally radiating to the thigh and iliac crest and rarely to the groin. The pain is usually worse when waking up from bed or trying to stand after prolonged sitting. Pain exacerbation is reported upon pressure, hyperextension, torsion, and lateral bending. Therapeutic armamentarium includes conservative therapy, infiltrations, percutaneous ablation/neurolysis or surgical techniques. Imaging-guided infiltrations can either be combined to the conservative therapy course (myorelaxants, analgesics, physiotherapy) or be solely performed as an intermediate step between any of the rest therapeutic options. In the lumbar spine, usual contents of the injectate include a long acting corticosteroid mixed with a local anaesthetic. Alternatively, sodium hyaluronate solutions or ozone were tested; however, more and extensive studies are required. There is

moderate evidence for facet joints infiltrations with the high success rates of the technique (immediate, 59%-94% and long-term, 27%-54%, relief) being directly related to proper patient selection. Alternative minimally invasive therapies include median nerve block, radiofrequency ablation of the medial branch nerves of the dorsal rami innervating each facet, and MR-guided HIFU. The evidence is good for facet joint neurolysis by conventional radiofrequency and limited for pulsed radiofrequency. MR-guided HIFU totally lacks any invasive character but it is of long duration and increased cost resulting in similar pain reduction rates to intra-articular infiltrations.

Learning Objectives:

1. To understand the difference between facet joint and disc disease.
2. To learn about different treatment options for facet disease.
3. To learn how to manage patients.

A-190 09:21

C. Intervertebral disc syndrome

D.K. Filippiadis; *Athens/GR (dfilippiadis@yahoo.gr)*

Intervertebral disc herniation accounts for 26-39% of low back pain/neuralgia cases. The vast majority (~80%) will report symptoms regression within 3-12 months. Therapeutic armamentarium includes conservative therapy, infiltrations, percutaneous disc therapies and surgical options. Foraminal or epidural infiltrations are palliative therapies performed either in combination to conservative therapy or prior to other techniques. During infiltration, glucocorticosteroid mixed to local anaesthetic is injected inside the epidural space or around a nerve root. The main goal is painful symptoms control during acute phase until natural recovery occurs. Within 6-13 days of post-infiltration, 65% of patients experience at least 50-65% pain reduction, lasting for an average of 15 months. Percutaneous, minimally invasive decompression techniques are imaging-guided therapeutic treatments during which a trocar punctures the disc's outer annulus with the least disruption of surrounding tissues. Through this trocar, a variety of thermal, chemical or mechanical decompression devices is introduced inside nucleus pulposus, assuring its partial removal. Indications for percutaneous decompressive therapies include symptomatic (refractory to 4-6 weeks conservative therapy course) intervertebral disc herniation occupying less than 1/3-1/2 of the spinal canal as confirmed by MRI. Contraindications include infection, uncorrected coagulopathy or a patient unwilling to provide informed consent. Sequestration is an absolute contraindication for percutaneous decompressive therapies. The mean success rates for all decompression techniques is approximately, 85% whereas, the mean potential complication (clinically significant) rate is < 0.5%. Imaging-guided percutaneous decompression techniques in comparison to conservative therapy seem to result in statistically significant better and longer-lasting outcome concerning pain reduction and mobility improvement.

Learning Objectives:

1. To understand possible treatment techniques for disc disease.
2. To learn more about clinical and imaging findings in treatment.
3. To learn about published results on percutaneous disc treatment.

09:44

Panel discussion: How can imaging methods identify candidates for percutaneous therapy or surgery?

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

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

MC 528

Abdominal emergencies

Moderators:
S. Mirvis; Baltimore, MD/US
A. Palkó; Szeged/HU

A-191 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 fulfil 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; Euromedic Intl.

A-192 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 emphasised. Key imaging findings of nontraumatic 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 ischemia will be emphasised.

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-193 09:30

C. Interactive case discussion

A. Palkó[1], R.J. Zagoria[2]; [1]*Szeged/HU*, [2]*San Francisco, CA/US*

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 MB 5**

E³ - ECR Academies: Diagnostic Urogenital Radiology

E³ 520

Kidney

Moderator:
C. Nicolau; Barcelona/ES

A-194 08:30

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 such as haemorrhagic cysts, chronic infected cysts, scarred cysts, multiloculated cysts and multiloculated cystic nephroma; 2. malignant tumours such as 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 includes 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-195 09:00
B. Differential diagnoses of solid renal masses
S.H. Kim; *Seoul/KR (kimshrad@snu.ac.kr)*

Recent advances in imaging resulted in increased detection of small renal tumours. When a small solid renal tumour is found, the role of imaging is characterisation with differentiation among renal cell carcinomas (RCC), angiomyolipomas (AML) and oncocytomas (OCT). There are various histologic subtypes of RCCs with clear cell type (ccRCC) being the most common, which is usually hypervascular and shows strong heterogeneous contrast enhancement in early-phase CT. Papillary type (papRCC) or chromophobe type (cpRCC) commonly shows more homogeneous and less strong contrast enhancement, and it may be difficult to distinguish from minimal fat AML (mfAML) or OCT. The diagnosis of AML is straightforward if it has gross fat, but not infrequently AML does not have enough fat that can be visible at CT or MRI. There has been number of studies focusing on differentiation between mfAML and RCC using various criteria. Renal OCT is the second most common benign renal parenchymal tumour after AML. Central stellate scar with spoke-wheel pattern of arterial enhancement have been reported as characteristic imaging findings of OCT, but those findings are usually not seen when OCTs are small. Recently segmental enhancement inversion (SEI) during corticomedullary and excretory phase CT images was reported as a characteristic enhancement pattern of small OCTs. Still preoperative imaging characterisation of small solid renal tumours is an unsolved and ongoing issue, but familiarity with findings at multimodality imaging studies will be helpful.
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-196 09:30
C. Acute and chronic renal infection
J. Lopes Dias; *Lisbon/PT (joaolopesdias85@gmail.com)*

Acute pyelonephritis is a frequent condition associated with significant morbidity. The diagnosis is established on clinical and laboratory data. Imaging is not usually recommended on uncomplicated infections and should be reserved for patients in whom treatment has failed or those who have recurrent or severe symptoms. US is usually the first choice in paediatrics and young adults; however, it has low sensitivity in this setting. CT is the gold standard for the initial approach and follow-up of renal infections. MRI may be useful in patients with contraindications to iodinated contrast administration and particularly in paediatric, pregnant, and kidney insufficiency patients to whom DWI might be a valuable choice. Patients with disorders predisposing to infection may benefit from early imaging. Particular attention should be provided to diabetics, who are prone to develop severe complications and emphysematous pyelonephritis. Immunocompromised patients like those with HIV infection or renal transplants also deserve a prompt imaging evaluation. For differential diagnosis purposes, it is mandatory to recognise typical AIDS nephropathy findings, as well as normal post-transplant and rejection features. Paediatric population has also some particularities. Due to vesicoureteral reflux of infected urine during childhood, some patients develop chronic pyelonephritis. Initially, imaging is essential to identify predisposing congenital anomalies and later to evaluate parenchymal damage with scarring/atrophy. The essential role of imaging is to identify potential complications, guiding patients towards adequate treatment as there are some imaging patterns that highly suggest particular conditions like pyonephrosis, emphysematous and xanthogranulomatous pyelonephritis, fungal infection, renal abscess, or renal tuberculosis.
Learning Objectives:
1. To learn about the different etiologies 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.

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

E³ - ECR Academies: Interactive Teaching Sessions

E³ 621
The treated liver

A-197 10:30
A. Imaging of liver transplantation
J.B. Karani; *London/UK (john.karani@nhs.net)*

Liver transplantation is the accepted treatment of patients with irreversible liver cell failure and some metabolic disorders and in a selected group of patients with hepatocellular carcinomas. Over the last decade, major transplant centres have reported improving survival rates, though during this period they have developed more complex surgical techniques, including split-liver, auxiliary and live-related transplantation, and have treated more marginal higher risk patients. This successful outcome has been dependent on appropriate recipient selection, robust surgical technique, improvements in immunosuppression and intensive care management and the prompt recognition and treatment of complications. Diagnostic and interventional radiology have been core specialties in achieving the goals of improved graft and patient survival. Improvement in surgical techniques has decreased the more common vascular and biliary complications, but the newer techniques present differing diagnostic and interventional challenges, particularly in paediatric recipients. Developments in MR and MDCT allow many of these vascular, biliary and infective complications to be diagnosed non-invasively. Vascular techniques of angioplasty and stent placement may reverse the sequel of graft ischaemia or portal hypertension. MRC allows the diagnosis of biliary strictures that may be treated by dilatation or stent placement. Imaging is also important in the diagnosis of recurrent disease and the acquired diseases of prolonged immunosuppression including atypical infections and the post-transplant lymphoproliferative disorders (PTLD). This interactive session will present these appearances by case example and provide guidance of the appropriate diagnostic and treatment paradigm.
Learning Objectives:
1. To understand the common imaging findings after liver transplantation.
2. To recognise significant complications following liver transplantation.

A-198 11:15
B. Imaging of treated liver tumours
I. Bargellini; *Pisa/IT (irenebargellini@hotmail.com)*

Accurate radiological assessment of tumour response after systemic or loco-regional treatments is essential for patients' prognosis and management and clinical investigation. After extensive validation, conventional uni-dimensional (i.e. RECIST 1.1) or bi-dimensional (i.e. WHO) criteria have gained worldwide acceptance for the assessment of metastatic liver lesions treated with conventional systemic chemotherapy. On the other hand, radiologists are facing the challenge of a rapidly evolving scenario with the introduction of new drugs and the widespread use of percutaneous and intra-arterial therapies. In this setting, conventional criteria based on the modification of the overall tumour size seem to lack the required accuracy to evaluate tumour response, particularly in the early follow-up. For hepatocellular carcinoma, these limitations have been overcome by the introduction and validation of modified criteria (such as, modified RECIST and EASL criteria) that take into account only the variation of the viable tumour, recognised by the contrast uptake in the arterial phase of a dynamic cross-sectional study. However, these modified criteria have limitations when dealing with newer treatment modalities, such as molecular-targeted agents and Y90-radioembolisation, and they cannot be extended to non-hypervascular lesions. Thus, there is an increasing interest in developing imaging biomarkers (for instance, diffusion and perfusion imaging, FDG activity, dual source CT) and translating their use in clinical practice. The work of radiologists is, therefore, rapidly changing with an increasing unmet need for tailored radiological response criteria that should be designed considering the specific tumour type and the specific treatment modality.
Learning Objectives:
1. To understand the common imaging findings after chemotherapy for liver tumours.
2. To recognise common imaging findings after radiofrequency ablation of liver tumours.
3. To be aware of the common imaging findings following transarterial treatment of liver tumours.

10:30 - 12:00 **Studio 2015**

E³ - Rising Stars Programme

Basic 2: Neuroradiology

A-199 10:30

Aging and degeneration in the brain

B. Gómez-Ansón; *Barcelona/ES (bgomeza@santpau.cat)*

Cognitive decline/dementia is an increasingly important public health issue in Europe. It is now well accepted that the healthy aging process of the brain can be well differentiated from neurodegenerative conditions causing cognitive decline/dementia, such as Alzheimer´s disease. There is postmortem evidence about the macroscopic changes aiding in this differentiation, and their correlation with in vivo brain imaging. On the other hand, inflammation in the brain has specific aspects, which are different from the rest of the body. These aspects determine the imaging findings that we can observe in the brain in infectious/inflammatory conditions. Brain inflammation is part of a maintenance programme, and in this regard, a novel approach has arisen, where neurodegenerative processes may be viewed as a failure of these brain repair mechanisms. The translation of this approach to imaging is attempted during this talk. In particular, the coexistence of inflammatory and degenerative imaging changes in conditions that eventually cause cognitive decline/dementia is discussed in detail. A few clinical cases supporting this conceptual framework are presented. The relevance for novel treatment strategies is also discussed.

Learning Objectives:

1. To present basic knowledge of imaging findings of the brain in healthy aging.
2. To discuss imaging findings in brain inflammation.
3. To present a new conceptual framework, where neurodegenerative processes may be viewed as a failure of brain repair mechanisms.
4. To translate this conceptual framework to imaging findings in the brain.

A-200 11:00

Brain trauma

M. Stajgis; *Poznan/PL (stajgis@gmail.com)*

Aetiologies of TBI are highly associated with age; children suffer from abuse and falls mostly, young patients are the victims of motor-vehicle accidents or sport/recreation activities, falls only are the most common in elderly patients. TBI encompasses a wide, heterogeneous group of intracranial injuries that includes acute primary insults occurred at the time of impact and secondary ones such as cerebral swelling or herniation. Accurate and proper diagnostic imaging is critical for diagnosis and further successful management in all patients with TBI. Noncontrast CT is still the "gold standard" imaging modality in acute setting, because it identifies intracranial extravasation immediately. This noncontrast phase is mandatory in whole body CT protocol dedicated for polytrauma patients. Characteristic patterns of epidural, subdural and subarachnoid haemorrhage (extra-axial) as well as cortical contusion and intraparenchymal haematoma will be presented. Traumatic axonal injury (TAI) is another, severe clinical condition with only minimal or complete absence of morphological changes on CT images. The role of magnetic resonance imaging with specific sequences in this group of patients will be discussed. Conventional MRI sequences in patients with brain trauma are less sensitive than CT in detection of hyperacute and acute intracranial bleeding. However, FLAIR technique is capable to detect even small amount of extravasated blood. Susceptibility-weighted imaging (SWI) is mandatory in evaluation of microhaemorrhages, together with DWI they play an important role in detailed diagnosis and prognosis of outcome of patients with severe form of TBI. Several open questions to the audience will be asked during the lecture.

A-201 11:30

Vascular malformations

P. Vilela; *Almada/PT (ferrovilela@sapo.pt)*

Vascular malformation is a name given to several types of vascular diseases and although it should be used only for congenital conditions, its use widespread for congenital and acquired lesions. The major differential diagnosis is made with vascular tumours such as the haemangiomas, and vascular variants. Vascular malformations may involve the arteries, capillaries, veins or the lymphatic vessels and are divided according to the major vascular component affected in arterial, arterio-venous capillary and venous and also in lymphatic and mixed types. Some vascular malformations are associated with congenital syndromes and several genetic errors accounting for the familiar forms of different types of malformations. For the congenital vascular malformations, the earlier the vascular development defect occurs, the larger the morphological expression (phenotypic) of the vascular malformation will be. The authors review the most important clinical and imaging features of the most common vascular malformation, such as the arteriovenous (vein of Galen aneurysmal malformation, pial AVM and dural AVF), capillary (capillary telangiectasias), venous (dural sinus malformations, cavernomas and venous malformations) illustrating the spectrum of changes that can be found from a metameric lesion to a focal sporadic lesion.

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

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

MC 628

Chest emergencies

Moderators:
S. Mirvis; Baltimore, MD/US
A. Palkó; Szeged/HU

A-202 10:30

A. Thoracic injuries

S. Mirvis; *Baltimore, MD/US (smirvis@umm.edu)*

Chest injuries account for 25% of traumatic deaths with aortic injury, the second most common aetiology in vehicular collisions. MDCT is both readily available and highly accurate for diagnosis of major thoracic injuries. While the chest radiograph has a subordinate role, many institutions still obtain this study initially to identify potential life-threatening injuries as tension pneumo or haemopericardium, massive haemo- or tension-pneumothorax and major herniation through diaphragm disruption. Focused, distinct evaluation of support and monitoring devices, osseous injury, pleural spaces, lungs, heart and mediastinum is essential. MDCT studies should be performed with intravenous contrast optimised for detection of major arterial injury. Mediastinal haemorrhage may be an isolated finding, but has significant association with arterial injury. Aortic injuries cause 16% of deaths in vehicular collisions and only 15% of passengers survive to reach medical care. Major vascular injuries span from intimal flaps and intramural haemorrhages, that can typically be managed without intervention, to pseudoaneurysms requiring stent-grafts. Pulmonary contusions are common, typically peripheral or paraspinal, geographic in contour and contain numerous punctate haematomas. Lacerations are almost always present. Shear forces, direct impact, pleural adhesions and fractured ribs are aetiologic. Haemo and pneumopericardium can be rapidly fatal via cardiac filling restriction. Rarely, mediastinal bleeding can result from major venous injuries including vena cavae and azygous systems. Deformity and/or elevation of a hemidiaphragm with cardiac shift indicate abdominal content herniation through a torn hemidiaphragm. MDCT can directly verify this diagnosis by revealing torn diaphragm edges and focal constriction of herniated structures.

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-203 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 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-204 11:30

C. Interactive case discussion

S. Mirvis[1], C.M. Schaefer- Prokop[2]; [1]*Baltimore, MD, MD/US*, [2]*Amersfoort/NL*

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

E³ - ECR Academies: Diagnostic Urogenital Radiology

E³ 620

Retroperitoneum and adrenals

Moderator:
F.M. Danza; Rome/IT

A-205 10:30

A. Anatomy and imaging techniques of the retroperitoneum

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

The retroperitoneum can be divided into four anatomical sub-compartments: the anterior pararenal space, the posterior pararenal space, the perirenal space, and the space surrounding the aorta and inferior vena cava. Retroperitoneal spaces and ligaments serve as boundaries for disease processes and as conduits for the spread of disease. Knowledge of these structures is important for accurate reporting and staging of diseases, i.e. infectious, inflammatory, neoplastic and traumatic processes. Current CT and MRI technology offer excellent insight into imaging of the retroperitoneum and dedicated protocols enable reliable assessment of retroperitoneal structures. Advantages of CT compared to MRI are the higher resolution and the fast examination time. For best quality of subsequent reconstructions isotropic imaging is advised. In both modalities it is essential to assess the retroperitoneum in three planes: coronal, axial, and sagittal. In the last years, MRI gained importance in the evaluation of retroperitoneal diseases, particularly in oncologic imaging. The advantage of MRI consists in its outstanding soft tissue contrast that helps to identify small nodular disease or slight fluid collections. The lack of radiation exposure renders it superior for the assessment of children. Disadvantages are the longer examination time and increased motion artifacts caused by bowel motion. Furthermore, air in the bowel structures induces susceptibility artefacts, in particular at higher field strength 3 Tesla devices.

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-206 11:00

B. Differential diagnoses of retroperitoneal masses

M.-F. Bellin, L. Rocher; *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 noninvasively differentiate between masses is crucial. Based on the imaging characteristics, enhancement patterns and demographics, the differential diagnosis 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 including volumetric CT and multiplanar unenhanced and enhanced MRI acquisitions plays 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 be 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-207 11:30

C. Differential diagnoses of adrenal lesions

G. Heinz-Peer; *St. Pölten/AT (Gertraud.Heinz@stpoelten.lknoe.at)*

The increased use of imaging modalities has demonstrated the presence of varying sized mass lesions in up to 5% of individuals subjected to CT studies for reasons unrelated to adrenal dysfunction. When confronting an adrenal incidentaloma for which the diagnosis is not certain, one must address the adverse outcomes by which the patient can potentially be harmed: morbidity or mortality from hormonal excess or cancer and the anxiety that comes from knowing about a tumour which might cause problems in the future. The differential diagnosis of an incidentally discovered adrenal mass is extensive. Incidental adrenal findings by their very nature pose a risk of overdiagnosis and overtreatment. Although most adrenal incidentalomas are of no significance beyond the anxiety they produce indirectly. Some incidentalomas are clinically significant, and inadvertently leaving them alone might damage the patients' health. CT and MR imaging are first choice in characterisation of adrenal lesions. Recently developed techniques of dual energy CT and histogram analysis may offer additional information. The value of PET and PET/CT has already been proven. Other new functional imaging techniques such as perfusion, diffusion-weighted imaging and MR-spectroscopy may play an important role in lesion characterisation. Most of adrenal masses can be characterised with accuracy of > 90% using these techniques. In this talk, strengths and limitations of established and novel imaging techniques in adrenal mass imaging and characterisation of adrenal masses will be addressed. A comprehensive imaging algorithm and the clinical management of an incidental mass will be considered.

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.

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

Plenary Session

HL 1

Josef Lissner - Honorary Lecture

Presiding:
B. Hamm; Berlin/DE

A-208 12:15

Is the 'Art of Medicine' dead in the era of population health management?

J.A. Brink; *Boston, MA/US (JABRINK@partners.org)*

Specialists may leverage several strategies when seeking to manage population health. For radiologists, reducing variation in the imaging examinations that we recommend and how we report key findings has the potential to support more uniform and appropriate care at the population level. Underutilisation of medical imaging risks decrements in the health of our population while overutilisation leads to increased cost and heightened morbidity from unnecessary follow-on imaging and interventional procedures. Moreover, increased precision in the quantitative nature of our reports promises to yield more effective treatments as therapies are personalised to precise patient phenotypes and disease states. Appropriateness criteria and referral guidelines take the guesswork out of which tests to recommend, and imaging-based care algorithms narrow the range of recommendations that referrers may receive in response to a clinical imaging scenario. However, such changes to our practice threaten the 'art of medicine' where intuition plays an important role in establishing diagnoses and understanding disease severity. Art can take many forms, ranging from the cubism of Picasso to the realism of da Vinci. The transition from personal impression to consensus and fact-based conclusion in the tests we recommend and the reports that we generate mirror the transition from abstract art to photorealism. The increase in precision does not make 'art' any less artistic; rather, it is simply based on a different set of principles. In the era of population health management, the art of medicine is not dead; it is just different.

Learning Objectives:
1. To learn the principles of population health management.
2. To consider the impact of variation in the practice radiology on population health.
3. To understand the potential roles that radiologists can play to improve population health.
4. To study the impact of these changes on the art and science of medicine.

Author Disclosure:
J.A. Brink: Board Member; American College of Radiology.

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

E³ - The Beauty of Basic Knowledge: Breast Imaging

E³ 25B

Cracking the mystery of needles and gauges

Moderator:
J. Camps Herrero; Alzira/ES

A-209 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 facilitates 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.

Author Disclosure:
R.M. Pijnappel: Advisory Board; Hologic.

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

E³ - The Beauty of Basic Knowledge: Skeletal Radiology

E³ 24B

The concept of degeneration: the tendons

Moderator:
V. Cassar-Pullicino; Oswestry/UK

A-210 12:30

The concept of degeneration: the tendons
K. Bohndorf; *Vienna/AT*

Tendons are the strongest component of the musculo-tendinous-oseous unit. Healthy tendons are fibroelastic structures and are composed of collagen, different proteoglycans and mostly water (> 50% of tendon weight). Ultrasound and MRI are excellent tools to diagnose normal and abnormal tendons. It will be explained why MRI shows the tendons to be black, despite the high water content. Quantitative and morphological MRI of the tendon and its substructures are highly dependent on MR methodology (sequences, field strength, etc). Factors will be discussed to understand optimal MR imaging of the tendon. In tendon degeneration there are areas consisting of mucoid or fatty degeneration with a disorganised collagen structure. With progression, there is coalescence of microscopic foci of mucoid material, collagen fiber separation, and disruption. The degeneration can progress to the stages of microtears, intrasubstance tear, partial tears, and complete tears. A continuum concept of degeneration of the tendon will be presented. MRI findings of tendon degeneration start of foci of mildly increased signals within the tendon, often longitudinally orientated. There is correlation between the histological findings of mucoid degeneration and chondroid metaplasia and increased tendon signal on MR images in water-sensitive images. Important imaging findings related to tendon degeneration such as mineralization and cystic changes at the insertion site which will be addressed.

Learning Objectives:
1. To learn about ultrastucture and anatomy of tendons.
2. To understand the concept of degeneration.
3. To understand imaging features of tendon degeneration.

Author Disclosure:
K. Bohndorf: Author; Educational Books.

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

E³ - ECR Academies: Interactive Teaching Sessions

E³ 721

The treated spine and joints

A-211 14:00

A. Imaging of the postoperative spine
P.N.M. Tyrrell; *Oswestry/UK (prudencia.tyrrell@rjah.nhs.uk)*

Spinal surgery is most frequently performed to decompress (disc herniation, stenosis, malignant infiltration), to fuse and stabilise (particularly following trauma or infiltrative destructive processes) and to correct deformity. Often there may be a combination of these procedures at one operation. Surgical instrumentation or bone graft is sometimes employed. Patients presenting with symptoms post-operatively may be early or late relative to the procedure. This interactive session seeks to address the variety of surgical procedures which are undertaken and subsequently imaged post-operatively as a result of symptoms. The session aims to help one to understand and become familiar with the expected post-operative imaging appearances related to the surgical procedure and to learn about abnormal pathological features as a cause of symptoms in the acute and more chronic situation and to explore the diagnosis and differential diagnosis. This may include post-operative fibrosis versus recurrent disc herniation versus post-operative infection. Failure of fusion due to failure of instrumentation or inadequate take of bone graft can give rise to pseudoarthrosis. Recurrent symptoms sometime following a fusion may be due to the development of vertebral instability at the level above. Recurrent stenotic symptoms may relate to an inadequate decompression, recurrent disc herniation, post-operative haematoma, extension of a malignant process, or ischaemic damage.

Learning Objectives:
1. To understand changes related to surgery.
2. To learn about changes related to non-surgical treatments.

A-212 14:45

B. Imaging of joint replacement
M. Zanetti; *Zurich/CH (marco.zanetti@hirslanden.ch)*

Joint replacement surgery for the treatment of arthritis most often offers the patient excellent results. However, there are potential complications that a radiologist should know about. It is essential to understand the importance of pre- and postoperative imaging for evaluating patients. Most commonly standard radiographs are used to assess the patients after joint replacement. However, CT, nuclear medicine methods as well as MR imaging play an increasing role in such patients. The radiologist should be aware of the most common type of prosthesis and the most common complications after joint replacement. These complications include post-operative prosthesis loosening, prosthesis fractures, periprosthetic fractures, postoperative infection, rotation failure of the prosthesis, and soft tissue abnormalities such as surrounding tendon tears. This interactive session seeks to address the variety of joint replacements which are undertaken and subsequently imaged postoperatively as a result of symptoms. The session aims to help one to understand and become familiar with the expected postoperative imaging appearances related to the joint replacement and to learn about abnormal pathological features as a cause of symptoms in the acute and more chronic situation and to explore the diagnosis and differential diagnosis.

Learning Objectives:
1. To learn about changes related to surgery.
2. To understand changes related to non-surgical treatments.

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

EuroSafe Imaging Session

EuroSafe 1

Clinical Decision Support: making imaging referral guidelines work for patients, doctors and hospital managers

A-213 14:00

Chairman's introduction

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

Imaging referral guidelines have been available for a long time; the American college of radiology began developing guidelines more than 20 years ago. However, their practicality and accessibility has been limited, and consequently the use of imaging referral guidelines has been inadequate, leaving ample room for improving optimisation and appropriateness. IT solutions such as clinical decision support are a useful tool to address these problems. Developing guidelines in a CDS-compatible format means that recommendations can be kept up to date with the latest scientific evidence, rather than conducting major overhauls only every few years. Recommendations can also be adapted to regional circumstances, such as the availability or quality of the available imaging equipment, or even tailored to institutional settings. This flexibility makes localisation at different levels possible, which is crucial for the acceptance of guidelines and their implementation in daily practice. In the US, 'ACR Select' and other CDS products have been implemented in numerous hospitals with promising results. The ESR has decided that Europe should follow suit, and it is developing a CDS system for Europe in cooperation with the ACR and the national decision support company, adapting the US criteria to the European setting as a first layer of localisation.

Session Objectives:

1. To understand the impact of Clinical Decision Support on the development of imaging referral guidelines.
2. To learn about the localisation of evidence-based imaging referral guidelines.
3. To learn about the implementation of ACR Select as a case study from the US.
4. To learn about the introduction of ESR iGuide, a CDS product for imaging referral guidelines in Europe.

A-214 14:05

CDS impact on guidelines development

K.J. Dreyer; *Boston, MA/US (kdreyer@partners.org)*

This session will present the changes required in appropriateness use guideline during the preparation of and implementing for clinical decision support systems. Case studies will be given for applications of the ACR appropriateness criteria as they are deployed at healthcare institutions within EHR systems throughout the United States.

Learning Objectives:

1. To understand the process of developing imaging referral guidelines for use in a CDS system.
2. To understand the different impacts text-based and IT-based guidelines have on clinical practice.
3. To learn about the advantages of CDS for updating and revising guidelines.

A-215 14:23

Adapting and updating guidelines

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

Imaging referral guidelines can help the clinician choose the most appropriate imaging exam. Available guidelines 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 and updating these on an ongoing basis. Since the American college of radiology (ACR) appropriateness criteria have been successfully introduced in the USA under the name ACR Select, the ESR entered into a partnership with ACR to adapt ACR Select to the European context. A team of ESR experts is currently reviewing the ACR appropriateness criteria to verify their compatibility with European standards and practices, and to adapt them where necessary. The review process includes a review of the clinical indications, the evidence tables, and the appropriateness ratings. Discordance between the ESR and ACR ratings are reviewed by the ACR rapid response committee to decide whether a Europe-specific rating should be used or whether a common consensus rating should be used. The desired short-term result is a generic set of evidence-based European guidelines. In the long-term, the goal of the ESR-ACR partnership is to develop a common set of global guidelines that are regularly updated by an international team of experts.

Learning Objectives:

1. To understand how guidelines can be adapted to regional/local/institutional needs and circumstances.
2. To learn about the impact of non-scientific factors (financial, available equipment, legal) on otherwise evidence-based guidelines.
3. To understand the difficulties in moving towards guidelines with common terminology and standards.

A-216 14:41

ACR select implementation experience

J.A. Brink; *Boston, MA/US (JABRINK@partners.org)*

Appropriate imaging exam selection can be facilitated through the use of tools designed to reduce variation among practices. One such tool is the appropriateness criteria produced by the American college of radiology (ACR) that identifies the most appropriate imaging examination for a particular clinical condition. The use and adoption of appropriateness criteria is maximised if they are available at the point of care. Computerised order entry with decision support offers the opportunity to make these tools available to the clinician at the point of order entry. Proof of their effectiveness is growing - at the Massachusetts general hospital, a decision support system coupled with computerised order entry has been shown to reduce the growth rate of imaging utilisation. At the Virginia Mason clinic, inappropriate utilisation of advanced imaging tests was decreased for certain clinical conditions, including lumbar MRI for low-back pain, head MRI for headache, and sinus CT for sinusitis, by use of decision support tools at the point of order entry. The ACR is now providing electronic access to the appropriateness criteria through a system called "ACR Select" enabling electronic medical record and medical information technology vendors to access the appropriateness criteria electronically for incorporation into decision support products. These developments are encouraging and bode well for the future of decision support as a means to curb the inappropriate use of medical imaging and the associated risks of ionising radiation.

Learning Objectives:

1. To appreciate the advantages of implementing CDS in practice.
2. To understand the challenges in management and medical practice of introducing CDS.
3. To become familiar with real-life case studies.

Author Disclosure:

J.A. Brink: Board Member; American College of Radiology.

A-217 14:59

ESR iGuide

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

The ESR has launched a project to introduce a CDS system for evidence-based imaging referral guidelines on the European market - ESR iGuide. It is only through an IT-based solution that guideline use can be improved, with the additional benefit that a common core set of guidelines will harmonise standards across different countries - ironing out unnecessary discrepancies in national recommendations - while retaining the flexibility for adaptations to national, local or institutional requirements. The American college of radiology (ACR) has pioneered the use of CDS in the US and transformed its appropriateness criteria for use in a system called ACR select, developed by the national decision support company (NDSC). And, instead of reinventing the wheel by creating guidelines from scratch or arduously comparing different national guidelines, the ESR has decided to utilise the American experiences with CDS by entering into collaboration with ACR and NDSC. While the ESR and ACR's ultimate goal is to have a global set of guidelines that will establish a common core valid on all continents, the purpose of the ESR's immediate project for Europe is to 'Europeanise' the ACR appropriateness criteria, that is conducting a thorough scientific review and adapting the criteria to European standards of practice. Overseen by a dedicated methodologist and with active cooperation from the ACR, it is expected that the process of 'Europeanisation' will also be a first step towards aligning terminologies and establishing common standards of indication.

Learning Objectives:

1. To learn about the specific challenges of developing guidelines for the heterogeneous European market.
2. To become familiar with the process of adapting the ACR Appropriateness Criteria to the European setting.
3. To learn about the potential benefits of implementing CDS into clinical practice in Europe.

15:17

Discussion

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

ESOR Session

Striving in radiological education

Moderators:
L. Bonomo; Rome/IT
N. Gourtsoyiannis; Athens/GR

A-218 14:00

Introduction
L. Bonomo; *Rome/IT*

One of the major commitments of the ESR regards education. As we have noticed over the past few years, the path of radiological education in Europe is very patchy, due to the lack of homogeneity in the policies of each European country. One of the most undeniable aspects is that the length of training varies a lot depending on the country. In order to deal with such situation, ESR and its flagship society ESOR have been very active, seeking to harmonise radiological education in Europe and raise standards in the field of scientific radiology, focusing on the future of the next generation of radiologists.
Session Objectives:
1. To understand the importance of a homogenous education path in each European country and its impact on young radiologists' training.
2. To illustrate which steps ESR and ESOR are going to take in the future to implement the education project.

A-219 14:05

ESOR in action 2015
N. Gourtsoyiannis; *Athens/GR*

A-220 14:15

The role of the European Training Curriculum: present and future
B. Ertl-Wagner; *Munich/DE (birgit.ertl-wagner@med.uni-muenchen.de)*

ESR strives to harmonise training in radiology throughout Europe. The European Training Curriculum for radiology recommends a five-year training period, consisting of Level I training for the first three years followed by two years of a more flexible Level II training scheme with potential special interest rotations during the last two years. Its content is based on knowledge, skills, competences and attitudes. The European Diploma in Radiology (EDiR) can be undertaken after a five-year training period in radiology. In addition to the Level I and II curricula of the ETC, level III curricula for subspecialty training and an undergraduate (U level) curriculum are currently being developed. The European Training Curricula in Radiology shall aid in homogenising training concepts and curricular planning in the various nations.

A-221 14:35

Spoon-feeding: present and future
P.R. Ros; *Cleveland, OH/US (Pablo.Ros@UHhospitals.org)*

"Spoon feeding" is the descriptive term referring to teaching centred on the teacher at the expense of the students learning process. Therefore, the teacher acts as a knowledge dispenser for passive students. Spoon feeding occurs most commonly both in traditional lectures and small teaching seminars when the teacher deliberately provides the answers to the students' questions. Spoon feeding is the most common teaching situation in medicine and radiology. There are many advantages to traditional lecturing. Lectures need little preparation as the lecturer is an expert in the field. Good teachers traditionally deliver the best lectures. Plus, once a lecture is delivered there is no need for much preparation for the following delivery of the same lecture. In addition lectures are both economic and effective because its content can be delivered to a large class. From the student's perspective, traditional lectures are popular because there is no need for active effort. The main skill is to take notes and memorise the information for a potential test. Spoon feeding is good for the teacher's ego since the answers are given to the students and therefore the teacher is perceived as the one who knows. A clear limitation of spoon feeding is its lack to promote independent learning and creativity.
Author Disclosure:
P.R. Ros: Equipment Support Recipient; Philips, Departmental Support, Siemens, Departmental Support, Toshiba, Departmental Support.

A-222 14:55

E-learning portfolios: present and future
M. Maas; *Amsterdam/NL (m.maas@amc.nl)*

In light of competence-based teaching and learning and continuous professional development a shift towards an outcomes-based model is seen in postgraduate learning. With an increasing focus on the documentation of physician self-assessment and a commitment to lifelong learning, the use of e-portfolio as learning and assessment tool is generally increasing. In post-graduate healthcare education the use of portfolio learning focuses on supporting reflective practice, delivering summative assessment, and aiding knowledge management processes. The portfolio use in the arena is merely seen as a key connection between learning at organisational and individual levels (BEME guide 12). Concerning experience in radiology Deitte L (2009) described annual self-assessment and the development of a learning plan required components. However, without mentoring, there can be a high level of uncertainty amongst residents how to develop an individualised learning plan. Introductory steps are advised: establishing ground rules, orienting mentors and residents to learning portfolio, use learning portfolio as an assessment tool. Regular feedback from a mentor enhances the success of portfolio. So we as teachers and trainers should be aware of the lessons learned from portfolio use, including the demands on us needed to be successful.

15:15
Awards

14:00 - 15:30 **Room L 1**

EIBIR Session

EIBIR 1

The complexity of personalised breast care

A-223 14:00

Chairman's introduction
T.H. Helbich; *Vienna/AT (Thomas.Helbich@meduniwien.ac.at)*

Molecular medicine opens a lot of opportunities. The imaging community has the chance to have a major impact for optimised diagnoses and therapy of individual patients. "P4 Medicine" stands for personalised, predictive, preventive, participatory and seems to play a pivotal role in the future. This talk will focus on P4 medicine and its relation to breast imaging. Three questions will be answered during the talk. 1. What can we offer already? 2. Which lessons have been learned? 3. Is there need for improvement?
Author Disclosure:
T.H. Helbich: Research/Grant Support; Siemens, Hologic, Bracco.

A-224 14:15

Breast cancer epidemiology and control - one size does not fit all
I. dos Santos Silva; *London/UK*

Breast cancer is the most common female cancer worldwide and its incidence is set to continue to rise globally as a result of population growth, increases in life expectancy and shifts in lifestyles in the direction of an increased risk profile. Most of the increase will occur in low and middle-income countries. The aetiology of breast cancer is a complex interplay between genetic and non-genetic factors, with the latter acting at (and accumulating through) different stages in life, extending from the prenatal period to late adulthood. But despite our extensive knowledge of the aetiology of this cancer, the scope for primary prevention is currently limited as most known non-genetic risk factors are not amenable to change in modern societies. Breast screening reduces mortality but controversy exists regarding the overall benefit:harm ratio. Current screening strategies are based on a "one-size-fits-all" principle, but mammographic screening with a single imaging modality and a fixed screening interval for all women may not be optimal. A tailored approach, based on a woman's individual risk, may improve screening outcomes while ensuring that resources would be used more efficiently (e.g. resources saved screening low-risk women could be used for more intense screening of higher-risk women). In particular, mammographic density, one of the strongest breast cancer risk factors and a major determinant of sensitivity to screening mammography, offers the potential to be used, alone or in combination with other risk factors, to tailor screening intensity according to a woman's risk.
Learning Objectives:
1. To learn about the complex interplay of genetic and non-genetic risk factors on the aetiology of breast cancer.
2. To understand how factors throughout a woman's life affect her breast cancer risk.
3. To appreciate the way epidemiological research may inform breast cancer control strategies and clinical decision making.

A-225 14:45

VPH-PRISM aiding the therapy decision making process by quantitative evaluation of personal imaging and non-imaging data

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

Decision making for breast cancer therapy today is a multi-disciplinary endeavour. Experts discuss each case in tumour boards based on the collected clinical evidence. This usually includes images as a prime source of information: radiological ones and multiply stained histopathology sections of specimen. While the quantitative analysis of radiological images has already left the research labs, this is not true for histopathology image assessment. We discuss how to add quantitative, reproducible, robust parameters from histopathology images to the comprehensive quantitative assessment. Moreover, spatially resolved pathology parameters can be spatially coregistered and jointly assessed with radiological parameters using advanced image registration methods and the concept of a standard breast model. We show how risk factors that pertain to the patient as a whole and that may change during the life course are integrated into the same parameter database and computational framework. Together, this comprehensive, longitudinal, interdisciplinary quantitative assessment will enable research into the predictive power of multi-disciplinary data, apt to change the way case-based decisions improve personalised breast cancer care in the future.

Learning Objectives:

1. To inform 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-226 15:00

Stroma and peritumoural stiffness: latest evidence for its importance and novel stroma imaging approaches to predict therapy response

A. Evans; *Dundee/UK (a.z.evans@dundee.ac.uk)*

In recent years, it has been recognised that peri-tumoural stromal abnormalities are important with regard to tumour progression, response to treatment and long term outcome. Shear wave elastography (SWE) allows quantitative and reproducible measurement of peri-tumoural stiffness. Such stiffness has recently been shown to be an independent predictor of lymph node metastasis. We hypothesised that such peritumoural stiffness may also be related to response to neoadjuvant chemotherapy (NACT). In a cohort of 80 patients receiving NACT associations were sought between pre-treatment peritumoural stiffness values and response to NACT as measured by residual cancer burden (RCB) scores and its components. We found significant associations between high pre-treatment, peri-tumoural stiffness and poor response of the primary tumour to NACT. No association was found between response of axillary metastases and the stiffness of the primary lesion. When a sub-analysis analysis was performed according to breast cancer subtype, prediction of response was strongest in HER-2 positive and luminal tumours.

Learning Objectives:

1. To appreciate the importance and role of the tumour-surrounding tissue to promote or prevent cancerous growth.
2. To learn about the microscopic and macroscopic tissue alterations in the stroma occurring during cancer growth.
3. To understand the yield of imaging these changes for early detection, differential diagnosis, and therapy success prediction.

Author Disclosure:

A. Evans: Other; Supersonic Imagine, BARD, Siemens.

A-227 15:15

Personalised treatment decisions: how to reason using multi-modal, multi-disciplinary data

R.M. Mann; *Nijmegen/NL (ritse.mann@radboudumc.nl)*

Medical practice related to breast cancer is in general unimodal, or at least very hierarchical. When a woman is at increased risk, the screening regimen might be changed, but as soon as a lump is detected, standard practice switches to triple assessment and the risk profile is largely ignored. Similarly, extensive imaging evaluations might be performed to document extent of disease but for any adjuvant treatment only histopathological features are taken into account. It is obvious that in this fashion very relevant information with proven predictive capacity is lost. To be able to use all information available during every step of the therapy, it is essential to understand how all these features interact. Subsequently, it is also necessary to understand how features change from situation to situation. A clear example at the micro-level is the change of breast lesion position during palpation, imaging studies and surgery. The integration of imaging findings and spatial positioning techniques may allow for much better surgical planning. Similarly, integration of personal factors, imaging characteristics and histopathological analysis might allow a much better prediction of metastatic potential of breast cancers and consequently might reduce the unnecessary chemotherapy that is currently given to many women. In this lecture reasons and methods for data integration to optimise breast cancer therapy will be discussed. This has great potential to better understand breast cancer behaviour and optimise breast cancer therapy.

Learning Objectives:

1. To understand the importance of carefully selected imaging protocols in reliable diagnosis and decision making.
2. To learn of the integration of multi-disciplinary data in the decision making process.
3. To understand the technical issues and potential solutions for automated sense-making in multi-disciplinary, multi-modal data.

Author Disclosure:

R.M. Mann: Speaker; Siemens, Bayer.

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

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

MC 728

CNS emergencies

Moderators:
S. Mirvis; Baltimore, MD/US
A. Palkó; Szeged/HU

A-228 14:00

A. CNS trauma and neurovascular injury

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

A practical imaging approach to brain and neurovascular trauma will be reviewed, with an emphasis on understanding the correlation between pathophysiology and imaging signs. Guidelines on when to order acute neurovascular studies will be presented. Special technical considerations to help optimise CT and MR imaging protocols for suspected brain injury, CNS haemorrhage, and arterial dissection will be discussed.

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; Bracco, Genentech, Gore, Lundbeck.

A-229 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 (CT/MRI) 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-230 15:00

C. Interactive case discussion

H.A. Rowley[1], M. Smits[2]; [1]*Madison, WI/US*, [2]*Rotterdam/NL*

Learning Objectives:
1. To learn about traumatic brain injury (TBI) and non-traumatic neurological emergencies.
2. To become familiar with imaging manifestations of TBI and non-traumatic neurological emergencies.
3. To understand the clinical implications of radiological imaging findings in TBI and non-traumatic neurological emergencies.
4. To learn about the state-of-the-art radiological imaging options for the assessment of acute TBI and non-traumatic neurological emergencies.

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

E³ - ECR Academies: Diagnostic Urogenital Radiology

E³ 720

Prostate

Moderator:
J.J. Fütterer; Nijmegen/NL

A-231 14:00

A. Ultrasound of the prostate

J. Venancio; *Lisbon/PT (josevenancio@netcabo.pt)*

Normal prostate gland is approximately 20-25 g in volume, 3 cm in length, 4 cm wide, and 2 cm in depth. As men get older, the prostate gland is variable in size secondary to benign prostatic hyperplasia. The prostate is a cone-shaped gland located between bladder and penis, with its base directed toward the bladder. Prostate zonal anatomy (Mc Neal), is composed of three glandular zones (central, transition and peripheral) and two non-glandular zones (anterior fibromuscular stroma and prostatic urethra). Tumour location is 70% in PZ, 20-25% in TZ and 5-10% in CZ. Prostate cancer is the non-cutaneous most common malignancy and the second leading cause of cancer-related mortality after lung cancer in men worldwide. Transrectal ultrasound (TRUS) is used to image prostate in benign and malign conditions, but its main interest is the diagnosis of prostate cancer. Currently DRE, PSA (a non-specific blood test), and TRUS are used in the entrance diagnostic tools. Frequency of probes for TRUS ranges from 5 to 12 MHZ, with 2 or 3 planes, end view or side view. TRUS clearly defines the PZ from other glandular zones where it is more difficult to see the classic appearance of prostate cancer: hypoechoic lesion in the PZ. Besides gray-scale ultrasound, we can use colour and power-Doppler ultrasound, contrast-enhanced ultrasound and elastography. Actually the main interest of TRUS in the diagnosis of prostate cancer is to guide biopsy under local anaesthesia and prophylactic antibiotics (detect potential cancer, its extent, volume and aggression). Several biopsy schemas are used.
Learning Objectives:
1. To become familiar with the technical requirements to perform US of the prostate.
2. To learn about the anatomy of the prostate.
3. To understand to detect suspicious lesions for ultrasound-guided biopsy.

A-232 14:30

B. Multiparametric MRI of the prostate

G.M. Villeirs; *Gent/BE*

Prostate multiparametric magnetic resonance imaging (mpMRI) combines morphologic T2-weighted MRI (T2w) with at least two functional techniques: diffusion-weighted MRI (DWI) as a marker of cellular density, dynamic contrast-enhanced MRI (DCE) to assess neoangiogenesis, and magnetic resonance spectroscopic imaging (MRSI) to assess tumour metabolism. The minimal technical requirements for these imaging tools have been described in the ESUR guidelines (Eur Radiol 2012;22:746). 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 in the central gland. PIRADS (prostate imaging reporting and data system) is a standardised reporting system, assigning a 1 (very unlikely) to 5 (very likely) probability score for cancer presence on T2w, DWI, DCE and MRSI, and a summary mpMRI probability score for harbouring clinically significant prostate cancer. Validation studies using this system have shown promising results (accuracy up to 86%) both in men with a negative prior biopsy and in biopsy-naïve men with increased PSA. Using a summary PIRADS cutoff scale of 4, a high sensitivity (> 90%) for detecting high-grade prostate cancer and a very high negative predictive value (99%) for excluding high-grade prostate cancer have been reported.
Learning Objectives:
1. To become familiar with technical aspects of DCE-MRI, DWI and MR spectroscopy.
2. To understand to recognise the advantages and limitations of each technique.
3. To understand to detect significant disease of prostate cancer in the peripheral zone.

A-233 15:00

C. Staging of prostate cancer

A.R. Padhani; *London/UK (anwar.padhani@stricklandscanner.org.uk)*

MRI has become increasingly used in the diagnosis and management of prostate cancer. With advances in multiparametric MRI (mpMRI) technology, such as the use of dynamic contrast-enhanced, diffusion-weighted imaging sequences and spectroscopy, observational studies have evaluated the utility for mpMRI in the continuum of prostate cancer management, from improving the detection of clinically significant prostate cancer, to planning radical prostatectomy and radiation therapy and the early detection of local recurrence. Furthermore, the potential for advanced imaging to reduce the burden of routine serial prostate needle biopsies for men on active surveillance is a promising area of research.
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.

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

E³ - ECR Academies: Interactive Teaching Sessions

E³ 821

Central nervous system changes after treatment: what you need to know

A-234 16:00

A. Drug-related conditions

F. Barkhof; *Amsterdam/NL (f.barkhof@vumc.nl)*

Systemic drugs can be used for the treatment of CNS and non-CNS diseases. Both classes can affect the brain inadvertently. Common general drugs that affect the brain in a bystander manner are steroids (~1% brain volume reduction), recreational drugs (alcohol, cocaine, heroin, XTC), metronidazole and anti-epileptic drugs (corpus callosum demyelination) and immunosuppressants such as cyclosporine/tacrolimus (PRES/RPLS) and methotrexate. Mechanisms of action include neurovascular compromise, fluid/metabolite shifts and toxic effects to myelin of other tissue components. Among CNS-targeted drugs, especially immunomodulating agents may cause specific side effects. Cytokine-release syndromes may occur with broad-acting agents such as general T-cell antibodies. Specific side effects may occur in multiple sclerosis, where treatment with natalizumab may cause reactivation of JC virus leading to progressive multifocal leukoencephalopathy (PML). Upon withdrawal of therapy this may then evolve into an immune reconstitution inflammatory syndrome (IRIS). In Alzheimer disease, novel antibodies or vaccinations against amyloid may cause amyloid-related imaging abnormalities (ARIA), which may present with microhaemorrhage on T2* images, or oedema and effusion on FLAIR.
Learning Objectives:
1. To understand changes related to systemic treatment.
2. To learn about CNS treatment agents.
Author Disclosure:
F. Barkhof: Advisory Board; Jansen Alzheimer Immunotherapy, Roche Pharmaceuticals, Novartis. Consultant; Biogen-IDEC, Toshiba Medical Systems.

A-235 16:45

B. Imaging of treated brain tumours

J. Alvarez-Linera; *Madrid/ES (jalinera@ruberinternacional.es)*

The objective of this session will be to review the diagnostic value of MRI sequences as well as the use of contrast in the monitoring of brain tumours, with special attention to gliomas. Many of the examples will address the advantages and limitations of advanced techniques: perfusion, diffusion, and spectroscopy. Immediately after the surgery, the main objective of the neuroimaging is to asses the degree of resection of the tumour. It may also be necessary to rule out complications such as haemorrhage, ischaemia or

infection.The fundamental technique is MRI with contrast in the first 48 hours, and also diffusion sequences. In late follow-up, the goal is to differentiate the changes secondary to treatment of those related to tumour progression or recurrence. In these cases, conventional sequences have important constraints and are useful for studies of diffusion, perfusion and spectroscopy. During follow-up after chemoradiotherapy, the objective is to assess tumour response. The response according to the new RANO criteria will be revised. The combination of chemotherapy and radiotherapy, as well the use of anti-angiogenic drugs may cause changes that complicate the assessment of the response to treatment: they will be referred to the concepts of pseudoprogression and pseudoresponse. In all these cases, the role of conventional MRI as well-advanced MRI techniques will be revised.
Learning Objectives:
1. To appreciate CNS manifestations after surgery.
2. To understand CNS changes after radiotherapy and other non-surgical treatments.

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

Special Focus Session

SF 8a

Advanced brain MRI techniques in paediatrics: toys or tools in daily practice?

A-236 16:00

Chairman's introduction
A. Rossi; *Genoa/IT (andrearossi@ospedale-gaslini.ge.it)*

The implementation of advanced MRI techniques into paediatric neuroimaging studies remains a challenge. The focus of this session is to explore the clinical indications of arterial spin-labelling perfusion imaging, MR spectroscopy, and diffusion tensor imaging in the study of the paediatric brain under normal and abnormal conditions. The ultimate goal is to focus on what is feasible in the everyday clinical practice, with an eye also on potential applications and future trends of research in this field.
Session Objectives:
1. To understand the indications of advanced MRI techniques (arterial spin-labelling perfusion imaging, MR spectroscopy, and diffusion tensor imaging) in the study of the paediatric brain under normal and abnormal conditions.
2. To learn how to practically implement these techniques in daily practice and to avoid pitfalls and artefacts.
3. To appreciate the potential applications and future trends of research in this field.

A-237 16:03

Arterial spin-labelling: measuring perfusion non-invasively in neonates and children
J. Hendrikse; *Utrecht/NL (j.hendrikse@umcutrecht.nl)*

Background: Arterial spin labelling (ASL) MRI is a noninvasive MRI method to visualise and quantify the brain perfusion in ml/min/100 gr brain tissue. For CBF quantification with arterial spin labelling, correction factors (haematocrit, T1) are needed which will be explained. Arterial spin label MRI signals are stronger at 3 Tesla compared to 1.5 Tesla. What does arterial spin labelling show in Neonates and Infants? In neonates, there is clear difference in brain perfusion pattern compared to adults. Perfusion signal is mainly seen in the basal ganglia and the motor cortex in neonates. The perfusion in the other grey matter is low in neonates and is on the border of the detection limit of arterial spin labelling MRI. In the first months this perfusion pattern changes rapidly with an increase in perfusion signal of the other gray matter regions. Changes in perfusion are in line with the development of the myelination. In infants the perfusion values are reported to be higher compare to adults. Patient studies and Future Developments: The number of patients studies reported is limited. In neonates, arterial spin labelling MRI has been used in hypoxic-ischaemic encephalopathy. Furthermore, the studies that have reported ASL results in infants have applied ASL in sickle cell disease, stroke, epilepsia and brain tumours. In addition to the clinical application of ASL methods also more advanced methods are being developed to use ASL in combination with other quantitative MRI parameters to allow quantification of the oxygen extraction fraction and cerebral metabolism.
Learning Objectives:
1. To learn about the technical possibilities and challenges of the use of different arterial spin-labelling MRI methods (pulsed, continuous) in neonates and children.
2. To understand potential sources of artefacts and pitfalls of arterial spin-labelling MRI image interpretation.
3. To become familiar with the interpretation of arterial spin-labelling MRI images in neonates and children.

A-238 16:27

MR spectroscopy: information vs time
J.F. Schneider; *Basle/CH (jacques.schneider@ukbb.ch)*

Proton nuclear magnetic resonance spectroscopy (MRS) is a common adjunct in diagnostic magnetic resonance imaging (MRI) procedures. It has the advantage of noninvasively assessing the cellular metabolism of normal or pathological tissue from the central nervous system (CNS). Particular strength of MRS lies in the combination of structural and metabolic information when analysed together with conventional MRI or other functional imaging procedures (like positron-emitting tomography, PET). It has the capacity not only to probe local pathological, but also to evaluate normal or contralateral brain structures for comparison. MRS has made considerable progress in the last decade and technical development has broadened the clinical investigation field. From single voxel up to 3D chemical shift imaging, not only has the amount of tissue normal and pathological sampled increased but the acquisition time has also dramatically decreased. This presentation will review basic principles and explain routine technical procedures. It will illustrate the role of individual metabolites and point to differences according to the magnetic field strength used but also to the pathology encountered. It will identify some common mistakes and pitfalls in routine procedures and illustrate the range of information one can retrieve, based on selected paediatric cases.
Learning Objectives:
1. To become familiar with the principal metabolites in the brain evaluated by proton spectroscopy.
2. To identify factors that can potentially interfere with obtaining spectroscopy results.
3. To assess the results from a patient's single- or multivoxel spectroscopy analysis.

A-239 16:51

Diffusion tensor imaging: connecting the dots
T.A.G.M. Huisman; *Baltimore, MD/US (thuisma1@jhmi.edu)*

Diffusion tensor imaging (DTI) is an advanced magnetic resonance (MR) technique that provides qualitative and quantitative information about the microarchitecture of white matter. DTI may show important information about the brain microstructure in brain malformations that may go undetected or remains underestimated on conventional MR sequences. DTI may better categorise various brain malformations that may look similar on conventional MR imaging, but may be caused by different pathomechanisms. Human disorders of axonal guidance result from aberrant axonal wiring and are caused by mutations in genes that code for molecules that guide axons within the brain. Much of our knowledge about human disorders of axonal guidance comes from DTI studies of crossing tracts, such as the corpus callosum, optic chiasm, corticospinal tract, and cerebellar peduncles. In summary, DTI and FT allow us to study the microstructure of the CNS in vivo and are consequently a valuable tool for the better understanding of the normal and abnormal brain development. The collected data will help to better classify malformations and may give important hints to the genetic bases of the encountered findings.
Learning Objectives:
1. To become familiar with the basics of diffusion tensor imaging (DTI) and fibre tractography (FT) in paediatric neuroradiology.
2. To understand the significance of DTI/FT for the exploration of the developing brain.
3. To learn how to use DTI/FT to better classify complex brain malformations.

17:15
Panel discussion: Do advanced brain MRI techniques really change current practice?

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

Pros & Cons Session

PS 827

Breast cancer: to screen or not to screen?

Coordinator:
F. Sardanelli; San Donato Milanese/IT
Teaser:
N. Houssami; Sydney/AU

A-240 16:00

A. Mammographic screening: pros
A. Frigerio; *Turin/IT (alfonso.frigerio@gmail.com)*

Mammographic screening (MS) has been extensively demonstrated to significantly reduce breast cancer (BC) mortality. Since the pioneering H.I.P. study of the early 1970s, evidence has accumulated. During the 1970s-1990s,

this was mainly from large randomised prospective trials (and case-control studies) that were also validated by a number of independent expert reviews. More recently, substantial evidence was produced through well-designed, controlled studies of service screening. All the above contributed to a general consensus that leads to the implementation of MS programs in many countries worldwide. Nonetheless, a few authors have repeatedly challenged MS for (1) the insufficient quality of evidence provided by the trials; (2) a negligible effect on BC mortality; (3) a negligible effect on all-cause mortality; (4) conspicuous overdiagnosis; (5) (again) no effect on BC mortality as perceived from country comparisons. All the above charges have been convincingly proved to be flawed and/or unfounded. A point will be made for the need to found any conclusions on evidence of the utmost quality, i.e. either from the "historical" well-conducted and independently reviewed randomised trials or from newer high-quality studies based on individual patient data and very long follow-up periods. The latter issue is of special importance when dealing with such a varied group of diseases, as BCs are. This approach will confirm that MS is an effective and efficient health intervention that may reduce BC mortality in excess of 40% in those attending - at a cost/effectiveness ratio that is competitive with other important medical interventions.

Learning Objectives:

1. To be aware of estimates of breast cancer mortality reduction and overdiagnosis from screening mammography.
2. To evaluate the cost-effectiveness of population-based mammographic screening.
3. To show ways for improving population-based mammographic screening.

A-241 16:25

B. Mammographic screening: cons

A.B. Miller; *Toronto, ON/CA (ab.miller@sympatico.ca)*

No benefit from mammography screening was found in the Canadian National Breast Screening Study, conducted when modern treatment was freely available in Canada. We concluded that the detriments, including cancers, detected not destined to present in the woman's lifetime, overdiagnosis, far outweigh any advantage. We estimated that 50% of the impalpable invasive cancers detected by mammography were overdiagnosed, 72% if in situ cancers are included. We were accused of falsifying randomisation so that women with advanced cancer were included in the mammography arm, and using poor mammography. However, the groups were well balanced in breast cancer risk factors, equal numbers of women with palpable abnormalities in the two arms were referred for review, and our cancer detection rates were as good or better than the trials performed in Sweden, where adjuvant treatment for breast cancer was not available. All women were taught breast self-examination (BSE). Women who developed breast cancer did better if they practised BSE well than those who practised it poorly. The population studies performed since the trials have in general failed to show an impact of mammography screening on the incidence of advanced breast cancer and breast cancer mortality. They cannot avoid the biases associated with such studies and have not been able to control for improved treatment. Thus, the rationale for screening by mammography should be reassessed. However, education, early diagnosis and excellent clinical care should continue to ensure that as many breast cancers as possible are diagnosed at a small and treatable stage.

Learning Objectives:

1. To show limitations of mammographic screening in terms of population outcomes.
2. To evaluate the real impact of screening programmes in comparison with effectiveness of available therapies of breast cancer.
3. To outline a scenario for fighting against breast cancer without screening.

A-242 16:50

Questions and answers

F. Sardanelli[1], N. Houssami[2]; [1]*San Donato Milanese/IT*, [2]*Sydney/AU*

The discussion will address the following issues:

1. How much of the breast cancer mortality reduction in the last decades can be attributed to screening?
2. Do we really have reliable estimates for overdiagnosis?
3. How can we reduce interval cancer rate?
4. Are there technical or clinical improvements to be implemented in screening programmes?
5. Is the comparison between countries having/not having screening useful for understanding advantages/disadvantages of screening programmes?
6. What are the societal and ethical implications in stopping population screening mammography programmes?

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

Multidisciplinary Session

MS 8

Critical limb ischaemia (CLI): limb salvage or life salvage?

A-243 16:00

Chairman's introduction: critical limb ischaemia in daily practise

J.A. Reekers; *Amsterdam/NL (j.a.reekers@amc.uva.nl)*

Critical limb ischaemia (CLI) is an important disease which can have serious implications if not treated acutely. Making the diagnosis of CLI is not easy. The international consensus document which is used to make the diagnosis of CLI is already 16 years old and all of the parameters in the document (ABI, toe pressure, ankle pressure and PCO_2) have all been shown to have only minimal value. Diagnostic imaging plays an important role in the workup of patients with CLI, but this is only to plan treatment. The radiologist who wants to be involved in CLI should know about all the aspects of the disease, the therapeutic opportunities and the natural history. Non-invasive diagnostic also plays a major role in workup of these patients. One has to understand the difference between the different aetiologies for CLI, atherosclerosis, diabetic foot disease, embolic disease and vasculitis (M Buerger). To be able to be of added value as a radiologist, a regular MDT meeting (at least once a week) is mandatory.

Session Objectives:

1. To learn what critical limb ischaemia is.
2. To understand what treatment options are available.
3. To appreciate a critical review of new technological treatment developments.

A-244 16:20

Diagnostic imaging and outcome

M. Koelemay; *Amsterdam/NL (m.j.koelemaij@amc.uva.nl)*

Accurate non-invasive imaging is required for planning appropriate endovascular or open surgery strategy in patients with CLI. Duplex ultrasonography (DUS), contrast-enhanced magnetic resonance angiography (MRA) and computed tomography angiography (CTA) are widely available. A recent meta-analysis demonstrated a high pooled diagnostic accuracy for detection of a $>50\%$ stenosis or occlusion in the lower extremity arteries in patients with IC and CLI, for CTA and MRA. Meta-regression analysis did not find an influence of the prevalence of patients with CLI in the individual studies on pooled sensitivity and specificity. Since all non-invasive modalities are highly accurate, other considerations such as availability, logistics, physician and patient preferences, and patient co-morbidity will guide the choice for a certain diagnostic modality. For most institutions this will imply MRA or CTA, whereas others have shown that treatment of patients with CLI can be safely based on DUS alone. Treatment of CLI is aimed at relieving pain, achieving wound healing and preventing a major amputation. It is attractive to focus on outcomes such as amputation-free survival and mortality to evaluate treatment outcomes for CLI, since these are easy to measure. Yet, other outcomes such as ambulation, functional capacity and quality of life are more relevant for a patient. The importance of Patient-Reported Outcome Measures (PROMs) has been acknowledged, but knowledge on this topic is as yet evolving. The evidence base for PROMs will be discussed as well as their interpretation and the concept of the minimally important difference (MID) to facilitate this.

Learning Objectives:

1. To learn about the value of diagnostic imaging.
2. To understand the outcome of treatment.
3. To appreciate how outcome can be tested.
4. To introduce Patient-Reported Outcome Measurements (PROM).

A-245 16:40

The diabetic foot patient

N. Schaper; *Maastricht/NL (n.schaper@mumc.nl)*

Approximately, 15% of all diabetic patients will develop a diabetic foot ulcer and these ulcers usually result from the interplay of ≥ 2 risk factors such as polyneuropathy, peripheral arterial disease (PAD), increased biomechanical stress and trauma. Wound healing frequently takes several months with continuously the risk of progressive gangrene and amputation. A multifactorial approach is therefore essential. Polyneuropathy results in an insensate and deformed foot, with abnormal loading during standing and walking. Due to the increased biomechanical stress the skin eventually breaks down. Up to 50% also have PAD which is characterised by diffuse, multilevel atherosclerotic disease in calcified vessels with impaired collateral formation. The ulcers frequently become infected and in particular, in ischaemic feet, these infections are an immediate threat of the leg; ""time = tissue" in these patients. Treatment

is aimed at restoring impaired tissue perfusion with a revascularisation procedure, such as a PTA or a surgical bypass. Plantar foot ulcers should be preferably off-loaded with non-removable casts, ulcers on other locations with other simple measures. Surgical debridement is, apart from antibiotics in sufficient high dosages to compensate for less optimal penetration, essential in many patients. In addition, management should include meticulous wound care, optimal blood glucose control and treatment of co-morbidities, such as oedema or malnutrition, Most ulcers can be treated effectively with such a multidisciplinary approach in which many disciplines are involved. Once healed, recurrence rate is high and in many patients, a great effort is needed to prevent re-ulceration.

Learning Objectives:

1. To learn about the clinical problems in diabetic foot disease.
2. To understand the different types of diabetic foot patients.
3. To appreciate how radiology and clinicians can work together.

17:00

Multidisciplinary team case discussion

1. To learn how a MDT should work.
2. To understand the role of the interventional radiologist.
3. To discuss the various treatment option for CLI.
4. To learn about the role of imaging.

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

E³ - ECR Academies: Image-Guided Interventions in Oncology

E³ 819

Kidney, lung and bone: an update on oncologic therapy

A-246 16:00

Chairman's introduction

A.D. Kelekis; *Athens/GR (akelekis@med.uoa.gr)*

Percutaneous ablation techniques include chemical ablation (i.e. injection of ethanol or acetic acid), irreversible electroporation (IRE), thermal ablation [laser, radiofrequency ablation (RFA), microwave ablation (MWA), cryoablation] and MR-guided HIFU (high-intensity focus ultrasound, which is totally noninvasive). These techniques may act as first-line therapies in certain pathological entities or as attractive adjuncts to conservative therapy, radiotherapy or surgery in other cases. All procedures are performed under extensive local sterility measures and prophylactic antibiotics. In addition, extreme care should be taken concerning the surrounding structures, especially those sensitive to heat or cold (e.g. intestine, nerves). Heating at 45 °C has been shown to be neurotoxic to spinal cord and peripheral nerves; similarly temporary neuropraxia occurs at –20 °C and permanent neurological damage at ≤–40 °C. Protective measures include passive thermal protection techniques (thermocouples for temperature monitoring, intraoperative neurological monitoring systems such as neurodiagnostic EEG, EMG and evoked potential electrodes and accessories) or active thermal protection techniques (skin protection, hydrodissection, gas dissection with CO_2 or air and balloon interposition). In the musculoskeletal system indications for ablation include benign tumours (curative goal), specific slow-growing primary neoplasms (curative goal) and metastatic lesions (curative or palliative goal). Lung ablation can be reserved for patients who are not candidates for surgical operation due to co-morbidities and present with primary lesions < 3.5 cm in diameter or metastatic lesions < 5 in number. Renal ablation is indicated in tumours < 4 cm in diameter. Ideal renal lesion for ablation should be unifocal, spherical, peripherally located and easily accessible.

Session Objectives:

1. To become familiar with the several available image-guided techniques for treating renal, lung and bone tumours.
2. To understand when image-guided techniques are clinically indicated in the management of patients affected by renal, lung and bone tumours.
3. To consolidate knowledge of clinical results available from the literature.

A-247 16:03

A. Renal cell carcinoma: when and how can we compete with surgeons

R.F. Grasso; *Rome/IT (r.grasso@unicampus.it)*

RCC shows a malignant potential dependent on size (i.e. tumours < 5 cm seem less aggressive) and a slow-growing evolution especially in elderly people. Due to this particular behaviour, not all cases are suitable for ablation which is reserved to biopsy-proven small RCCs in patients with good medical conditions and long-life expectancy. All the other cases should enter a programme of active surveillance. Among the available image-guided techniques of ablation, radiofrequency (RFA) and cryo-ablation (CA) have been fully investigated. Possible advantages of these and other techniques include reduced morbidity, out-patient therapy and treatment of high-risk surgical candidates. Experience with micro-wave ablation (MWA) is still limited even though it seems that MWA should be reserved to peripheral RCCs because of speed, high temperatures, and cautery. Consolidated data obtained with RFA and CA proved both techniques to achieve optimal local control (local recurrence ≤ 3%) especially for tumours ≤ 3 cm. Although RFA and CA seem comparable, CA may yield some advantages such as a better oncological outcome for tumours ≥ 4 cm and reduced pain and aggressiveness to the calico-pyelic system. The choice of the most appropriate modality depends on tumour size and location and on proximity of vulnerable structures. In conclusions, with RFA or CA local oncological control is optimal for biopsy-proven RCC ≤ 3 cm in patients with good medical conditions and long-life expectancy. Further studies are needed for MWA.

Learning Objectives:

1. To understand the current indications for ablation in renal cancer.
2. To learn about when radiofrequency ablation, microwaves ablation and cryo ablation are indicated.
3. To consolidate knowledge of results from personal experience and the literature.

A-248 16:32

B. Lung tumours: the clinical evidence for percutaneous techniques

T. de Baère, F. Deschamps, L. Tselikas; *Villejuif/FR (debaere@igr.fr)*

Since first report of RFA in lung cancer in year 2000, RFA has been demonstrated to provide 80 to 90% complete ablation for tumours less than 2 cm, with decrease in efficacy for larger tumours. RFA is today a valid option for primary NSCLCC in non-surgical candidates with overall survival reported after RFA between 36 and 58% at 3 years. For lung metastases, there is growing evidence of survival after RFA close to what reported in large surgical series even if no comparative data exist. Age, disease-free interval, tumour size and tumour numbers which have been reported as predictive of survival after surgical metastasectomy are well-independent predictors of survival after RFA of lung metastases. The ideal candidate has less than 3 tumours less than 3 cm. One of the beauties of RFA is that it can be easily repeated in case of occurrence of new metastases which is difficult with surgery due to the aggression of the procedure. The same does not apply to stereotaxic radiation therapy where multiple irradiation results in toxicity lo lung parenchyma, skin or mediastinum. Consequently, RFA is today part of routine practice armamentarium against lung cancers. However, many fields remain to be investigated to improve efficacy and to better determine the role of RFA relative to other therapies.

Learning Objectives:

1. To understand the indications for percutaneous ablation in primary and metastatic disease.
2. To learn about technical issues.
3. To consolidate knowledge of results from literature.

A-249 17:01

C. Image-guided therapies for bone tumours

A. Gangi; *Strasbourg/FR (gangi@unistra.fr)*

Imaging has a central role in the diagnostic of bone tumours. The imaging can be also used in the percutaneous biopsy or treatment of these tumours. The first step is the diagnosis before any treatment. After this step, different options are available and a multidisciplinary team should propose the best solution and the less invasive one to the patient. The argument of the cost should be included in the discussion. Image guided therapies, is indicated in focal control, palliation, or consolidation. As image guided procedures are less invasive, for some tumours or locations, they are indicated in the first place for example in osteoid osteomas. For benign or malignant tumours, a personalised solution is systematically proposed. The association of different specialities (surgery, medical oncology, radiotherapy and Interventional radiology) and different techniques allow considering for an efficient treatment more complex and advance cases.

Learning Objectives:

1. To understand how to select bone lesions to be ablated.
2. To learn about technical issues for both palliation and curative aims.
3. To become familiar with clinical results.

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

Professional Challenges Session

PC 8b
Imaging in population-based studies

A-250 16:00
Chairman's introduction
N. Hosten; *Greifswald/DE (hosten@uni-greifswald.de)*

Population imaging studies gather information from large cohorts of people. Information may include imaging data as well as data described as genomics, metabolomics, etc. Population studies contribute in different ways to medical knowledge. 1) Relevance of imaging findings may be secured by long-time follow-up. 2) Imaging findings may be connected to other information, like results of cognitive function tests. Population imaging plays an important role for radiology, as the large number of subjects included in these studies leads to better acceptance of scientific results.
Session Objectives:
1. To understand how population imaging studies can generate high-level evidence for radiological methods.
2. To understand the importance of governance in defining the role of medical specialties in population studies.
3. To understand radiology's role in setting ethical standards in population imaging studies.
Author Disclosure:
N. Hosten: Author; Editor, 2 books on accidental findings in population imaging. Equipment Support Recipient; Siemens AG. Research/Grant Support; Bayer Schering.

A-251 16:03
Population imaging for the prediction of neuro-degenerative diseases
G.P. Krestin; *Rotterdam/NL (g.p.krestin@erasmusmc.nl)*

Imaging biomarkers have a substantial contribution in detecting, localizing, and determining the extent of disease. Identifying imaging biomarkers and risk factors of pre-symptomatic disease and development of predictive models for functional and structural alterations requires large, prospective epidemiological studies in unselected populations in which sub-clinical pathology can be assessed. Population imaging addresses this question by providing analysis of medical images at a large scale in controlled population cohorts. In neuro-degenerative disease population imaging has allowed to identify a number of imaging biomarkers like regional brain volumes, distribution and quantification of white matter lesions, subclinical brain infarcts or microbleeds as well as the structural and microstructural integrity of the white matter associated with the development of mild cognitive impairment and full-blown dementia long before any symptoms were present. For example, new MR imaging sequences allowing to increase the conspicuity of hemosiderin deposits showed a 25% prevalence of microbleeds in the elderly asymptomatic population. Microbleeds are thought to reflect vessel fragility, on the basis of either hypertensive vascular damage or amyloid angiopathy. Moreover, common genetic variants could be found that contribute to explain variance in imaging phenotypes associated with dementia by a systematic analysis of the genome based on genome-wide association studies (GWAS). The power of GWA analyses has been recently demonstrated with the identification of susceptibility genes involved in dementia-associated imaging phenotypes like intracranial volumes or size of the hippocampus. These associations are highlighting new aetiological pathways and are expected to improve the understanding of the molecular basis of neuro-degenerative diseases.
Learning Objectives:
1. To understand the role of population-based imaging studies in predicting outcome.
2. To present the most relevant imaging biomarkers for predicting neurodegenerative diseases.
3. To explain the association between genotype and imaging phenotypes in neurodegenerative diseases.
Author Disclosure:
G.P. Krestin: Board Member; Quantib BV. Consultant; GEHC. Equipment Support Recipient; GEHC. Grant Recipient; GEHC. Research/Grant Support; NWO, EC, NIH, Alzheimer Research.

A-252 16:18
The German National Cohort: population based imaging in a nation-wide multi-centre setting
F. Bamberg; *Tübingen/DE (fabian.bamberg@uni-tuebingen.de)*

Population-based phenotyping using advanced imaging techniques, such as magnetic resonance imaging, provides high-resolution insights into the morphologic and functional degree of subclinical disease burden. As such, important implications for our understanding of disease processes, associations with other markers of risk (i.e. genetic) and prognostic relevance of imaging findings can be obtained. The talk will review the concept of the German National Cohort with a particular emphasis on the MR-Study that will enrol 30,000 asymptomatic subjects at five imaging sites from the German general population. Protocol details of the whole body acquisition as well as challenges related to such a multi-centric design will be discussed. This includes standardised procedures of quality control and quality assurance, as well as algorithms for the management of incidental findings and basic integrative and modular data-handling strategies.
Learning Objectives:
1. To learn about the scientific potential and challenges that whole-body MRI pose to the imaging community in large-scale multi-centric cohort studies.
2. To understand the rationale and design of the German National Cohort MRI Study.
3. To appreciate the current state of the data acquisition and post-processing of the German National Cohort MRI Study.
Author Disclosure:
F. Bamberg: Speaker; Siemens Healthcare.

A-253 16:33
Population-based cardiac imaging
S. Petersen; *London/UK (s.e.petersen@qmul.ac.uk)*

UK Biobank is a prospective cohort study with 500,000 participants aged 40-69 years. Cardiovascular magnetic resonance (CMR) will be part of a multi-organ, multi-modality imaging visit in dedicated UK Biobank imaging centres that will acquire and store imaging data from 100,000 participants (subject to a successful ongoing pilot study) over a period of 5-6 years. The imaging modalities will include brain MRI at 3 Tesla, CMR and abdominal MRI at 1.5 Tesla, carotid ultrasound and DEXA scans using carefully selected protocols. We review the rationale, challenges and proposed approaches for concise phenotyping using CMR on such a large scale. We discuss the benefits of this imaging study and review existing and planned population-based cardiovascular imaging in prospective cohort studies. We will discuss the CMR protocol, feasibility, process optimisation and costs. Procedures for incidental findings, quality control, and data processing and analysis are also presented.
Learning Objectives:
1. To appreciate the opportunities provided by population-based cardiac imaging.
2. To acknowledge the challenges posed by population-based cardiac imaging.
3. To discuss first-hand experiences from the UK Biobank - the largest ongoing population-based cardiac imaging project.

A-254 16:48
The Trauma Cohort: a joint project of the German Röntgen Society and the German Society of Trauma Surgery
S. Langner; *Greifswald/DE (soenke.langner@uni-greifswald.de)*

The Traumakohorte is a cooperative study between the German Society of Trauma surgery (DGU) and the German Roentgen society (DRG). It is a population-based multi-centre study for the evaluation of polytrauma patients. The rationale and design of the study will be presented and the scientific potential of this large-scale imaging study will be highlighted. Differences between population-based imaging of healthy subjects and severely injured patients will be discussed.
Learning Objectives:
1. To understand the rationale and design of the Trauma Cohort.
2. To appreciate the scientific potential and challenges of a large-scale multi-centric polytrauma imaging study.
3. To learn the differences between population-based imaging studies of healthy subjects and severely injured patients.

A-255 17:03
Ethical aspects of population imaging
R. Schmücker; *Münster/DE (res@wwu.de)*

The more incidental findings being encountered in MRI research, the more it is apparent that dealing with them raises fundamental ethical issues. As the core of these ethical problems posed by incidental findings in MRI research, a fundamental conflict between the duty of care towards the individual research subject and the need to ensure the validity of the study is identified. Although this conflict appears prima facie to be a collision of an ethical norm with a methodological standard, the conflict is in fact, as it will be shown, a genuine ethical dilemma. The complex issues involved boil down to the following question: should the researcher disclose incidental findings, if this is in the interest of the research subject, or is this duty overruled by his or her responsibility to safeguard the external validity of the study results by not disclosing such findings? Different options to answer this question will be

discussed as well as further ethical problems concerning the question whether incidental findings should be disclosed or not.
Learning Objectives:
1. To learn about the diversity of ethical problems occurring in MRI research.
2. To understand the methodological relevance of the ethics of incidental findings for the validity of population-based studies.
3. To present some preliminary solutions to the most urgent ethical challenges.

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

Musculoskeletal

RC 810
The ankle and foot

Moderator:
J.L. Bloem; Leiden/NL

A-256 16:00
A. Ankle sprain: patterns of injury
J.L.M.A. Gielen, P. Van Dyck, J. Veryser; *Antwerp/BE (jan.gielen@uza.be)*

Ankle distortion is inversion or eversion injury with-without extension. In the acute setting, the Ottawa clinical decision rules are accepted to decide whether or not radiographs are needed; leading to 35% less radiographs. In case of negative radiographs, additional evaluation is restricted to patients with residual pain after one week. Although radiographs easily detect displaced fractures, 30% of occult fractures occur; also ligament and retinaculum lesions go undetected. The major advantage of assessment of ankle distortion with the Lauge-Hansen classification by the radiologist is that it defines talocrural and distal tibiofibular joint (in)stability, a major drawback is that it is not tailored on subtalar lesions. To rule out instability, only in restricted cases, additional imaging is tailored on specific signs and symptoms. Detection of significant lesions (talar fractures and complete calcaneofibular ligament tears), that is with no return to sports activities after 12 months, have our major interest. The latter is explained by the instability at the level of the subtalar joint with associated sinus tarsi syndrome. In case of residual tenderness posterior-inferior to the lateral malleolus, calcaneofibular ligament and retinaculum peroneorum are best evaluated with (dynamic) ultrasound. In case of residual pain posterior to the medial malleolus, ultrasound may be used to evaluate the deltoid ligament and flexor retinaculum. MRI or CT is used to detect occult fractures in case of residual talocrural joint effusion with anterior talar tenderness during endorotation and plantar flexion. MRI is is used to evaluate subtalar ligaments and also will demonstrate occult fractures.
Learning Objectives:
1. To learn more about the imaging appearances of soft tissue and osteoarticular injury.
2. To become familiar with the patterns of bone and soft tissue injury in the ankle and foot.

A-257 16:30
B. Inflammatory disorders
R. Lalam; *Oswestry/UK (radhesh.lalam@rjah.nhs.uk)*

The ankle and foot can be affected by inflammation from a number of diseases. The main focus of this lecture will be inflammation secondary to infection and systemic inflammatory disorders. Due to its function in locomotion and weightbearing, the foot is specifically susceptible to infections secondary to penetrative trauma including foreign bodies or to abnormal repetitive pressure. In addition, both seropositive and seronegative arthropathies can affect the foot. Other unusual causes of inflammation include chronic recurrent multifocal osteomyelitis, osteoarthritis, mechanical disorders and sensory loss. This lecture will deal with the various patterns of inflammation in the context of pathogenesis and discuss the imaging features that aid in diagnosis. The importance of the clinical context in diagnosis will also be discussed.
Learning Objectives:
1. To learn more about the imaging appearances of soft tissue and osteoarticular inflammation.
2. To become familiar with imaging findings of specific inflammatory conditions.

A-258 17:00
C. Tumours and tumour-like lesions
I.-M. Noebauer-Huhmann; *Vienna/AT (iris.noebauer@meduniwien.ac.at)*

Soft tissue tumours of the foot and ankle are rare. This leads to frequent misdiagnosis or diagnostic delay, which is of importance, especially in the few patients with unsuspected malignancy. By the use of ultrasound, some entities which are clearly benign and do not require further imaging, can be identified. In the other lesions, MR is the imaging modality of choice; additionally, radiography should be performed. Several common benign soft tissue tumours and those of intermediate dignity, as well as tumour-like lesions of the foot and ankle region, exhibit typical MR features, e.g. the Morton neuroma, plantar fibromatosis and aggressive fibromatosis/extra-abdominal desmoids, lipoma, ganglia, and also vascular malformations and extraskeletal chondromas. MR findings of synovial lesions, such as the pigmented villonodular synovitis (PVNS) and the giant cell tumor of the tendon sheath (GCTTS), as well as synovial chondromatosis, are also characteristic. Lesions that are indeterminate or likely malignant require histological diagnosis. Biopsy may be performed by ultrasound- or MR-guidance. It is important not to misdiagnose the most common malignant tumour of that region, the synovial sarcoma, as the growth rate may be slow. The same is true for clear cell sarcoma, which tends to have a high incidence of distant metastases and a high recurrence rate. The importance of MRI for staging of soft tissue tumours will be discussed, including the recognition of compartmental involvement and relation to adjacent neurovascular structures.
Learning Objectives:
1. To learn more about the spectrum of intra and para-articular soft tissue tumours, and tumour-like soft tissue lesions.
2. To become familiar with US and MRI findings of specific soft tissue lesions.

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

Special Focus Session

SF 8b
New frontiers in brain tumour imaging

A-259 16:00
Chairman's introduction
H.R. Jäger; *London/UK (r.jager@ucl.ac.uk)*

Clinical management and treatment options for brain tumours are becoming more complex and represent a rapidly evolving field. Consideration of genetic and molecular tumour markers informs how managements decisions more than classical histological WHO grading. The field of brain tumour imaging has to keep pace with these developments. Conventional structural imaging may no longer be sufficient and multi-modal imaging providing physiological information as well as specific molecular markers are likely to be used increasingly. These methods contribute to refining the diagnosis, predicting patient survival and treatment response and differentiating treatment effects from tumour progression.
Session Objectives:
1. To become familiar with recent advances in brain tumour imaging.
2. To understand the role of structural, physiological and molecular imaging methods.
3. To learn how these methods contribute to individualised management of brain tumour patients.

A-260 16:05
Imaging correlates of brain tumour genotypes
M. Smits; *Rotterdam/NL (marion.smits@erasmusmc.nl)*

Primary brain tumours are histopathologically subtyped into World Health Organisation (WHO) grades I to IV, according to-increasing-degrees of malignancy. These grades provide prognostic information and guidance on management, such as radiotherapy and chemotherapy after surgery. Despite the confirmed value of the WHO grading system, a multitude of studies and prospective interventional trials indicate that tumours with identical morphological criteria, i.e. of the same WHO grade, can have highly different outcomes. To personalise brain tumour management, we need additional diagnostic markers that can differentiate tumours beyond the current morphological WHO grading system. Molecular markers can distinguish subtypes of tumours within the same morphological type and WHO grade, and are therefore of great interest for personalised medicine. Recent genomic wide studies have resulted in a far more comprehensive understanding of the genomic alterations in gliomas, and the suggestions of a new molecularly based classification. MR imaging phenotypes can serve as non-invasive surrogates for tumour genotypes and as such provide important information on diagnosis, prognosis, and, eventually, personalised treatment. The newly emerged field of RadioGenomics links specific MR imaging phenotypes with gene expression profiles. In this presentation, I will discuss the three best known tumoural genotypes with prognostic and-potential-therapeutic consequences: 1. isocitrate dehydrogenase (IDH) mutation, 2. 1p19q deletion, and 3. methyl guanine methyltransferase (MGMT) promotor methylation. I will give an overview of the known and potential MR imaging features of these genotypes, and their value and validity in a clinical context.

Learning Objectives:
1. To become familiar with the most relevant molecular and gene abnormalities of glial and other neuroepithelial tumours.
2. To understand how these molecular and gene abnormalities influence patient outcome and treatment response.
3. To learn about the imaging correlates of the most important molecular and genetic tumour subtypes.

A-261 16:30

Multi-parametric MR tumour imaging in brain tumour diagnosis and monitoring

M.A. Lucic; *Sremska Kamenica/RS (milos.a.lucic@gmail.com)*

The recent introduction of numerous different imaging techniques, most of whom derived from MRI, such as MR spectroscopy, arterial spin labelling MR perfusion, diffusion-weighted imaging, diffusion kurtosis imaging, diffusion tensor imaging, susceptibility-weighted imaging, fMRI, etc. provided us with the unique possibility to obtain and to compare not only the images, but also to explore and scrutinise the multi-parametric brain maps. Consequently, these imaging techniques, whether CT-based, MRI-based, PET/CT or PET/MRI-based, unfolded the fully new insight on brain tumours, allowing us to observe and to provide not only the common information regarding the tumour morphology, size, exact location, and relation to surrounding structures, but also to scrutinise minutely the structure and internal architecture of the brain tumours, and moreover, to investigate the functional and molecular features of the tumorous tissue. This actually introduces, gradually but indubitably, the "tissue is the issue" principle into our daily neuroradiological practice. Understanding the concept of obtaining and interpreting the multi-parametric maps is therefore of utmost importance, by opening the wide spectrum of possibilities to the neuroradiologists to bring forth a more accurate and complete information on multiple tumourous features to neurooncologists on the one hand, and on the other hand, by increasing our comprehension of the mechanisms of tumour behaviour and internal structural and functional organisation of tumorous tissue. At the same time, multi-parametric imaging is emerging as a current cornerstone in brain tumour diagnosis and monitoring and becoming an exceptional impetus for the future management of brain tumour patients.

Learning Objectives:
1. To become familiar with the use of MR perfusion, MR diffusion imaging and MR spectroscopy in brain tumour imaging.
2. To understand how these methods can add value to structural MR imaging of brain tumours.
3. To learn how multiparametric MR imaging can be used in the differential diagnosis and prediction of treatment response of brain tumours.

A-262 16:55

MR/PET in brain tumour diagnosis: the added value of combining structural and molecular imaging

F. Fraioli; *London/UK (f.fraioli@ucl.ac.uk)*

PET/MRI lies at the cutting edge, combining the power of MRI for tissue characterisation, microstructural appraisal and functional assessment together with new positron emission tomography (PET) tracers designed to target specific metabolic processes. In selected brain tumours, this combination could provide additional information about cellular proliferation, improve selection of biopsy and potentially separate tumour tissue better from scarring and necrosis. ^{18}F-fluorodeoxyglucose (FDG) is the most commonly used PET tracer but its application in evaluating brain tumours is limited because the normal brain has physiologically high-glucose metabolism. Alternative tracers to FDG have been developed, some of which are used in the clinical practice of centres with radiochemistry labs and PET facilities: Labelled amino acids and their analogues (methionine [^{11}C-Met] and ^{18}F-fluorotyrosine) are markers of protein synthesis that many brain tumours can overexpress. ^{11}C and ^{18}F-choline have been investigated as biomarkers of cell membrane turnover with increased uptake reflecting tumour aggressiveness. ^{68}GaDotatate, a somatostatin receptor tracer has shown intense uptake in meningioma with recent studies demonstrating the adding value of combining the high anatomical details of MRI with that of tissue characterisation of ^{68}GaDotatate to determine the extension of meningioma into the neighbouring anatomical structures. The simultaneous acquisition of metabolic, structural and functional information has important clinical impact that result in improved patient compliance with a significant reduction in measurement time and spatial and temporal co-registration of PET and MRI data. In this presentation, some examples of the main practical applications of PET/MRI will be presented.

Learning Objectives:
1. To become familiar with the most important PET tracers currently used in brain tumour imaging.
2. To understand the different aspects of tumour metabolism that can be measured with these tracers.
3. To learn about the advantages and pitfalls of simultaneous acquisition of structural and molecular information in brain tumours using PET MRI.

17:20
Panel discussion: Modalities and parameters - what do we really need?

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

Professional Challenges Session

PC 8a

Integration of imaging biomarker activities on a European level

A-263 16:00

Chairman's introduction

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

Imaging biomarkers play an increasing role in the detection and treatment of major diseases including cancer. Using imaging biomarkers to streamline drug, tumour and disease progression discovery represents a huge advancement in healthcare. Imaging biomarkers play a key role in particular in new drug development, as advancements in quantitative medical imaging provide the opportunity of using imaging biomarkers to speed up the development process of new drugs. However, there are several bottlenecks that currently prevent imaging from unfolding its full potential in the contribution to personalised medicine. Imaging biomarkers have to be technically validated, robust and reproducible, and need to be clinically validated, necessitating access to large cohorts, which is very difficult to achieve in stand-alone imaging studies. There is a need to consider imaging biomarkers in clinical trials and drug approval processes as a mandatory add-on whenever possible. There is also a need to set up a European platform for the standardisation of imaging biomarkers and to support a collaborative effort of academia, industry and regulators. The ESR has established a European Biomarkers Task Force to create synergies with QIBA RSNA and to tackle in particular clinical validation of imaging biomarkers at the European level.

Session Objectives:
1. To understand the importance of imaging biomarkers for radiology.
2. To become familiar with ESR activities related to imaging biomarkers.
3. To appreciate a new structure for coordinated imaging biomarker activities in Europe.

A-264 16:05

From qualitative to quantitative imaging: a paradigm shift in radiology

S. Trattnig; *Vienna/AT (siegfried.trattnig@meduniwien.ac.at)*

In radiology for many years qualitative analysis was done for the diagnosis of lesions and pathological processes compared to healthy tissue. However, driven by clinical follow-up studies in oncology, development of quantitative imaging was necessary. Quantitative imaging involves measurement of some variables using images, is based on an underlying biophysical model for the tissue of interest and results in unbiased, quantitative estimate of a biological parameter. In principle two groups of quantitative imaging can be subdivided: 1) morphological quantitative imaging for tumour lesion size measurements (as proposed by RECIST and WHO) and 2) quantitative imaging based on functional (compositional) methods using CT, nuclear medicine (SPECT and PET) and MR. The methods which get clinically more important are diffusion-weighted MR imaging with ADC values for tissue oedema and apoptosis, dynamic-contrast enhanced (DCE) CT and MR for the plasma volume, 1H and 31P MR spectroscopy for cell membrane turnover and energetics, BOLD or susceptibility-weighted MRI and DCE perfusion CT/MRI for tissue perfusion and blood volume. In nuclear medicine PET tracers of physiological processes and molecular pathways to measure tumour blood flow, tumour blood volume, tumour cell proliferation, etc. are available. These quantitative techniques have the potential for detection of disease at an early stage, in which morphological changes are not yet visible and they are more sensitive and specific in monitoring of cancer after different therapies, in particular when used in combination providing multiparametric quantitative information.

Learning Objectives:
1. To learn about the difference between qualitative and quantitative imaging.
2. To understand the role of quantitative imaging in clinical trials.
3. To become familiar with quantitative imaging as a prerequisite for imaging biomarkers.

A-265 16:20

Experience of the Quantitative Imaging Alliance (QIBA) of the RSNA

R. Boellaard; *Amsterdam/NL (r.boellaard@vumc.nl)*

A quantitative imaging biomarker (QIB) is an objectively measured characteristic derived from an in vivo image as an indicator of normal biological or pathogenic processes or a response to a therapeutic intervention. In response to the need for reliable and reproducible imaging biomarkers, the RSNA in 2007 organised the Quantitative Imaging Biomarkers Alliance (QIBA, http://rsna.org/QIBA_.aspx) whose mission is to improve the value of quantitative imaging biomarkers by reducing variability across devices, patients and time. A short-hand way to think about QIBA is that our goal is to have imaging systems be manufactured as measuring instruments, like blood pressure cuffs, where one expects to get the same numerical reading no matter who the manufacturer is. QIBA participants span a wide range of expertise including clinical practice, clinical research, physics, statistics, engineering, marketing, regulatory, pharmaceutical, and computer science. There are several sources of variability in quantitative results obtained from clinical images: (1) image acquisition hardware, software and procedures; (2) measurement methods used; and (3) reader variability. QIBA employs a consensus-driven approach to produce a QIBA Profile that includes one or more Claims and specifications for image acquisition and processing necessary to achieve that Claim. QIBA Profiles are based on published data and on expert consensus opinion where no data exist. QIBA has completed three Profiles (CT Volumetry; DCE-MRI; and FDG-PET) and has several in development. Under a research contract from NIH/NIBIB, QIBA funds about 12 to 15 "groundwork projects" per year to collect data for specifications in the profiles.

Learning Objectives:

1. To outline the structure of the QIBA of the RSNA.
2. To learn about the main goals of the QIBA of the RSNA.
3. To appreciate the value of standardisation and technical validation.

Author Disclosure:

R. Boellaard: Research/Grant Support; Philips Collaborative Research Grants.

A-266 16:35

Introduction to the Quantitative Imaging European Task Force

H.-U. Kauczor; *Heidelberg/DE (Hans-Ulrich.Kauczor@med.uni-heidelberg.de)*

Quantitative imaging biomarkers represent a general paradigm shift from qualitative to (semi-) quantitative imaging for improved detection of small volume disease, prediction of disease aggressiveness and response as well as for treatment monitoring. Standardised and validated imaging biomarkers, either singly or in a multi-parameter combination, will establish imaging biomarkers as surrogate endpoints in multicentre clinical trials. To reach their full potential, standardisation, validation, quality assurance and regulatory issues need to be addressed at the European level. To address these issues the ESR Subcommittee on Imaging Biomarkers as well as the European Society of Molecular and Functional Imaging in Radiology (ESMOFIR) were established. Already in 2007, RSNA established the Quantitative Imaging Biomarker Alliance (QIBA) in the USA to improve the value and practicality of quantitative imaging biomarkers by reducing variability across devices, patients and time. This involves also acceleration of the development and adoption of hardware and software standards needed to achieve accurate and reproducible quantitative results from imaging methods. QIBA develops profile specifications and coordinates the necessary research and qualification groundwork. In May 2014, the Quantitative Imaging European Task Force (QETF) was set up by the ESR to structure the respective activities in Europe, whilst at the same time avoiding duplication of work already done within QIBA. QETF will interface with the international QIBA scientific community and industry, and reinforce collaboration with the EORTC (European Organization for Research and Treatment of Cancer), EIBIR (European Institute for Biomedical Imaging Research) and EMA (European Medicines Agency).

Learning Objectives:

1. To learn about existing activities in imaging biomarkers.
2. To appreciate the importance of a new European structure for integrated imaging biomarker development.
3. To acknowledge the benefit of imaging biomarkers for radiology.

Author Disclosure:

H.-U. Kauczor: Equipment Support Recipient; Siemens, Philips. Speaker; Siemens, Bracco, Bayer, Boehringer, Novartis.

A-267 16:50

Clinical validation of imaging biomarkers and their role in European Medicine Agency (EMA) applications

O. Clément; *Paris/FR (olivier.clement@inserm.fr)*

Imaging biomarkers are quantitative parameters measured by imaging, which are indicators of treatment response or toxicity. Thanks to their non-destructive and repetitive longitudinal aspects, they represent an enormous potential for assessing the efficacy of new drugs, both at preclinical and clinical levels. Their use could reduce development costs and shorten the development time for a safe and effective new drug. In oncology for example, kinase inhibitor-based PET could predict therapeutic response, and DCE-MRI could evaluate the efficacy of an anti-angiogenic therapy. To be used as a generalised tool to drug development, an imaging biomarker would need to be qualified by the European regulatory agency, EMA, through a formal scientific advise process, according to the framework of interactions between regulatory agencies and submitters. Currently, a few imaging biomarkers have already been qualified by the agency. This presentation will review these different aspects.

Learning Objectives:

1. To learn about the role of clinical validation for imaging biomarkers.
2. To understand how imaging biomarkers may become surrogate endpoints in clinical trials.
3. To become familiar with the requirements of the EMA.

A-268 17:05

The role of imaging biomarkers in the EORTC clinical trials

N.M. deSouza; *Sutton/UK (nandita.desouza@icr.ac.uk)*

Imaging provides a fundamentally important read-out for assessing therapeutic response. The Response Evaluation Criteria for Solid Tumours (RECIST) measurement uses the largest dimension of a lesion; longitudinal assessment of the percentage decrease or increase in lesion dimension is used to classify disease response or progression. Increasingly however, simple size dimensions are considered less sensitive, as estimates of response are required early before shrinkage has occurred, or because changes in a tumour in response to a targeted therapy are likely to alter tumour function well in advance of a reduction in size. A number of functional biomarkers are available with imaging that exploit a tumour's vascular, cellular, metabolic and stiffness features. Selecting them appropriately is critically dependent on an understanding of the mechanism of action of the therapeutic agent being studied. In addition, rigorous methodology for standardising and quality assuring these measurements is necessary together with an ongoing programme of quality control before implementing them in multicentre clinical trials.

Learning Objectives:

1. To learn about the EORTC's role and its performance of clinical trials.
2. To become familiar with the tasks and opportunities of the imaging group within the EORTC.
3. To understand how to implement imaging biomarkers in the clinical EORTC trials.

Author Disclosure:

N.M. deSouza: Research/Grant Support; CRUK and NHS England Research & Development funding.

17:20

Panel discussion: How to strengthen the role of imaging biomarkers in clinical trials

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

Special Focus Session

SF 8c

Breast imaging modalities: beyond the conventional

A-269 16:00

Chairman's introduction

M. Lobbes; *Maastricht/NL (marc.lobbes@mumc.nl)*

In breast imaging, mammography remains to be one of the most important imaging modalities. However, the diagnostic performance of mammography depends heavily on the density of the fibroglandular breast tissue. Mammography's ability to detect and evaluate breast cancer significantly decreases in extreme dense breasts. As a result, there is a continuous search for further improvement of the breast imaging modalities. Recently, some promising developments have been observed in the field of contrast-enhanced spectral mammography (CESM), breast CT and non-enhanced breast MRI. In this session, an overview of current scientific evidence for these new modalities is provided.

Session Objectives:

1. To become familiar with the latest developments in the field of CESM, breast CT and non-enhanced breast MRI techniques.
2. To understand their advantages and disadvantages.
3. To appreciate the current scientific evidence for these novel techniques.

A-270 16:05

Contrast-enhanced mammography

C. Dromain, F. Bidault, S. Ammari, M. Saghatchian, M.-C. Mathieu, C.S Balleyguier; *Villejuif/FR (clarisse.dromain@gustaveroussy.fr)*

The contrast-enhanced spectral mammography (CESM) is a recent development of mammography coupling a X-rays breast imaging and the use of intravenous iodinated contrast agent. This technique is based on dual energy exposure acquisitions using spectra with energies predominantly below (low-energy LE) and above (high-energy HE) the iodine K-edge at 33.2 keV. A breast morphology image, similar to a standard mammogram, can be provided by the LE image. An image of iodine contrast agent uptake can be obtained by applying an appropriate recombination algorithm to the LE and HE images. CESM increases sensitivity per patient and per lesion vs. mammography and increases specificity vs. mammography+ultrasonography. Moreover, recent prospective data comparing CESM and MRI has shown that CESM has similar sensitivity and better specificity than MRI for the detection of index cancer. CESM could replace mammography in symptomatic patients and could be an alternative to MRI in case of contraindications, access and/or economic reasons in pre-surgical patient management decisions. Major clinical indications the screening of high-risk women, the evaluation of newly diagnosed breast cancer to assess extent of disease and to evaluate for possible contralateral disease, a problem solving method for better characterisation when conventional mammography assessment is equivocal, the assessment of response to neoadjuvant chemotherapy and the evaluation of breast cancer recurrence. Its value for DCIS grading has to be confirmed.

Learning Objectives:

1. To become familiar with the CESM examination technique.
2. To know the clinical performance of CESM in comparison with conventional mammography and MRI.
3. To understand and illustrate major clinical indications.
4. To give an overview of future improvements and developments of CESM.

Author Disclosure:

C. Dromain: Grant Recipient; GE Healthcare. **C. Balleyguier:** Research/Grant Support; GE healthcare. Speaker; GE healthcare, Guerbet, hologic.

A-271 16:30

Breast CT

W.A. Kalender; *Erlangen/DE (willi.kalender@imp.uni-erlangen.de)*

Prior efforts: X-ray computed tomography (CT) of the breast has been a topic of interest for about two decades. It was proposed and evaluated in different designs by a number of groups as a potential alternative method for breast imaging. Efforts so far showed success with respect to contrast-enhanced imaging, but suffered from limited spatial resolution and increased dose levels. Respective studies and clinical results will be reviewed. Advanced technology: A new concept of spiral breast CT which will go into clinical testing in 2015 aims at providing high spatial resolution of better than 100µm to cover micro-calcification imaging. Scan times shall be below 10 seconds. Dynamic contrast-enhanced scanning with continuous acquisition is available to support differential diagnosis of lesions. To achieve this, spiral scan capabilities, high-resolution detectors and high-power micro-focus X-ray tubes are demanded. The concept has been evaluated and confirmed previously by simulations and by prototype studies [Kalender et al. (2012) Eur Radiol 22:1-8]. Novel detector technologies based on directly converting cadmium telluride (CdTe) crystals are the key allowing for improved resolution and maximal dose efficiency. Increased performance: Spatial resolution has been measured at about 80µm; average glandular dose for a typical breast of 14 cm diameter was determined at about 3 mGy. Comparative measurements on the American College of Radiology (ACR) accreditation phantom by standard mammography and by the breast CT prototype revealed clearly superior results for CT. Clinical results are expected around mid-2015. Breast CT can be expected to provide improved diagnostic capabilities.

Learning Objectives:

1. To become familiar with previous trials of using CT for breast imaging.
2. To learn about the potential of advanced CT technologies for breast CT.
3. To appreciate that breast CT can be obtained with very high 3D spatial resolution at screening mammography dose levels.

Author Disclosure:

W.A. Kalender: Consultant; Siemens Healthcare Erlangen, Bayer Healthcare Berlin.

A-272 16:55

Non-contrast MRI

P.A.T. Baltzer; *Vienna/AT*

Following the reported association between Gd containing MRI contrast media, the long abandoned field of unenhanced MRI techniques received new attention. The last years have brought several reports of unenhanced MRI for diagnosis of breast pathology. Diffusion Weighted Imaging, alone or in combination with morphological T2-contrast based sequences, is the most promising candidate as a substitute to contrast enhanced MRI. This talk will provide an overview of the actual status of unenhanced breast MRI and answer the question: do we still need contrast media in breast MRI?

Learning Objectives:

1. To become familiar with the current status of unenhanced MRI techniques for detection and classification of breast lesions.
2. To understand possible clinical applications of unenhanced breast MRI.
3. To appreciate the limitations of unenhanced breast MRI.

17:20

Panel discussion: Is there still room for conventional breast imaging?

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

E³ - ECR Master Classes (Chest)

E³ 826

Lung cancer staging

Moderator:
E. Castañer; Sabadell/ES

A-273 16:00

A. Limitations and perspectives

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

The latest review of the TNM system (7th edition) has made several changes, in particular regarding the T stage in non-small cell lung cancer (NSCLC), to better correlate disease with patient prognosis and treatment. However, several limitations still remain in staging lung cancer at imaging, particularly as regards indications on how to measure tumour dimension and the definition of tumour extent. Issues regarding the presence of neoplastic tissue contiguous to the mediastinum or chest wall, in the absence of certain signs of infiltration, still pose the dilemma of whether it is a T3 or T4 tumour. The staging of tumours involving adjacent lobe across the fissures remains ambiguous. Indeed, the invasion of visceral pleura beyond the elastic layer, including invasion into an adjacent lobe, is still defined as T2 even though there are evidences that overall survival and disease-free survival of patients with adjacent lobe invasion are similar to those of T3. Many controversies still exist for the definition of multifocal diseases or lymphangitic spread of tumour also. In the presence of a contralateral additional pulmonary nodule, it is advisable to not upstage the case at M1a before having excluded the possibility of syncronous primaries of the lung, particularly in the absence of mediastinal lymph nodes. The new international lymph node map has been revised with the attempt to clarify the anatomical borders of mediastinal nodal stations and it introduced the concept of nodal zones for prognostic assessment. Nevertheless, up to now the clinical relevance of nodal zones remains unknown.

Learning Objectives:

1. To consolidate knowledge about lung cancer staging.
2. To understand the radiological limitations: size measurement, multifocal disease, lymphangitic carcinomatosis, etc.
3. To appreciate mediastinal lymph node staging as a multidisciplinary process.

A-274 16:30

B. CT phenotypes of adenocarcinoma

M. Das; *Maastricht/NL (m.das@mumc.nl)*

In 2011, the new classification of lung adenocarcinoma was published. The major change was to introduce a new classification using the new terms "adenocarcinoma in situ (AIS)" and "minimally invasive adenocarcinoma (MIA)". The terms "bronchioalveolar carcinoma (BAC)" and "mixed subtype adenocarcinoma" should not be used anymore. The new classification mainly aimed at disease-specific therapy and survival rates implicating that AIS and MIA will have almost 100% survival rate after surgical resection. Furthermore atypical adenomatous hyperplasia (AAH) is usually referred to as first atypical proliferation of type II pneumocytes. Thin slice CT imaging is capable of diagnosing these lesions. As these preinvasive lesions are usually ≤5 mm CT acquisition with image reconstruction ≤ 1 mm is mandatory. AAH usually presents as pure ground glass nodules (GGN), either single or multiple. AIS may also present as GGN, but may also contain partly solid parts, or at least higher attenuation values. MIA may present as part-solid nodule with partly ground glass appearance. The differentiation remains challenging, as there is substantial overlap between different subtypes in terms of imaging features. As usually growth rate is very slow and lesions initially are very small, different regimens apply. Depending on lesion size and CT appearance follow-up or

biopsy is recommended to conform to the published guidelines (e.g. Fleischner society guidelines for solid and subsolid pulmonary nodules).
Learning Objectives:
1. To know about the implications of the new lung adenocarcinoma classification.
2. To understand the correlation between CT phenotypes and the new IASLC classification.
Author Disclosure:
M. Das: Grant Recipient; Siemens, Bayer, Philips. Speaker; Siemens, Bayer.

A-275 17:00

C. Functional imaging of lung cancer heterogeneity
O.L. Sedlaczek; *Heidelberg/DE (sedlaczek@web.de)*

Tumour heterogeneity describes the observation that within a tumour, cells show distinct morphological and phenotypical profiles, including gene expression, metabolism, proliferation, and metastatic potential. This refers to both inter- and intra-tumour heterogeneity. (Serial) Tumour staging reflects aspects of heterogeneity and is crucial for the selection of therapeutic strategies. While CT imaging just reflects the size aspect of a tumour mass, functional MRI with diffusion and perfusion imaging additionally integrates tissue vascularisation and ultrastructure directly. The application of these techniques in thoracic organs, the relevance of additional clinical information and how to handle typical artefacts will be discussed. Staging strategies in lung cancer traditionally include PET/CT. Here MR/PET is offering a "one stop shop" and can be expected to be superior. Clinical data and cases will be presented to exemplify its potential role.
Learning Objectives:
1. To become familiar with the therapeutic impact of tumour heterogeneity.
2. To learn about the potential of functional MRI.
3. To learn about the potential of PET/CT and MR/PET.

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

Head and Neck

RC 808

Head and neck imaging: don't sell your ultrasound yet!

Moderator:
S.S. Özbek; Izmir/TR

A-276 16:00

A. Salivary gland imaging with ultrasound
N. Gritzmann; *Vienna/AT (norbert.gritzmann@gmail.com)*

Due to their superficial position the parotid, the submandibular and the sublingual glands can be imaged with high-resolution transducers. In acute inflammatory diseases sonography can differentiate between obstructive or non-obstructive sialoadenitis. Abscess formations may be detected and the maturation of the colliquation may be controlled. Abscesses may be punctured under US guidance. In Sjögren´s Syndrome, the sonographic changes correlate with the histological destruction, in acute forms hypervascularisation is found in color Doppler. In fibrotic cases, the stimulation-induced hyperemia is impaired. In sialoadenosis, inflammatory and tumourous lesions can be ruled out by sonography. Tumours of the salivary glands can be visualised with high sensitivity. Like other imaging methods the specificity in assessment of the histology of a tumour is low. Multilocular lesions as sarcoidosis, lymphoma, metastases or cystadenolymphoma are discussed. In deep located, malignant tumours or when the tumour cannot be delineated completely, MR or CT are obligatory to delineate the tumour. Sonography enables the diagnosis of cysts or ranulae. The accuracy of sonography in assessment of sialolithiasis is about 90%. Non-opaque stones can be visualised too. However, small stones of less than 2 mm are difficult to detect since the posterior shadow may be missing. The concrements can be differentiated into intraductal or intraglandular stones. Indirect signs like ductal dilatations or inflammatory changes may be found. Pseudotumourous lesions as hypertrophy of the masseter muscle, tuberculosis, sarcoidosis or lymphoepithelial lesions in AIDS are discussed. In children, the main differential diagnosis of salivary gland pathologies are addressed.
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-277 16:30

B. Masses of the soft parts of the neck
S. Robinson; *Vienna/AT (s.robinson@dzu.at)*

Ultrasound is not competing with CT, MRI and functional imaging, but can be used as an inexpensive first means in palpable neck masses and serve as a valuable adjunct. Skin emphysema (recent tracheostomy), thick beards and skin ulcerations can interfere with ultrasound waves and prevent proper examinations. A flat pillow helps the patient to hyperextend the neck. In most cases, high-frequency linear transducers are applied. In deep lesions of the base of the tongue, low-frequency curved probes should not be forgotten. Rarely, ultrasound gel pads can be of help in very superficial lesions. Ultrasound anatomy will be presented, both in healthy volunteers and in patients after neck dissection and cervical embryology rehearsed. The endolarynx can be evaluated, as long as the plates of the thyroid cartilage are not calcified or ossified. I-phonation gives a hint to the mobility of vocal cords. When a neck mass is found, echogenicity, homogeneity, vascularization, borders, change of size with compression, mobility with swallowing, centre of origin and relationship to adjacent structures, especially vessels and bone should be assessed. Characteristic features of typical neck masses will be covered and the importance of the patient's medical history, previous examinations and operations will be stressed. After the examination, the diagnosis can be clear and therapy started straight away. In other cases, ultrasound follow-up after conservative treatment will be recommended. Only when deeper infiltration or further lesions have to be ruled out, the patient will be referred to cross-sectional imaging.
Learning Objectives:
1. To become familiar with cervical ultrasound anatomy.
2. To learn about benign neck masses.
3. To understand the value of US in oncologic imaging.

A-278 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 tumor 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 G**

Genitourinary

RC 807

Lessons I learned from mistakes in kidney and adrenal imaging

A-279 16:00

Chairman's introduction
G. Heinz-Peer; *St. Pölten/AT (Gertraud.Heinz@stpoelten.lknoe.at)*

PET-CT and DWI (diffusion weighted imaging) are currently the fastest growing imaging techniques in the world. PET and CT are synergetic since PET offers high sensitivity and CT the necessary temporal and spatial resolution. DWI can provide insight into water composition within a tumour. Benign tumours tend to

have proportionate increase of cells as well as intercellular space whereas, malignant tumours usually have a disproportionate increase of cells as compared to interstitial tissue as well as disrupted cell membranes. These properties of malignancies result in selective restriction of diffusion of water molecules that may provide strong evidence for malignancy in a lesion. PET-CT and DWI may allow new insights into pathology/pathophysiology of renal and adrenal tumours. DWI may challenge histologic characterization of the various subtypes of renal cancer. Novel imaging findings in renal and adrenal tumours will have major impact on treatment approaches and evaluation of treatment responses. In this course, molecular processes in the pathophysiology of renal cancer and adrenal tumours will be outlined. Strategies for treatment and response assessment will be provided. Limitations of these techniques will be addressed. Also, it will be described how to avoid common sources of mistake and pitfalls in functional imaging. Last but not least, minimal invasive treatment techniques in renal and adrenal tumours will be discussed including how to avoid mistakes. The Panel discussion after the state of the art talks will give some space to further discuss the role of various imaging modalities in kidney and adrenal disease.

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-280 16:05

A. Renal cancer

T. Bäuerle; *Erlangen/DE (tobias.baeuerle@uk-erlangen.de)*

For the clinical management of renal cancer, the radiologist is of major importance regarding primary diagnosis and monitoring treatment response during follow-up. The objectives of this lecture are to review basic challenges and pitfalls considering (a) differential diagnoses and (b) follow-up criteria of renal cancer. Histologic and molecular characteristics of renal cancer will be presented to relate histopathology with the corresponding imaging findings and to understand treatment response mechanisms of these lesions. Histopathological differences are reflected by multiparametric imaging techniques from CT and MRI that offer various approaches for discrimination between renal cancer and benign kidney lesions, such as morphologic criteria, multiphase approaches, diffusion-weighted imaging (DWI) and in/opposed-phase imaging. Based on the molecular characteristics of renal cancer, the implementation of targeted therapeutic agents have substantially improved systemic treatment options for kidney neoplasms-in particular, for metastatic disease-but require dedicated methods for response assessment. For this purpose, functional imaging techniques are currently available in addition to morphological evaluation, e.g. for determination of vascular parameters by dynamic contrast-enhanced (DCE)-MRI, DCE-CT and DCE-US. RECIST and other tumor response criteria will be compared when using these techniques to define treatment response. Overall, challenges and pitfalls will be reviewed for diagnosis and follow-up of renal cancer using multiparametric morphologic and functional imaging methods on the background of pathophysiologic disease characteristics.

Learning Objectives:

1. To understand molecular processes in the pathophysiology of renal cancer.
2. To become familiar with strategies for treatment and response assessment of renal cancer.
3. To learn about pitfalls of multimodal imaging techniques for renal cancer.

A-281 16:28

B. PET/CT in nephrourology

M. Notohamiprodjo; *Tübingen/DE*

PET-CT provides both qualitative and quantitative metabolic information combined with morphologic imaging and is valuable for diagnosis and management particularly of oncology patients. PET-CT can assist in the differentiation of benign from malignant tumours and in the follow-up of urogenital cancer patients who have undergone surgery, radiation therapy, or chemotherapy. However, PET-CT has its own unique pitfalls and artefacts. Misinterpretation of PET-CT in nephrourology may either be based on false positive, or false negative findings, the latter particularly due to low tumour-FDG-affinity or physiological FDG-excretion. Thus, physicians interpreting PET-CT scans should be familiar with the pearly and pitfalls associated with this modality.

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 mistake in PET/CT in the area of nephrourology.

A-282 16:51

C. Ablation mistakes in tumour percutaneous RFA

W.W. Mayo-Smith; *Boston, MA/US (WMayo-Smith@Lifespan.org)*

Solid renal masses are being detected with greater frequency with the increased use of cross-sectional imaging. Over 70% of renal masses are now detected incidentally on cross-sectional imaging performed for other purposes. There are approximately 64,000 new cases of renal cell carcinoma in the United States per year accounting for 14,000 cancer deaths. Renal cell carcinoma accounts for approximately 4% of all new cancer cases in the US and 2.4% of all cancer deaths. The treatment for solid renal masses has traditionally been total, partial, or laparoscopic nephrectomy. All these procedures require general anesthesia, operating room time, hospital admission with their attendant risks and costs. Partial nephrectomy is now considered by most urologists to be the preferred treatment for tumours ≤4 cm in size. Renal cancer often occurs in older patients with medical co-morbidities. In these patients, tumour ablation is an alternative treatment. Five year cancer-specific survival for T1a renal tumours treated with ablation is comparable to that of surgery. Complications from image guided ablation are uncommon. Hematomas are rare and seldom require transfusion. Centrally located tumours adjacent to the collecting system have a greater incidence of ureteral stricture than peripheral exophytic lesions. In addition, lager tumours have a higher incidence of residual tumour. This lecture will emphasise how to choose appropriate patients for ablation, how to minimise complications when performing this procedure and how to manage complications after they occur.

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:

W.W. Mayo-Smith: Other; Book royalties from Elsevier and Cambridge University Press.

17:14

Panel discussion: How to avoid mistakes using imaging modalities in other kidney and adrenal diseases?

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

E³ - ECR Academies: Hybrid Imaging (basic)

E³ 818

Essentials of hybrid imaging

Moderator:
R. McDermott; Dublin/IE

A-283 16:00

A. Normal variants and pitfalls

G. Cook; *London/UK (Gary.Cook@kcl.ac.uk)*

As with any imaging modality, a thorough knowledge of normal variants, false positives / negatives and technical artefacts is essential for interpretation of images. The number of hybrid modalities has increased (e.g. SPECT/CT, PET/CT and PET/MRI) and the number of tracers in clinical use has also expanded, increasing the number of potential pitfalls we experience. The normal distribution of radiotracers used in hybrid imaging technologies, such as PET/CT or PET/MRI, can vary due to a number of physiological, therapeutic, pathological and technical reasons. Reporter experience, patient preparation, technical attention to detail as well as a complete relevant clinical history are all essential for avoiding pitfalls. In oncologic hybrid imaging, a number of benign pathologies may mimic cancer and frequently the anatomical component (e.g. CT or MRI) may improve the specificity in these situations. A number of technical artefacts may also occur that may interfere with interpretation and should be minimised and recognised. Normal variants, false positives, false negative and technical artefacts will be presented focussing predominantly on PET/CT.

Learning Objectives:

1. To learn to identify normal variants.
2. To become familiar with typical pitfalls in hybrid imaging.
3. To appreciate artefacts in hybrid images.

A-284 16:30

B. The SUV: when does its use make sense?

P. Veit-Haibach; *Zurich/CH (patrick.veit-haibach@usz.ch)*

The SUV (standard uptake value) is one of the most used "quantitative" values in hybrid imaging. It is defined by activity times a normalised value divided by the injected activity. However, it comes in different flavours (SUVmax, mean, peak). Additionally, several staging criteria use different SUV values and/or

additional qualitative measures to evaluate primary diagnosis and therapy response. This talk will give an overview on how the different SUVs are calculated and in which staging criteria and guidelines which SUV value is used. Furthermore, we will provide a short overview how and why the SUV is used at primary diagnosis (e.g. for solid tumours and well as in lymphoma) and for therapy response assessment. Also here, several guidelines on how to use the SUV for therapy response assessment will be discussed. Lastly, several technical parameters which can influence the SUV will be explained and what new techniques are currently being assessed to create a more standardised SUV for comparative purposes.

Learning Objectives:

1. To appreciate different ways to calculate the SUV.
2. To understand the indication for the SUV in tumour diagnosis.
3. To become familiar with the indication for the SUV in therapy response assessment.

Author Disclosure:

P. Veit-Haibach: Board Member; EANM Oncology Board. Grant Recipient; IIS grants from Bayer Healthcare, Roche Pharmaceutical, Siemens Medical Solutions, GE Healthcare. Speaker; Speaker fees from Siemens Medical Solution, GE Healthcare.

A-285 17:00

C. Indications for hybrid imaging in radiation therapy planning

D. Georg; *Vienna/AT (dietmar.georg@meduniwien.ac.at)*

Over the last decades the precision and efficacy in radiation oncology (RO) have increased due to great improvements in treatment planning and beam delivery. For example it is possible to modulate the treatment and deliver lower doses to healthy tissue while escalating the dose-to-tumour subvolumes, e.g. less perfused (hypoxic) areas. In parallel, spectacular advances were made in medical imaging, such as PET-CT, multiparametric MR, MR-PET, which enable improved target definition. Moreover, they contribute to detect, characterise, delineate and track lesions with a high precision, to respond to changes in the tumour volume during the course of the treatment, both with respect to changes in time and space. The inclusion of hybrid PET-CT imaging in target definition and treatment response assessment with 18 F-FDG, especially for lung cancer, was certainly an important achievement in this direction. For detecting hypoxic areas different specific PET tracers are explored, e.g. in head-and-neck cancer, to react on radiation resistance. Furthermore multiparametric MR has been demonstrated to have potential for tumour characterisation and response prediction, e.g. in prostate and cervix cancer. Upcoming hybrid MR-PET solutions can even have larger impact on RO for treatment planning and optimisation, but several technical issues need to be overcome, for example to extract heterogeneity information from MR. One of the key issues when using any hybrid imaging technology for biologically motivated treatment planning is quantitative imaging. In this aspect hybrid imaging is not radiation oncology ready and it is essential that interdisciplinary research is intensified.

Learning Objectives:

1. To become familiar with PET/CT-based radiation therapy planning.
2. To appreciate the information desired by the radiation oncologist.
3. To understand the effect of functional data on the target volume.

17:18

Panel discussion: What does the individual gain from population imaging studies?

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

Vascular

RC 815

EVAR endoleaks: imaging and management

Moderator:
F. Fanelli; Rome/IT

A-286 16:00

A. The role of US: Doppler, 3D US, CEUS

U.K.M. Teichgräber; *Jena/DE*

Diagnosis and monitoring of endoleaks after endovascular aneurysm repair (EVAR) of abdominal aortic aneurysms (AAA) is an important task for diagnostic radiologists. EVAR surveillance at 1 and 12 months should consist of contrast-enhanced CT imaging. For Type II endoleaks, contrast-enhanced CT angiography (CTA) should be performed as 6-month interval for aneurymal sack assessment. Color duplex and non-contract CT are suggested for patients with renal insufficiency. If neither a endoleak nor an aneurysm growth is documented during the first year, then color duplex ultrasound alone is suggested as an alternative for annual surveillance. The new generation of ultrasound contrast agent have improved the clinical application of ultrasound in the evaluation of EVAR. Using contrast-enhanced ultrasound (CEUS) with SonoVuie can lead to a sensitivity and specificity comparable to multislice CT angiography. CEUS overcomes the limitations of CTA such as potential contrast agent allergy, nephrotoxicity and radiation exposure. The indications and technique of applying CEUS for the evaluation of EVAR will be shown in this review.

Learning Objectives:

1. To appreciate the rationale behind ultrasonographic imaging of EVAR endoleaks.
2. To become familiar with the principles of each ultrasonographic modality.
3. To understand the relative indications of each ultrasonographic modality.

A-287 16:30

B. CTA and MRA: current concepts

A. Bücker; *Homburg a.d. Saar/DE (arno.buecker@uks.eu)*

CTA was the initial gold standard for EVAR follow-up. The multiple phases acquired by CT are used to compare plain images to those after contrast agent to detect any increase in HU within the aneurysm sac. A later phase is required to detect any slow-filling endoleaks. At the same time, the position and integrity of the aortic prosthesis can be judged especially by reconstructed CT projections. MRA could and was used in a similar fashion for MR compatible stents. The sensitivity of this technique was at least comparable to CTA. Additional X-ray images of the stent were necessary to evaluate the stent position and possible stent fractures. Modern MR scanners and sequences allow the acquisition of very fast 3D-MRA data sets. This time resolved MRA technique proved to be superior to CTA in differentiating between types of endoleaks. Availability, cost and the limitation to MR compatible stents are disadvantages of this technique compared to CTA. Nowadays, possible fast CTA could yield similar dynamic information, but at the cost of a substantially-not to say forbidding-higher radiation dose. Of course, contrast-enhanced ultrasound is a strong competitor for the follow-up of EVAR offering the highest temporal resolution.

Learning Objectives:

1. To learn about the indications for CTA and MRA in EVAR endoleak imaging.
2. To become familiar with technical aspects of each modality in EVAR endoleak imaging.
3. To learn about the pros and cons of each modality.

Author Disclosure:

A. Bücker: Founder; Aachen Resonance. Research/Grant Support; AbbVie Amgen BAYER Bracco Celgene Exelixis Gilead iSYMED Janssen Lilly Medivation Novartis OncoGenex ONYX Roche Sanofi Seattle Genetic Siemens Medical Systems St. Jude Medical. Speaker; Bracco.

A-288 17:00

C. Endovascular management

M.A. Funovics; *Vienna/AT (martin.funovics@meduniwien.ac.at)*

Depending on the anatomical inclusion criteria, between 10 and 25% of EVAR patients need to undergo one or more endovascular secondary procedures after Stentgraft implantation due to endoleaks. Type I endoleaks are treated with balloon dilatation, implantation of a bare metal self-expandable stent, or stentgraft elongation. If these methods fail or are not applicable due to anatomical limitations, proximal endoleaks can be excluded by conversion to a fenestrated solution by implantation of tubular fenestrated extension stentgraft. Similarly, distal elongation with branched stentgrafts can be performed to avoid covering or occlusion of the internal iliac artery. Type II endoleaks are treated with embolisation of the feeding arterial branches. The inferior mesenteric artery can be reached via the SMA through Riolan´s or the marginal anastomosis with a hydrophilic micro catheter. Similarly, lumbar arteries can be reached via the internal iliac artery through the lumbar collateral network, however, tis is not always technically possible. In such situations, a "perigraft" approach (entering the aneurysm between the arterial wall and the outer surface of the stentgraft) or a CT-guided percutaneous approach (direct puncture of the aneurysm sac) can be necessary. Type III endoleaks are treated with secondary insertion of another stentgraft. If the leak is located in the main body of the stentgraft, a aortomonoiliac conversion is usually required with subsequent femora-femoral cross-over bypass. This latter procedure is also the last option for Type V endoleaks.

Learning Objectives:

1. To learn about the indications for endovascular treatment of EVAR endoleaks.
2. To appreciate the different interventional techniques.
3. To learn about the pros and cons of each technique.

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

Cardiac

RC 803
Imaging of heart failure

A-289 16:00
Chairman's introduction
M. Gutberlet; *Leipzig/DE (matthias.gutberlet@helios-kliniken.de)*

Heart Failure (HF) is a rapidly growing epidemic. More deaths result from HF causing sudden cardiac death than from all forms of cancer combined; the 5-year mortality after a diagnosis of HF is as high as 50%. Imaging in these patients offers a lot of possibilities and allows for risk stratification to provide tailored therapy. But it is rather difficult to choose the appropriate imaging modality in a dedicated patient. The optimal imaging modality should provide data about LV-function, - shape and size, exclusion or diagnosis of coronary artery disease, tissue characterisation, i.e. about ischemia and viability, as well as about valve morphology and function and sympathetic innervation. At the moment this can't be provided by one imaging modality only. Therefore, despite the major role of echocardiography, heart failure is a condition in which access to multiple imaging modalities is mandatory. The different advantages and disadvantages of the different imaging modalities will be discussed in this refresher course.
Author Disclosure:
M. Gutberlet: Speaker; Moderate Lecture Honorarium from Bayer, Bracco, Philips, Siemens.

A-290 16:05
A. Current ESC and AHA guidelines: how to choose imaging techniques in heart failure patients?
J.T. Ortiz-Perez; *Barcelona/ES (jtortiz@clinic.ub.es)*

Heart failure (HF) is a syndrome where typical symptoms (fatigue, breathlessness, ankle swelling) and signs (pulmonary crackles, jugular venous ingurgitation) appear from an altered cardiac structure or function. However, due to the unspecific nature of HF symptoms, early diagnosis and crucial to impact outcomes, is difficult. Recognition of the underlying pathology is essential for a tailored therapy as well. Myocardial disease causing systolic or diastolic dysfunction, but also the valves, pericardium, heart rhythm and conduction abnormalities may cause HF. Cardiac imaging has a pivotal role in this scenario. Clinicians should be familiar with the evaluation of pre-test probability of heart disease which modulates the diagnostic test accuracy. The information provided, availability, technical expertise, and costs are factors to be considered when choosing the imaging modality. Based on its wide availability, portability, accurate and comprehensive information provided, echocardiography remains the cornerstone of cardiac imaging, being included in the guidelines for the essential initial workup of HF. Cardiac magnetic resonance is a multimodal technique that provides functional evaluation of the heart with unprecedented precision. The ability of late enhancement magnetic resonance to depict the pattern, location and extent of myocardial pathology with unique spatial resolution highlights the role in the recognition of the underlying pathology, beyond that provided by echocardiography. Single-photon emission computed tomography and positron emission tomography are well-validated techniques that provide relevant functional information, particularly in ischaemic heart disease. Future advances in the field of molecular imaging and tissue characterisation may increase our ability to diagnose HF at earlier stages.
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-291 16:28
B. Differentiating the causes for heart failure: is MRI the undisputable gold standard?
T. Leiner; *Utrecht/NL (t.leiner@umcutrecht.nl)*

Heart failure is a complex clinical syndrome that may present with preserved or reduced ejection fraction. Echocardiography is and remains the first-line imaging test due to its ubiquitous availability and low cost. Despite these advantages, echocardiography is not well suited to assess myocardial structural abnormalities that may provide important clues regarding the cause of heart failure. Cardiac magnetic resonance (CMR) imaging is an important test to elucidate the aetiology of heart failure. Its ability to depict both cardiac function and myocardial structure coupled with the absence of radiation makes it the preferred second-line imaging test. CMR is the best imaging test to assess both left and right ventricular volumes, mass and ejection fraction because it is not limited by acoustic windows or patient habitus. CMR can also characterise myocardial tissue and assess myocardial viability, and has the capability to distinguish ischaemic from non-ischaemic cardiomyopathies based on the pattern of delayed gadolinium enhancement on post-contrast T1-weighted images. Furthermore, CMR offers outstanding capabilities to narrow the differential diagnosis of potential underlying heart failure causes. Of all available imaging modalities CMR confidently allows for differentiation of heart failure due to coronary artery disease, valvular disease and other non-ischaemic cardiomyopathies such as myocarditis, sarcoidosis, amyloidosis, ARVC, endomyocardial fibrosis and other diseases.
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-292 16:51
C. SPECT as an alternative imaging technique
F. Bengel; *Hannover/DE (Bengel.Frank@mh-hannover.de)*

Radionuclide imaging techniques play a pivotal role in heart failure, where they are being used for the assessment of myocardial ischaemia, viability, innervation and other molecular signals. It is well-known that myocardial perfusion SPECT enables the distinction between ischaemic and nonischaemic cardiomyopathy, and that the extent of ischaemia, viability and functional impairment, as derived from imaging, provides incremental prognostic value. More recently, specific tracers for targeting of molecular signals such as autonomic innervation, but also inflammation, cell death and metabolism, are penetrating the clinics. Prospective studies confirm e.g. that detection of impaired sympathetic innervation identifies subjects at increased risk of life-threatening arrhythmia and/or heart failure progression. The vision for radionuclide-based imaging in heart failure is to provide imaging markers for individual optimisation of therapeutic decision making.
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.
Author Disclosure:
F. Bengel: Advisory Board; GE Healthcare. Grant Recipient; Mallinckrodt Pharma, Siemens. Speaker; GE Healthcare, Mallinckrodt Pharma, Siemens.

17:14
Panel discussion: What is the preferred comprehensive imaging test in heart failure?

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

Abdominal Viscera

RC 809
Current trends in transarterial chemoembolisation (TACE) and radioembolisation for HCC

A-293 16:00
Chairman's introduction
T.K. Helmberger; *Munich/DE (Thomas.Helmberger@klinikum-muenchen.de)*

Diagnostics and treatment in hepatocellular carcinoma (HCC) is challenging due to the interaction of the usually underlying liver disease and the variable hepatic neoplastic activity. Therefore, for staging HCC, further therapy planning, therapy monitoring, and follow-up sophisticated imaging is of ample importance.
In consensus with most of the worldwide guidelines for treatment of HCC, the therapy should be applied according to the stage of disease-defined by the grade of the systemic liver disease and the extent of hepatic tumour load. At present, in most of the cases, an image-guided procedure (thermal- ,chemo-, radio-ablation) will be best suited for treatment, whereas the transarterial techniques (transarterial chemotherapy-TACE; transarterial radioembolisation-TARE) will be applied in the majority of cases-represented by an intermediate and moderately advanced stage. Recent technical and medical developments

and increasing study evidences-with special focus on TACE and TARE-will be discussed enhancing the knowledge on an improved therapeutic stratification in HCC.
Author Disclosure:
T.K. Helmberger: Speaker; BTG, Celonova, Sirtex.

A-294 16:05

A. Imaging in therapy planning and follow-up
V. Vilgrain[1], M. Burrel[2]; [1]*Clichy/FR;* [2]*Barcelona/ES*

We have now evidence of more than a decade that transarterial chemoembolization (TACE) improves survival in a selected group of patients with hepatocellular carcinoma (HCC). There have been also published promising data about the benefit of intraarterial radiotherapy (TARE) in HCC patients. Accurate selection criteria are essential to provide good outcome after TACE and/or TARE. Accurate preoperative diagnosis and staging with MR and/or CT play an essential role to select those patients who may benefit from intraarterial therapies. The non-invasive imaging techniques together with emerging technologies for image guidance and device navigation have also become of great importance to perform therapeutic procedures. Imaging techniques are again a key tool for tumor response assessment after locoregional therapies. The aim of locoregional therapies is to necrose tumour tissue and this is very often not initially captured only by measuring tumour size. Tumour necrosis is identified by the absence of contrast uptake within the tumour. Assessment of response after TACE is challenging, given that the rate of complete response is lower compared to curative therapies and residual disease is frequent. Response assessment after TARE is even more difficult, since changes may not be observed after several months after treatment. Current trends of imaging that influence in patient selection, therapy planning and follow-up of patients treated with TACE or TARE will be discussed in this presentation.
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-295 16:28

B. TACE and TAE for HCC: new agents, new schedules, new combinations
R. Lencioni; *Pisa/IT (riccardo.lencioni@med.unipi.it)*

Transarterial chemoembolisation (TACE) is the most widely used treatment for hepatocellular carcinoma (HCC) worldwide. A meta-analysis of randomised trials has established TACE as the standard of care for patients classified as intermediate-stage according to the Barcelona Clinic for Liver Cancer (BCLC) staging system. The most popular TACE technique is the administration of an anticancer-in-oil emulsion followed by embolic agents. The key component of this procedure is Lipiodol, which is used both as a vehicle to carry and localise the chemotherapeutic agent inside the tumour and as a microembolic agent for tiny tumour vessels. Recently, the introduction of embolic, drug-eluting beads has provided an alternative to Lipiodol-based regimens. Clinical experiences have suggested that drug-eluting beads provide a combined ischemic and cytotoxic effect locally with low systemic toxic exposure. However, any TACE regimen, by interrupting blood flow to the tumour, may create conditions that permit or encourage angiogenesis. Surrogate markers of tissue hypoxia that increase after TACE include hypoxia-inducible factor 1 alpha and both plasma and hepatic vascular endothelial growth factor (VEGF). Thus, inhibition of angiogenesis may be synergistic with TACE. The introduction of molecular targeted agents that inhibit tumor cell proliferation and angiogenesis to the therapeutic armamentarium for HCC has prompted the design of clinical trials aimed at investigating the synergies between loco-regional and systemic treatments. Encouraging safety and efficacy signals were captured by the phase II studies completed so far. However, further randomised controlled studies are required to understand the survival benefit associated with such combination regimens.
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-296 16:51

C. Radioembolisation: critical appraisal of techniques and guidelines for treatment
J.I. Bilbao; *Pamplona/ES (jibilbao@unav.es)*

Radioembolisation (RE) is an endovascular procedure that has some technical similarities with chemoembolisation /TACE): selective catheterisation with microcatheters and deep knowledge of vascular anatomy. But also some peculiarities, among them the need of in-depth and multidisciplinary pretreatment plannified strategy depending on tumour burden, liver volumes, liver functional reserve and vascular anatomy. Since RE is, haemodinamically, a microembolic procedure there are no limitations in terms of liver ischemic damage consequences and so the procedure can be safely performed in patients with multinodular HCC as well as in cases of segmetal/lobar portal vein tumoral invasion. Published results with RE in such unfavorable conditions for performing TACE are satisfactory and the available information has allowed to explore subgroups within BCLC-B and BCLC-C stages that will benefit from this treatment. RE has also expanded the frontiers of the endovascular therapeutic armamentarium for HCC with new concepts such as radiation "segmentectomy" and "lobectomy". The former is based in the delivery of a high dose of radiation in a very selective manner (directly within the tumor) to obtain a local result similar than that obtained with surgery. Radiation lobectomy consists in the application of the dose in the liver volumen that includes the tumoral area while sparing some liver segments. This allows a unique achievement which is the treatment of the tumor as well as a subsequent increase in the volumen of the non-targeted area similar to the obtained with portal vein embolisation.
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: Speaker; Sirtex Medical Europe, Terumo.

17:14
Panel discussion: The intermediate HCC patient: how can we stratify patients and allocate them to different therapies?

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

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

MC 828

General principles: paediatric and ENT emergencies

Moderators:
S. Mirvis; Baltimore, MD/US
A. Palkó; Szeged/HU

A-297 16:00

A. General principles
U. Linsenmaier; *Munich/DE (Ulrich.Linsenmaier@helios-kliniken.de)*

This lecture will cover:: 1. Demonstrate general principles, logistics and handling of diagnostic imaging in Emergency Radiology in traumatic and non-traumatic emergencies. 2. Identify possible scientific resources for running your own Emergency Radiology section.3. Analyse etiology, background and management of common radiological emergencies. 4. Identify the role, indications and protocols for US, CR, MDCT in modern emergency radiology. 5. Emergent imaging of multiple trauma / polytrauma: Patient triage, logistics and the role of modern emergency radiology in diagnosis of polytrauma. Imaging protocols for the initial workup: A standardized WBCT comprises native CCT, CT of thorax, head&neck and c-spine (arterial) and CT (pv) of abdomen and pelvis. MDCT could replace all conventional radiographs (CR), US is used as FAST (focused abdominal solography in trauma) to directly initiate lifesaving interventions. WBCT can be now modified with additional arterial CTA scans (@ 35-45s for e.g. extremity injuries, active bleeding), late scans (@120s for e.g. bleeding dynamic, pseudoaneurysms) or delayed CT urography (CTU @ 420-500s, for all kidney and GU injuries), which can also be combined with retrograde CT cystography (e.g. in pelvic and bladder injuries).CT scout views and clinical findings determine the extent and indications of the latter scan options… Modern CTA is providing an excellent workup of the vascular tree, MPRs allow for thorough workup of bony structures including the entire spine and pelvis.
Learning Objectives:
1. To learn about general principles of diagnostic imaging in emergency radiology in traumatic and non-traumatic emergencies.
2. To understand the etiology, background and management of common radiological emergencies.
3. To appreciate the role, indications and protocols for US, CR, MDCT in modern emergency radiology.

A-298 16:30

B. Challenges of imaging paediatric abdominal emergencies

C.J. Sivit; *Cleveland, OH/US (Carlos.Sivit@UHhospitals.org)*

Diagnostic imaging plays a critical role in the evaluation of paediatric abdominal emergencies. The clinical evaluation may be limited particularly, in infants and younger children who are not able to verbalise complaints or localise the site of pain. Advances in imaging technology have changed the algorithm for evaluating many associated conditions. Additionally, the role of diagnostic imaging in excluding disease and therefore, eliminating the need for hospital observation also plays an important role in patient management. Midgut malrotation is the most important abdominal emergency in the newborn period. Intestinal intussusceptions and acute appendicitis are the most frequent conditions in older infants and children. This session provides a clinical overview and reviews the rationale for imaging and important imaging features of these conditions.

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-299 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 localise 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 MB 5**

E³ - ECR Academies: Diagnostic Urogenital Radiology

E³ 820

Upper and lower urinary tract

Moderator:
N. Grenier; Bordeaux/FR

A-300 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-301 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. On 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 pelvicaliceal irregularities, focal or diffuse mural thickening, caliceal amputation, and tumour-filled distended calices. 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 syncronous 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 carcinomas 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-302 17:00

C. Imaging of bladder and urethra

T.A. El-Diasty; *Mansoura/EG (teldiasty@hotmail.com)*

Cross-sectional imaging plays a growing, important role in the evaluation of patients with malignant and nonmalignant disease of the urinary bladder. For imaging of bladder cancer, MR imaging is the modality of choice for accurate local staging of bladder cancer. In addition, MRI helps detect lymph node involvement, and in conjunction with CT, provides complete staging. PET/CT is emerging as a novel-imaging tool for the detection of distant metastases. For imaging of the urethra, conventional radiographic contrast studies including voiding cystourethrography and retrograde urethrography are most commonly utilised. They are best suited for delineating luminal abnormalities of the urethra and thus are commonly used as the primary imaging modality for patients with various urethral abnormalities such as trauma, inflammation, and stricture. More recently, ultrasound, MRI and CT have been utilised increasingly for urethral and periurethral abnormalities. Familiarity with optimal imaging protocols, normal anatomy, and pathologic imaging appearances of urinary bladder and urethra is essential for the radiologist. In this interactive session, we emphasise the value of current imaging modalities and discuss the most common differential diagnoses and the potential applications of novel imaging techniques in patients with various diseases of urinary bladder and urethra.

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 nonmalignant disease.
3. To learn about the most frequent differential diagnoses.

Friday, March 6

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

E³ - ECR Academies: Interactive Teaching Sessions

E³ 921
Thoracic changes after treatment

A-303 08:30
A. Drug-related conditions
T. Franquet; *Barcelona/ES (tfranquet@santpau.cat)*

Pulmonary reaction secondary to drug toxicity may mimic any lung disease and is often difficult to distinguish from other causes of diffuse lung disease. The number of drugs, that cause lung disease, will continue to increase as new agents are developed. Several CT patterns have been related to pulmonary response to drug toxicity: 1) interstitial pneumonitis and fibrosis, 2) eosinophilic pneumonia, 3) cryptogenic organising pneumonia and 4) diffuse alveolar damage. Other reactions such as granulomatous pneumonitis, vasculitis, alveolar proteinosis, obliterative bronchiolitis, and venoocclusive disease are less common. One of the most common forms of drug-induced pneumonitis is NSIP pattern. This is characterized histologically by more or less homogeneous alveolar wall thickening by fibrous tissue and mononuclear inflammatory cells. This reaction is commonly associated with methotrexate, amiodarone, or carmustine therapy. The second form is UIP pattern. This pattern occurs most commonly in association with cytotoxic chemotherapeutic agents, such as bleomycin, busulfan, methotrexate, doxorubicin, and carmustine. Cryptogenic organizing pneumonia (COP) is characterised by parenchymal interstitial infiltration of mononuclear inflammatory cells and obliteration of the lumens of respiratory bronchioles, alveolar ducts, and (usually to a lesser extent) alveoli by fibroblastic tissue. The reaction has been reported most frequently in association with methotrexate, cyclophosphamide, gold, nitrofurantoin, amiodarone, bleomycin, and busulfan. Diffuse alveolar damage (DAD) is characterized by the presence of alveolar airspace and interstitial oedema, hyaline membrane formation, and proliferation of type II pneumocytes. It occurs most commonly in association with cytotoxic agents such as bleomycin, aspirin, and narcotics.
Learning Objectives:
1. To understand pulmonary changes related to treatment.
2. To understand the mechanisms of injury to the lung in drug-related conditions.

A-304 09:15
B. Device-related conditions
G.R. Ferretti; *Grenoble/FR (GFerretti@chu-grenoble.fr)*

In this interactive session, we will present and discuss several cases illustrating thoracic changes after instrumental procedures in the thorax such as intensive care, radiofrequency ablation, and interventional endoscopy. Radiologists have an important role for assessing the results of these procedures as well as for depicting the complications. However, knowledge of normal appearance after those procedures has to be presented.
Learning Objectives:
1. To understand changes related to lines and wires in ICU patients.
2. To learn about findings related to surgery.

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

Abdominal Viscera

RC 901
Technical advances in liver and pancreatic imaging
Moderator:
C. Bartolozzi; Pisa/IT

A-305 08:30
A. CEUS and elastography
G. Mostbeck; *Vienna/AT (gerhard.mostbeck@wienkav.at)*

Contrast-enhanced ultrasound (CEUS) and elastography are evolving US techniques that have already found their ways in clinical practice (CEUS) or will do so in the next years (elastography). CEUS is performed with 2nd-generation US contrast media, but these contrast media are not available worldwide. In many European countries, SonoVue® (Bracco, IT) is the only available contrast, consisting of micro-bubbles less than the size of red blood cells. In contrast to CT and MR contrast media, these bubbles are strictly intravascular. For US imaging, low mechanical index US techniques are used to see the resonance of sound by these bubbles. CEUS is excellent for the differential diagnosis of focal liver lesions based on vascularisation and specific contrast uptake (imaging the wash-in and wash-out of US contrast over time with excellent temporal resolution) and increases US sensitivity for liver metastases in colorectal cancer patients. However, CEUS is only useful when there are excellent US conditions. In pancreatic US, CEUS allows to differentiate adenocarcinoma from neuroendocrine tumours based on vascularisation (US contrast uptake). Whereas elastography (strain elastography or shear wave elastography) is established for the diagnosis of liver fibrosis, there are no general recommendations to use these various techniques to measure "hardness of a focal lesion" in focal liver and pancreas lesions.
Learning Objectives:
1. To become familiar with novel technical applications that are useful in liver and pancreatic diseases.
2. To understand the underlying pathophysiologic processes.
3. To learn about the strengths and limitations of CEUS compared with CT and MRI in the study of focal liver lesions and pancreatic diseases.

A-306 09:00
B. MRI: diffusion, perfusion and elastography
B. Van Beers; *Clichy/FR (bernard.van-beers@bjn.aphp.fr)*

Imaging biomarkers obtained with diffusion and perfusion MRI and MR elastography help in disease characterisation and improve the assessment of tumour response to treatment. To improve the reproducibility and accuracy of these functional imaging methods, several points should be considered: 1. Finding the best compromise between acquisition speed, spatial resolution and signal to noise ratios. 2. Using breathholding or image registration methods. 3. Comparing the goodness of fit and reproducibility of several image analysis methods. 4. Using volumetric assessment, semi-automatic lesion segmentation and voxelwise analysis in heterogeneous tumours. 5. Analysis of multiple quantitative parameters may further improve the diagnostic accuracy of functional MRI of the abdomen. However, the optimal set of biomarkers for specific diseases remains to be determined. The usefulness of functional parameters obtained with diffusion and perfusion parameters in the assessment of tumour response to targeted treatments has been shown in clinical studies. The added value of MR elastography in this context has been suggested in some animal studies, but remains to be shown in humans.
Learning Objectives:
1. To learn about the technical requirements necessary for diffusion-weighted MRI and how to avoid artefacts.
2. To learn about the technical requirements for CT and MRI perfusion.
3. To become familiar with imaging biomarkers useful in tumour evaluation.

A-307 09:30
C. Liver-specific contrast agents
B.J. Op de Beeck; *Antwerp/BE (bart.op.de.beeck@uza.be)*

For state-of-the-art MR liver and pancreatic imaging, a field strength of at least 1.5 T is required. All non-blood pool Gadolinium chelate-based contrast agents are suitable for dynamic liver and pancreatic MRI. All Gadolinium chelates should be routinely administered at a rate of 1-2 ml/sec followed by a 20-ml saline flush at 1-2 ml/sec using a power injector. To obtain hepatobiliary phase imaging in addition to dynamic phase imaging, the use of liver-specific contrast agents is required. Gd-EOB provides the highest hepatocyte enhancement but an overlap between delayed phase and hepatocyte phase has to be considered during dynamic evaluation. Hepatocyte phase can be considered adequate when contrast is detected in the intrahepatic bile ducts. Hepatobiliary phase imaging benefits from a gradient-echo high flip angle, depending on magnet field strength. In the absence of liver function impairment and biliary obstruction, contrast-enhanced MR cholangiography can be obtained with Gd-EOB within 20-40 minutes, and with Gd-BOPTA within 60-120 minutes. When the differential diagnosis is primarily between solid benign lesion and metastasis, the use of a liver-specific CA is recommended due to the ability to diagnose FNH confidently. The combined interpretation of dynamic and hepatobiliary phase improves diagnostic accuracy of MR imaging for the detection of HCC. Haemangiomas and intrahepatic CCC results relative hypointense in the late vascular phase after Gd-EOB administration as opposed to sole extracellular agents. When combined with T2-weighted MRCP, contrast-enhanced MRC allows morphologic and functional assessment of the biliary system.
Learning Objectives:
1. To learn about the principals and recent technical advances in the use of liver-specific contrast agents for liver imaging.
2. To appreciate the similarities and differences between the classes of contrast agents.
3. To become familiar with indications of liver-specific contrast in biliary diseases.
4. To learn about future directions of MRI contrast agents.

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

Special Focus Session

SF 9a

Evaluation of treatment response in head and neck cancer

A-308 08:30

Chairman's introduction

M. Becker; *Geneva/CH (minerva.becker@hcuge.ch)*

In the introduction of this special focus session, currently available treatment options in head and neck squamous cell carcinoma will be reviewed with emphasis on chemo-radiotherapy. The concept of personalised treatment based on morphologic, functional and molecular imaging findings will be briefly addressed and illustrative cases will be shown. Relevant imaging findings affecting treatment response and patient outcome will be discussed as well as the role of the radiologist in the setting of multidisciplinary tumour boards. This short lecture will introduce the key imaging findings discussed in detail by the following speakers.

Session Objectives:

1. To become familiar with treatment options in head and neck cancer.
2. To understand the concept of personalised treatment based on morphologic, functional and molecular imaging findings.
3. To review the key imaging findings affecting treatment choice in head and neck cancer.
4. To learn which CT, MRI and PET/CT findings allow for correct assessment of treatment response.
5. To learn how to report the relevant imaging findings in a structured fashion.

A-309 08:35

Prognostic factors influencing treatment choice and treatment response

R. Hermans; *Leuven/BE (Robert.Hermans@uzleuven.be)*

Head and neck cancer can be treated with curative intent by radiotherapy (RT), chemoradiotherapy (CRT), surgery or a combination of these. In the absence of metastastic disease, treatment selection is largely determined by the site of origin and TN-staging of the neoplasm. Many cancers originate from the mucosal lining, but show the tendency to extend submucosally. CT/MRI are essential to evaluate this deep tumour extent, influencing the T-staging and therapeutic decisions. For example, extensive perineural tumour spread, involving the skull base, precludes surgical treatment. The T-staging is mainly based on involvement of certain anatomical structures or spaces; it does not take into account the degree of involvement. This explains why CT or MRI determined tumour volume is a better prognostic factor than the T-staging. Nodal metastasis is another important prognostic factor. N-staging is based on localisation (ipsi, bi- or contralateral to the primary tumour), size and number of adenopathies. It does take into account neither nodal volume, nodal level (low versus high in the neck), nor presence of extracapsular tumour spread, all important factors influencing the search for possible metastatic disease, treatment selection and outcome. CT/MRI provide important information regarding nodal disease, possibly overruling decisions merely based on N-staging. After RT/CRT, treatment-induced tissue changes may make clinical neck evaluation difficult. Imaging is helpful to detect such a recurrence at an early stage. In patients with residual nodal masses after CRT, imaging findings help to decide whether or not to perform an additional neck dissection.

Learning Objectives:

1. To become familiar with key imaging issues affecting treatment choice in head and neck cancer.
2. To understand which main imaging findings affect the outcome of radiation therapy.
3. To learn how to report the findings and which measurements to perform in clinical routine.

A-310 09:00

Evaluation of early treatment response: can MRI techniques make a difference?

H.C. Thoeny; *Berne/CH (harriet.thoeny@insel.ch)*

In recent years, radiotherapy as treatment option in head and neck squamous cell carcinoma has increased substantially. Follow-up after surgical removal of a tumour is mainly based on detection of a newly detectable lesion already evaluable on morphological imaging (CT or MRI). After radiotherapy, however, evaluation of the neck is more challenging not only for the clinician but also for the radiologist due to substantial soft tissue changes also of normal structures hampering imaging interpretation based on morphological images. In recent years, functional MR imaging techniques including dynamic contrast-enhanced MRI (DCE-MRI) as well as Diffusion-weighted MRI (DW-MRI) gained increasing importance in the evaluation of predicting and monitoring treatment response at an early time point. Few studies applied DCE-MRI in this context. But, several studies showed promising results applying DW-MRI in response assessment. DW-MRI can be interpreted qualitatively by visual image analysis or quantitatively by measuring the Apparent Diffusion Coefficient (ADC). In most of the published investigations an increase in ADC early into or after treatment was associated with a favourable outcome. On the other side no change in ADC or a drop in ADC correlated with early recurrence, partial or no response to radio- or chemotherapy treatment. The background of DW-MRI as well as clinical studies will be discussed in more detail.

Learning Objectives:

1. To learn what additional information is acquired by MRI with diffusion-weighted and perfusion sequences.
2. To appreciate the clinical importance of this examination in the early follow-up of head and neck cancer patients.
3. To learn how to interpret results and how to avoid mistakes.

Author Disclosure:

H.C. Thoeny: Grant Recipient; Maiores Foundation.

A-311 09:25

Post treatment imaging: is PET a reliable indicator for tumour viability?

S. Bisdas; *Tübingen/DE (sotirios.bisdas@med.uni-tuebingen.de)*

Traditionally, treatment monitoring has relied on anatomical changes reflected in bi-dimensional measurements of tumour before and after treatment. Conventional imaging, however, has limited utility in this setting, as therapy-induced changes cannot be reliably differentiated from residual disease. Functional imaging with 18 F-fluorodeoxyglucose positron emission tomography (FDG PET) as integrated with CT or MRI has shown potential as surveillance modality to influence and guide therapeutic decision-making since the estimates of sensitivity and specificity are sufficiently high to recommend its use in routine clinical practice. Early detection of residual/recurrent disease allows timely initiation of salvage therapy, while prediction of complete response may obviate the need for surgical intervention preventing major morbidity. However, the positive predictive value may be suboptimal (< 60%) both for primary site and nodes suggesting higher false positivity. Standardised uptake value (SUV) of suspected lesions cannot be a sole determinant of malignancy. SUV metrics performance may not surpass the physician's performance, though the latter is dependant on the physician's experience and familiarity with typical and atypical patterns of FDG uptake. The negative predictive value of PET is exceptionally high suggestive of absence of viable disease. It has being increasingly recognised that FDG-PET done within the first few weeks after treatment may have limited accuracy, which improves moderately if imaging is delayed and performed ≥12 weeks after completion of therapy. Nonetheless, the use of hybrid PET imaging, either with CT or mostly MRI, improves substantially the predictive value of PET images alone and thus, it is highly recommended in the clinical practice.

Learning Objectives:

1. To understand what additional information is provided by PET/CT in the post-treatment setting.
2. To appreciate the clinical relevance of PET/CT and its effect on patient management.
3. To learn how to interpret PET/CT examinations and how to avoid interpretation pitfalls.

09:50

Panel discussion: Can we provide accurate information for the evaluation of treatment response?

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

ESR Research in Education and Training Session

Research for trainees made easy: critical reading of the literature

Moderator:
J. Hodler; Zurich/CH

A-312 08:30

Introduction
J. Hodler; *Zurich/CH (juerg.hodler@usz.ch)*

Reading original papers can be demanding, and the sheer number of available publications can be frightening. Still, to become a successful researcher, there is no way around original papers. To read them critically is important to detect errors and gaps which may lead to incorrect conclusions. To include basic science papers is another important issue. Radiology needs to be present in basic research to maintain its credibility as a scientific discipline. On the other hand, research should have an effect on clinical decision making. All these aspects are evaluated in this session by experts in their field.
Author Disclosure:
J. Hodler: Equipment Support Recipient; Siemens. Grant Recipient; Bayer, Guerbet, Siemens.

A-313 08:35

Overwhelmed by the available information? How to organise yourself
P. Rodríguez; *Madrid/ES (pablorodriguezcarner@ucm.es)*

Nowadays the worldwide radiological scientific production has reached gigantic proportions, and the widespread use of the internet has made immediate and global access possible. Trainees can feel overwhelmed by this amount of information: it is sometimes difficult to discern important and interesting papers and sometimes it is also hard to find good sources. This lecture's aim is to provide some tips and tools for the trainees in their quest for learning radiology and keeping updated through the reading of scientific literature, and help them optimize their time. We will review ways that can assist in organising the reading of the the most interesting and latest scientific articles of the major radiological journals (subscription to the table of contents, personalised subscription based on particular interests, etc)., some of the most complete radiology hubs where we can find new advances and also good refreshing and reviews, useful tips to optimize a scientific search, and some collaborative initiatives that can also help in dealing with recently published literature (journal clubs, etc).
Learning Objectives:
1. To learn how to cope with the overwhelming amount of available information.
2. To become familiar with resources adequate for trainees.
3. To learn how colleagues with similar experience levels assess literature.

A-314 08:55

Errors you should detect when reading scientific papers
A.K. Dixon; *Cambridge/UK (akd15@radiol.cam.ac.uk)*

A common error in study design is to investigate an anomalous population. This is particularly true in retrospective studies. But even in prospective studies, the results can be considerably distorted by investigating a group a patients with a very high/low prevalence of disease. And results based on referrals to a specialist centre may not be applicable in the community. When reading publications the patient cohort should be studied closely, especially those patients and examinations excluded from further analysis. Another major error is insufficient prospective consideration concerning the power of the study. Hence, there is importance of obtaining expert statistical advice at the outset. Ideally the concept of the project and the ethical/statistical implications should be approved by some form of expert governance committee; most institutions now insist on such approval. This should include aspects of authorship. Of course there are isolated examples of gross scientific fraud. However, unfortunately, there are numerous examples where some results are withheld to maximise the impact of certain aspects of the paper. Some serious fraud arises from naivety and this may even arise innocently from poor study design at outset.
Learning Objectives:
1. To learn about typical errors in study design.
2. To recognise such errors while reading publications.
3. To understand the meaning and severity of scientific fraud.

A-315 09:15

Clinical relevance of publications: influence on outcome
D.J. Wilson; *Oxford/UK (david.wilson@ndorms.ox.ac.uk)*

Research is the cornerstone of medical practice. However, much of our learned knowledge is based on experience without scientific support. We must continue to add to the evidence that underpins our practice, but when reading new work it is essential to have a practical and pragmatic approach. The quality of the evidence is the key. Read with the view that you will need to defend management based on this evidence. Did the authors select a reasonable cohort of case material, how would it match your practice? Were they influenced by being a special clinic or did they exclude patients who you think are part of your referral group? Did they design the study to answer the important questions? Does the argument they present convince you enough to submit yourself or your relatives to this process? Statistics are powerful tools but real changes in practice are usually made by studies that produce self-evident figures. Remember placebo response and observer bias, the better the blinding and more the controls the safer the study outcome. Meta-analysis is popular and it looks convincing. Consider whether it was reasonable to include all the studies and whether each of the primary authors has targeted the subject being analysed. Keep up to date with what is in the literature and base your practice on studies that convince you.
Learning Objectives:
1. To recognise the clinical relevance of publications.
2. To understand characteristics of clinically relevant papers.
3. To be able to plan clinically relevant scientific evaluations.
Author Disclosure:
D.J. Wilson: Board Member; British Institute of Radiology. Owner; St Lukes Radiology Oxford. Shareholder; European Radiology London.

A-316 09:35

Do not be afraid of basic science papers
N. Grenier; *Bordeaux/FR (nicolas.grenier@chu-bordeaux.fr)*

Advance in knowledge is a very powerful stimulation for young radiologists to share exciting developments in their fields of interest. Most of the significant innovations came first from either basic science or preclinical works published in scientific journals. Such papers bring new concepts, new ideas, new techniques in the different fields feeding most of radiology development, such as biology, chemistry of agents, physics, informatics and post-processing. In fact, if reading of these papers could seem esoteric to many, they drive problems we are facing in our everyday work, providing fresh resourcing and perspectives of improvements. If pure physic or chemistry papers remain extremely far from our culture, they become rapidly accessible as soon as clinical applications can be discerned. The main objective for radiologists reading preclinical papers is to capture their objectives, their innovative part and their potential to provide new input for clinics, even if all the details and specific methods used cannot be fully understood. However, critical analysis of preclinical studies by clinicians remain mandatory to evaluate how adequate and/or pertinent are the chosen animal models or the imaging technique used, before to be able to extrapolate the results to patients. Such a curiosity and critical analysis of this literature is essential for all young radiologists expecting to play a role in developing radiology for the next decades.
Learning Objectives:
1. To appreciate the role of basic research in radiology.
2. To become familiar with typical methodology in basic research.
3. To understand differences and similarities between clinical and basic research.
Author Disclosure:
N. Grenier: Advisory Board; Supersonic Imagine.

A-317 09:55

Summary
J. Hodler; *Zurich/CH (juerg.hodler@usz.ch)*

Several experienced speakers have presented their lectures from their own experience (see abstracts of previous presentations). Scientific contributions by as many radiologists as possible are important for advancing the field and science requires reading of other groups' publications. This session should contribute to critical and successful reading of the literature.
Author Disclosure:
J. Hodler: Equipment Support Recipient; Siemens. Grant Recipient; Bayer, Guerbet, Siemens.

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

E³ - ECR Academies: Image-Guided Interventions in Oncology

E³ 919

Colorectal liver metastases: the emerging role of interventional radiologists in oncology

A-318 08:30

Chairman's introduction

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

Optimised and personalised therapy of patients with metastatic colorectal cancers should be based on multidisciplinarity with oncology, surgery, interventional oncology and radiation therapy. Among the different modalities used by interventional radiologists to treat colorectal liver metastases, we differentiate between percutaneous thermal ablation and transarterial therapies, radioembolisation or chemoembolisation. To optimise the treatment strategy and patients' outcomes, minimally invasive therapies may be advantageously combined with surgery or systemic chemotherapies. In patients with colorectal liver metastases, overall survival in selected cases is similar after thermal ablation compared with patients after resection. Combining systemic treatments or surgery with thermal ablation seems very promising.

Session Objectives:

1. To become familiar with the several image-guided interventions in the multidisciplinary clinical management of patients affected by liver metastases from colorecatal cancer.
2. To understand the role of interventional radiology in the treatment algorithm for metastases from colorectal cancer.
3. To learn about the clinical evidence for image-guided interventions in this field.

Author Disclosure:

P.L. Pereira: Advisory Board; Terumo, BTG, Medtronic, Bayer, Siemens, BTG. Consultant; Terumo, BTG, Medtronic, Bayer, BTG, Angiodynamics, Celonova. Equipment Support Recipient; Siemens, Terumo, Angiodynamics, Covidien, Amica HS. Grant Recipient; BTG, Siemens, Celon Olympus, celonova. Investigator; BTG, Terumo, Siemens. Speaker; BTG, Terumo, Angiodynamics, Celonova, Microsulis.

A-319 08:33

A. Tumour ablation: when and how in a modern oncological setting

V. Válek; *Brno/CZ (vlvalek@med.muni.cz)*

Radiofrequency ablation (RFA) is currently the most widely used modality for tumour ablation. RFA is a local thermal therapy that uses a form of electrical energy to achieve tumour destruction and is recommended as a technique for the treatment of small liver metastases. Careful evaluation of tumour number, size, morphology, location, adjacent structures, and extrahepatic spread is important. The RFA generator applies a high-frequency alternating electrical current, causing ionic agitation that heats the volume of tissue in the area of the electrode tip. The tumour and surrounding adjacent liver is thermally destroyed. Probe is target under ultrasound or CT guidance. The ideal tumour for percutaneous ablation is a solitary lesion with largest diameter up to 3 cm. The good indications are: maximum of 3 lesions < 3 cm in size. Tumour size up to 5 cm may be acceptable for ablation although multiple overlapping ablations will be required. Within the past 10 years, several publications indicated the effectiveness and safety of RFA. After correctly indicated, we can expect 5-year survival around 25% and curative treatments in 30% patients. However, some studies have reported 5-year survival of less than 20%, whereas other studies have reported 5-year survival rates in the range of 40% or more. Local tumour recurrence rates after RFA varied from 6% to 40%, and are associated to the size, location, and number of lesions. Mortality and morbidity after IRFA, with or without resection, are low. Technical morbidity does not exceed 10.6% and mortality is 0.5%.

Learning Objectives:

1. To understand the role of percutaneous ablation in clinical practice.
2. To learn about essential technical issues.
3. To consolidate the knowledge of clinical results.

A-320 09:02

B. Intra-arterial drug delivery: the state of art

M. Bezzi; *Rome/IT (mario.bezzi@uniroma1.it)*

Colorectal cancer (CRC) is a major health concern with over 140,000 new cases diagnosed in 2012 in the United States (US). The most common site for CRC metastases is the liver. Hepatic resection is the treatment of choice for colorectal liver metastases (CLM), with a 5-year survival rate ranging from 35% to 58%. Unfortunately, only about 20% of patients are eligible for resection. There are a number of options for extending resection to more advanced patients including systemic chemotherapy, portal vein embolisation (PVE), two-stage hepatectomy, ablation and hepatic artery infusion (HAI). There are few phase III trials comparing these treatment modalities and choosing the right treatment is patient-dependent. Treating hepatic metastases requires a multidisciplinary approach and knowledge of all treatment options as there continues to be advances in management of CLM. If a patient can undergo a treatment modality to increase their potential for future resection, this should be the primary goal. If the patient is still deemed unresectable then treatments that lengthen disease-free and overall-survival should be pursued. These include chemotherapy, ablation, HAI, chemoembolisation, radioembolisation (RE) and stereotactic radiotherapy. These new hepatic-directed modalities of treatment are being investigated and may offer new approaches to providing palliation and prolonging survival. This lecture reports the possibilities of intraarterial chemotherapy and other liver-directed approaches to deliver chemotherapy to the CLM.

Learning Objectives:

1. To become familiar with the current indications for intra-arterial chemotherapy in liver metastases.
2. To learn about how to implant a hepatic intra-arterial infusion system.
3. To learn about results coming from personal experience and from the literature.

A-321 09:31

C. Intra-arterial radiation delivery - when and how: the clinical evidence

T.K. Helmberger; *Munich/DE (Thomas.Helmberger@klinikum-muenchen.de)*

Colorectal cancer (CRC) is one of the most common cancers in the Western World. During the course of disease 70-80% of patients will develop hepatic metastases, which will limit the patients' survival drastically if untreated. Surgical resection of metastases might be amenable in 20-25% at its best; unfortunately, post-surgical recurrence will be more than 70%. In consequence, systemic chemotherapy ± biologicals is the main therapeutic pillar in the neoadjuvant setting or in recurrent/progressive disease not suitable for local resection or ablation. Nevertheless, chemotherapy efficacy and tolerance in the long run is limited raising the need for locoregional therapy regimens. Only in liver disease, various transarterial therapies may be applied offering local tumour control together with significantly reduced systemic adverse events. Depending on the intrahepatic extent and localisation of CRC metastases, transarterial therapies such as chemotherapy ± particles (particle TACE) and radioembolisation (TARE) can be deployed as a whole liver treatment, regionally (lobar, segmental) or even lesion selectively. At present, most experience exists for TARE. In case of no contraindications (bilirubin > 3 mg/dl; albumin < 3 g/dl; INR > 1.6; significant lung shunting; uncorrectable aberrant blood flow; prognosis determining extrahepatic disease) typical indications are salvage or symptomatic treatment, neoadjuvant therapy prior to surgical resection ± combination with systemic chemotherapy, or even failed first- or second-line systemic chemotherapy. TARE provides significant response rates in the salvage situation and also in first- and second-line therapy, whenever still more data on optimal treatment algorithms are needed.

Learning Objectives:

1. To become familiar with the main indications for TARE/TACE in liver metastatic disease.
2. To learn about techniques for both intra-arterial treatments.
3. To consolidate knowledge of results from the literature.

Author Disclosure:

T.K. Helmberger: Speaker; SIRTEX, BTG, Celonova, Terumo.

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

Professional Challenges Session

PC 9
Personalised medicine in radiology

A-322 08:30
Chairman's introduction
R. Manfredi; *Verona/IT (riccardo.manfredi@univr.it)*

The aim of personalised medicine (PM), in medical imaging, is to achieve an early diagnosis and subsequently tailor an individual-specific treatment. Different aspects of PM will be discussed: prediction, diagnosis and especially treatment. The concepts of PM will be illustrated to prepare the medical community to this new vision.
Session Objectives:
1. To understand the concept of personalised medicine (PM).
2. To learn about the role of imaging in PM.

A-323 08:35
Imaging is everywhere in personalised medicine
A. van der Lugt; *Rotterdam/NL (a.vanderlugt@erasmusmc.nl)*

In 2014 ESR published its second white paper on personalised medicine. The focus of this paper was on the important and essential role of medical imaging in early diagnosis, and individually tailored treatment. The white paper concludes that medical imaging plays a critical role in all aspects of PM: prediction, diagnosis and especially treatment. For PM to reach its highest potential, medical imaging must be an integral part. It is important that the benefits and contributions of imaging research to PM are acknowledged and supported to fulfil the promises of personalised medicine. As personalised medicine has already entered the clinical arena, it is also important that the medical imaging community is aware of this concept and is prepared for participating as relevant partner in personalised medicine. In this lecture the concept of personalised medicine is explained. The important role of imaging in the different domains of personalised medicine is highlighted.
Learning Objectives:
1. To understand the concept of personalised medicine.
2. To appreciate the role of imaging in personalised medicine.
3. To understand why personalised medicine cannot flourish without imaging (and radiologists).
Author Disclosure:
A. van der Lugt: Research/Grant Support; GE Healthcare. Speaker; GE Healthcare.

A-324 08:55
Personalised prevention: population-based imaging and image-based screening
F. Bamberg; *Tübingen/DE (fabian.bamberg@uni-tuebingen.de)*

Population-based imaging is increasingly being recognised as an opportunity to advance our understanding of disease processes, of associations with other markers of risk (i.e. genetic), and of the prognostic relevance of imaging findings, which all form the basis to establish meaningful imaging biomarkers in the general population. Consequently, this field may particularly contribute to personalised medicine in radiology. The talk will initially review the rationale and challenges of screening in general and its role for personalised medicine. Special emphasis will be given the role of imaging in screening and examples of imaging concepts for screening (i.e. lung cancer screening) will be discussed. In addition, the presentation will highlight the role of population-based imaging as a mean to identify feasible imaging biomarkers that may serve as valuable screening targets. Finally the challenges with respect to population-based imaging and the radiology community for screening will be presented.
Learning Objectives:
1. To understand the concept of screening.
2. To become familiar with population-based imaging.
3. To understand how imaging can improve personalised prevention.
Author Disclosure:
F. Bamberg: Speaker; Siemens Healthcare.

A-325 09:15
Integrated diagnostics: towards one diagnostic department
A. Cuocolo, C. Nappi, E. Zampella; *Naples/IT (cuocolo@unina.it)*

A biomarker is a characteristic that is objectively measured and evaluated as an indicator of normal or pathogenic biological process or pharmacological response to a therapeutic intervention. Biomarkers are potentially useful along the whole spectrum of the disease processes, in diagnosis, staging, monitoring therapy and evaluation of recurrent diseases. Predictive biomarkers, which predict the likely response of patients to specific treatments, require more extensive data for validation, specifically large randomised clinical trials and meta-analysis. Surrogate end points are even more challenging to validate, and require data demonstrating both that the surrogate is prognostic for the true end point independently of treatment and that the effect of treatment on the surrogate reliably predicts its effect on the true end point. The use of imaging biomarkers has also been proposed as a method for obtaining early indications of drug effectiveness and safety, thereby reducing cost and development time. However, pharmaco-imaging needs to evolve from a research tool to a high-throughput production system, with integration of multiple imaging modalities and strong validation of new imaging biomarkers. The first attempt to introduce guidelines for biomarker evaluation was realised from the American Heart Association in 2009. The proposed model for development of cardiovascular biomarkers resembles that of a new drug or device. In this lecture we will present the concept of biomarkers, in particular in integrated diagnostics and its role in personalised medicine.
Learning Objectives:
1. To understand the concept of biomarkers and their role in personalised medicine.
2. To appreciate the differences and synergies between blood- and tissue-based biomarkers and imaging biomarkers.
3. To learn from other diagnostic departments about accuracy and validation of biomarkers.

A-326 09:35
Interventional radiology: a paradigm for personalised medicine
S.N. Goldberg; *Jerusalem/IL (sgoldber@bidmc.harvard.edu)*

This talk will highlight key ways in which interventional radiology is helping to spearhead the personalised medicine revolution. We will first address the current and potential role of image-guided percutaneous and transcatheter sampling as often representing the most minimally invasive method to obtain sufficient specimen for both histopathologic diagnoses as well as biomarkers that can help tailor individualised patient therapy. We will further highlight multiple cutting-edge functional and dynamic imaging strategies that can be used to insure optimal tissue sampling both for establishing an initial diagnosis as well as for monitoring treatment response. The second half of the lecture will be dedicated to demonstrating how the current practice of interventional oncology represents an ideal model of the personalised approach to disease treatment. Using hepatocellular carcinoma as a model, we will demonstrate how the various interventional options included image-guided tumour ablation and transcatheter embolisation strategies have not only meaningfully impacted upon patient survival - often turning this formally invariably fatal disease into a chronic management issue, but also how selection of therapy over the course of the patient's life is personalised based upon the evolving presentation of this disease.
Learning Objectives:
1. To understand how functional imaging can improve tissue sampling.
2. To appreciate the personalised approach in interventional radiology.
3. To become familiar with targeted therapies in interventional radiology.

09:55
Panel discussion: How can we best accelerate the adoption of personalised medicine in radiological practice?

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

New Horizons Session

NH 9
Image-guided interventions of the prostate

A-327 08:30
Chairman's introduction: defining the target
A.R. Padhani; *London/UK (anwar.padhani@stricklandscanner.org.uk)*

The prostate mpMRI target often called the index lesion or dominant intraprostatic lesion is a lesion that is "clinically significant". That is, a tumour that poses a significant risk to health which in turn depends on aggressiveness of the tumour and the life expectancy (period of risk) of the patient. To make this meaningful, the definition is debated in the literature but a commonly used definition is an index tumour volume > 0.5 ml and/or Gleason pattern 4 or 5 and/or extra-capsular disease (ECE/SVI). The original Stamey TA (1993) definition of 0.5 ml may not be applicable for Gleason 3+3 disease whereas 1.3 ml for the index lesion may be more appropriate (Wolters T, 2011).
Session Objectives:
1. To introduce the concept of the index prostatic cancer lesion as a valid target that determines patient therapy and outcomes.
2. To illustrate the concordance between the MRI-depicted and histologically defined intraprostatic target.

A-328 08:35
MR-targeted prostate biopsy
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, multiparametric on the current status of in-bore MRI-guided biopsy.
Learning Objectives:
1. To understand the pros and cons of MRI-guided biopsies versus ultrasound approaches.
2. To understand how to perform MRI-targeted biopsies.
3. To discuss patients selection and appreciate how MRI-targeted biopsy results affects management of patients with positive and negative results.

A-329 08:53
MR-US fusion prostate biopsy
F. Cornud, C. Escourrou, N.B. Delongchamps; *Paris/FR (frcornud@imagerie-tourville.com)*

Accuracy of multiparametric MRI has greatly improved the ability of localising tumour foci of prostate cancer. This property can be used to perform a TRUS-MR image registration, new technological advance, which allows for an overlay of an MRI onto a TRUS image to target a prostate biopsy towards a suspicious area. Three types of registration have been developed: cognitive-based, sensor-based and organ-based registration. Cognitive registration consists of aiming a suspicious area during biopsy with the knowledge of the lesion location identified on multiparametric MRI. Sensor-based registration consists of tracking in real time the TRUS probe with a magnetic device, achieving a global positioning system which overlays in real time the prostate image on both modalities. Its main limitation is that it does not take into account prostate and patient motion during biopsy. Two systems (Artemis and Uronav) have been developed to partially circumvent this drawback. Organ-based registration (Koelis) does not aim to track the TRUS probe, but the prostate itself to compute in a 3D acquisition the TRUS prostate shape, allowing for a registration with the corresponding 3D MRI shape. This system is not limited by prostate/patient motion and allows for a deformation of the organ during registration. Pros and cons of each technique and the rationale for a targeted biopsy only policy are discussed.
Learning Objectives:
1. To understand the pros and cons of different US-guided biopsy approaches.
2. To understand how to perform US-targeted biopsies.
3. To discuss patient selection and appreciate and how US-targeted biopsies affect management of patients with positive and negative results.

A-330 09:11
Image-guided tumour ablations
H.U. Ahmed; *London/UK (Hashim.ahmed@ucl.ac.uk)*

The treatment of localised prostate cancer includes radical whole-gland therapy using surgery or radiotherapy through to active surveillance for low risk cases. Although radical therapy carries a survival benefit in the long-term there is a risk of incontinence and impotence as well as rectal toxicity. This occurs due to collateral damage to surrounding tissues including the neurovascular bundles, external urinary sphincter, bladder and rectal mucosa. Minimally-invasive ablative therapies aim to reduce the toxicity of whole-gland radical therapy whilst retaining the cancer control benefit. Recently, interest has centred on the focal ablation of individual lesions within the prostate, with a margin, whilst avoiding damage to other parts of the prostate and crucial surrounding tissues. So-called focal therapy relies heavily on accurate disease detection, localisation and characterisation using state-of-the-art imaging and targeted biopsies and thus a change in the diagnostic paradigm for prostate cancer itself. Early to medium term outcomes from focal therapy using high intensity focused ultrasound and cryotherapy show reduced incontinence and reduced impotence. Cancer control is so far acceptable. Long term data is awaited and the feasibility of randomised controlled trials assessing focal therapy compared to radical therapies is currently being assessed. Focal therapy using ablative modalities has the potential to address one of the largest over-treatment burdens in oncology.
Learning Objectives:
1. To present the pros and cons of different physical/chemical methods that are used for focal therapy of prostate cancer.
2. To discuss patient selection criteria and show how tumour/prostate gland treatments are undertaken in practice.
3. To present the oncologic results of image-guided prostate tumour ablations.

A-331 09:31
Prostate artery embolisation (PAE) for benign hypertrophy
F.C. Carnevale; *Sao Paulo/BR (fcarnevale@uol.com.br)*

Prostatic artery embolization (PAE) has emerged as an alternative to medical and surgical treatments for benign prostatic hyperplasia (BPH). Patients bothered by lower urinary tract symptoms (LUTS) are candidates for PAE. General contraindications are bladder atonia, neurogenic bladder disorder or other neurological disorders, large bladder diverticula or stones and chronic renal failure. Urodynamic evaluation, ultrasound (US) and magnetic resonance imaging (MRI) baselines are established. In 108 patients with a mean follow-up of 15 months (range, 3 months to 5 years and 4 months): treated patients had prostate volume ranging from 30 to 252 cm3 (mean 90 cm3). Technical success (bilateral PAE) was 93.7%. Symptoms improved from 19.6 (severe) to 7.6 (mild) according to the mean IPSS score (P=0.000); quality of life improved from unhappy/dissatisfied (QoL 4.8) to pleased/satisfied (QoL 1.6) (P=0.000); mean PSA reduced to 50% of baseline (P=0.001); peak urinary flow increased by 2 times (P=0.000); and mean prostate volume reduction of 30% by MRI (P=0.001). Patients refer dysuria and frequent urination after PAE for 3-5 days. Randomised study comparing PAE to TURP showed that similar results were obtained at two-year follow-up. Most complications after PAE were minimal amount of blood/mucus mixtured in the stool, reduction of the ejaculation volume, transient haematuria, urinary tract infection, transient haematospermia, transient ischaemia of the bladder, seminal vesical and rectum. Symptoms' recurrence (IPSS> 8) was observed in 14/104 (13.5%) patients in a mean time of 14.7 months (range, 3-36 months) follow-up. A multidisciplinary approach with urologists and radiologists is essential.
Learning Objectives:
1. To understand the pros and cons of PAE in relation to other methods for treating benign hyperplasia.
2. To discuss patient selection criteria and show how PAE is undertaken.
3. To review the literature on complications, efficacy outcomes of urinary function, symptoms and quality of life and on Long-term results.

09:51
Panel discussion: Do organ-sparing prostatic treatments make sense?

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

Oncologic Imaging

RC 916
New insights in bone tumour imaging

A-332 08:30
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 effectivness and help adapting chemotherapy. The staging may change with this preoperative treatment, and surgical technique and indications can be modified. MRI and PET help diagnosing myeloma extension, and again evaluate the extent of the disease, classify better and choose the treatment. How imaging can diagnose, evaluate and follow better the tumours will then be discussed.
Session Objectives:
1. To become familiar with the appearances and treatment strategies in bone tumours.
2. To learn about the role of current imaging techniques in management of bone tumours.

A-333 08:35
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's sarcoma and chondrosarcoma will be outlined. Multimodal treatment of highgrade 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 posttreatment period.The pathophysiology and imaging characteristics of treatment induced (radiotherapy /chemotherapy) changes in imaging the bone marrow and the sourrounding tissues will be explained. Diffussion 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 posttherapeutic oedema or fibrosis.
Learning Objectives:
1. To understand treatment strategies in bone tumours.
2. To learn the essentials in sarcoma imaging.
3. To understand chemo- and radiation-induced bone marrow changes in patients with bone tumours.

A-334 08:58
B. New insights in staging and restaging musculoskeletal tumours introduction
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 MR 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 how to cooperate with physicist and technicians in optimising MR protocol.
2. To understand the role of MR imaging in staging and restaging.
3. To analyse clinical MR studies.

A-335 09:21
C. New insights in hybrid imaging for multiple myeloma
G. Sommer; *Basle/CH (gregor.sommer@usb.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 distruction). Monoclonal gammopathy of unknown significance (MGUS) and smoldering MM are precursor states of symptomatic MM. The key role of imaging in the initial diagnosis of MM is to detect 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. Severity of disease is classified by the traditional Durie and Salmon staging system, which includes the number of osteolytic lesions detected on skeletal survey and by the more modern International Staging System, which has shown better correlation with overall survival. Modern techniques for assessment of MM are magnetic resonance imaging (MRI) and ^{18}F-fluorodeoxyglucose positron emission tomography (FDG-PET). MRI is more sensitive than CT for detection of MM, as it detects diffuse 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 potentially useful for therapy management. Its clinical use, however, is still limited to scientific protocols. The clinical role of hybrid imaging such as PET/CT and PET/MRI remains to be defined as well.
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 MR imaging in patients with multiple myeloma.

09:44
Panel discussion: The future of bone tumour imaging

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

Multidisciplinary Session

MS 9
Management of rectal cancer: a paradigm shift

A-336 08:30
Chairman's introduction
R.G.H. Beets-Tan; *Maastricht/NL (r.beets.tan@mumc.nl)*

The increasing role of radiologists in the multidisciplinary management team of patients with rectal is well recognised and MR imaging has nowadays become the imaging method of choice for staging these tumors. Although organ preservation is the standard treatment for anal cancer, organ saving treatment for rectal cancer patients has only recently been discussed. It's clear now that major resection with associated morbidity and mortality is not justified anymore for all patients who have responded with near complete or complete response to preoperative treatment. The shift in rectal cancer treatment towards organ preservation is eminent. The objective of this session is to understand the concept of organ preservation in rectal cancer, who are the eligible candidates, how should these patients be selected and followed, which are the relevant clinical questions for radiologists and what is the value of modern imaging. The second objective is to know the performance of functional imaging techniques for assessment of response after preoperative chemoradiotherapy.
Session Objectives:
1. To learn about new organ-saving treatments in rectal cancer and the clinical background.
2. To understand the new role of radiologists within and the questions from the multidisciplinary team during the selection and follow-up of these patients.
3. To learn how radiologists can answer the relevant clinical questions and which are the most accurate imaging methods.

A-337 08:35
Organ-saving treatment: what does the surgeon want to know?
G.L. Beets; *Maastricht/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 require a permanent colostomy are often very willing to consider organ preservation. In addition 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 discriminate 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 the standard rectal surgery. Local recurrences can occur in the lumen, the bowel wall, and the lymph nodes. Compared to the standard treatment, organ preservation strategies require additional information from MRI imaging.
Learning Objectives:
1. To learn about new organ-saving treatments in rectal cancer and the clinical background.
2. To understand the pros and cons of organ-saving treatment.
3. To know how to select patients and understand the factors relevant for clinical decision making.
4. To understand what the surgeon wants to know from radiologists during the selection and follow-up of these patients.

A-338 08:55
Organ-saving treatment: what does the radiation oncologist want to know?
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 amongst individualized 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 terms of indication and radiation field size. A broad portfolio of external radiotherapy techniques + combined with boost strategies by endocavitary brachytherapy can offer the patients a 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 the patient an organ-preserving strategy and take all the benefits of a less aggressive treatment to foster a better long-term quality of life.
Learning Objectives:
1. To learn about pathways of rectal tumour and nodal spread.
2. To understand what radiation oncologists will do with the anatomical information from imaging and how it will influence the radiation fields.
3. To become familiar with various preoperative radiation treatment schedules with or without chemotherapy.
4. To know how radiation treatment can improve the number of patients with complete response and whom can be offered an organ-saving treatment.

A-339 09:15
Organ-saving treatment: what is the radiologist's role?
R.G.H. Beets-Tan; *Maastricht/NL*

The increasing role of radiologists in the multidisciplinary management team of patients with rectal cancer is well recognised and MR imaging as well as ERUS are now part of the standard staging work-up. MRI after preoperative chemoradiotherapy of advanced tumours can show tumor regression and alter surgical approach, therefore useful for surgeons to plan their treatment. Organ-saving treatment in a selected group of patients with clinical complete response after preoperative chemoradiotherapy is under investigation and still controversial. Critical for a good outcome is the selection and follow-up of the right patients. Accurate response assessment is central herein. The objective of this lecture is to understand the performance of imaging methods for the assessment of response after chemoradiotherapy and to know whether MR imaging has a role as a selection and surveillance tool in organ-preserving treatment.
Learning Objectives:
1. To understand the role of radiologists in the multidisciplinary management of patients both during the selection and follow-up for organ-saving treatment.
2. To learn how radiologists can answer the relevant clinical questions.
3. To know the imaging tools and their capacities for identifying viable disease in bowel wall and (extra) mesorectal nodes.
4. To become familiar with the imaging features and pitfalls in interpretation.

09:35
Interactive case discussion: What do clinicians expect from us in organ-saving treatment management?

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

Special Focus Session

SF 9b
The forgotten joints

A-340 08:30
Chairman's introduction
M. Padrón; *Madrid/ES (mario.padron@clinicacemtro.com)*

Session Objectives:
1. To become familiar with the usual patterns of disease in these joints.
2. To learn about the role of imaging in the different disease processes.
3. To understand how imaging can assist in the management of these lesions.

A-341 08:35
Fingers and toes: little joints, big trouble?
A. Klauser; *Innsbruck/AT (andrea.klauser@i-med.ac.at)*

Identifying causes of small joint pain might be demanding because of extensive differential diagnosis. Besides a thorough history and physical examination imaging plays a crucial role. Not only acute but also chronic arthritides may present abruptly. In traumatic settings extra- and intraarticular fractures (insufficiency Fx, sesamoid fx, luxation fx, avulsion fx) should be differentiated from palmar plate injuries and periarticular injuries affecting tendons, retinacula and nerves. Overuse syndromes in workers, sportsmen and the aging population can present challenging towards crystal-induced arthritis, serum sickness reactions and various forms of inflammatory arthritis (rheumatoid arthritis, spondyloarthritis). Plain-film radiographs may demonstrate classic findings of specific rheumatologic diseases; however, it may be normal or show

only nonspecific changes early in the disease process. Ultrasound is of great value for differential diagnosis and early detection of several diseases and by discussion with the patient himself enables for a final diagnosis in a majority of cases. MRI is the imaging modality of choice for evaluation of arthritis, when conventional radiography or sonography is inconclusive. The detection of bone marrow oedema and hyperaemia, which can appear in association, is of great clinical significance, since they are considered as signs of active disease in rheumatologic settings. Furthermore, MRI presentation of bone marrow oedema has a prognostic value, being a strong predictor of bone erosions on follow-up. Generally, the value of MRI consists in the comprehensive detailed assessment of osseous and periarticular structures, however in doubtful gouty arthritis DECT CT will allow for final diagnosis.

Learning Objectives:
1. To understand the imaging strategies available for diagnosis.
2. To differentiate inflammatory, traumatic and degenerative changes.
3. To learn about the management of these injuries.

A-342 09:00

The symphysis pubis

C.W.A. Pfirrmann; *Zurich/CH*

The symphysis pubis is a joint with an interposed fibrocartilaginous disk. The symphysis pubis has attachments of numerous muscles: The rectus abdominis, adductors, gracilis, aponeurosis of the adductor and rectus abdominis muscles. The adductor longus tendon is in continuity with the tendon of the rectus abdominis. The superficial fibers of adductor longus and the rectus abdominis are in continuity over the symphysis pubis. Osteitis pubis is characterised by erosive and sclerotic changes on plan radiographs and bone marrow oedema in the bone adjacent to the symphysis. The ethology is discussed controversial; non-infectious inflammation such as an ankylosing spondylitis or a stress reaction after pregnancy or with high-level athletic activity may be the cause of changes around the pubic symphysis. Morphologic symmetry is important to detect abnormalities at MRI. Tears of the adductor aponeurosis may be diagnosed using the secondary cleft sign. The primary cleft of the joint space is at the intraarticular disk. The "secondary cleft" sign is indicative of an avulsion of the tendon fibres of the adductor aponeurosis. Midline lesion may also be present extending into the rectus abdominis and the adductor aponeurosis.

Learning Objectives:
1. To learn the imaging anatomy of the structures around the symphysis pubis.
2. To be able to set up an MR imaging protocol for the assessment of the symphysis pubis.
3. To understand the pattern of disease around the symphysis pubis.

Author Disclosure:
C.W.A. Pfirrmann: Advisory Board; Siemens MSK-MR. Consultant; Medtronic.

A-343 09:25

The acromioclavicular joint: patterns of injury

D.A. Barron; *Leeds/UK (dominic.barron@leedsth.nhs.uk)*

The acromioclavicular joint is a synovial joint which sometimes has a central disc. The joint capsule is strengthened by the superior and inferior acromioclavicular ligaments. The coraco-clavicular ligaments-conoid (medial) and trapezoid (lateral) ligaments should be considered part of the overall joint. Acromioclavicular joint dislocations account for 12% of all dislocations of the shoulder (1). The mechanism is usually a fall on the shoulder or the outstretched hand.Radiography remains the mainstay for imaging these injuries. These are classified using the 6 grade system described by Rockwood (1998). Essentially grades IV, V and VI are variants of grade III. Type I Radiography - Normal; Type II Radiography-ACJ widened and clavicle elevated but not above the superior border of the acromion. Coraco-clavicular distance is normal; Type III Radiography-clavicle elevated above the superior border of the acromion but coracoclavicular distance is less than twice normal; Type IV Radiography-this is a true posterior dislocation with the clavicle displaced posteriorly into trapezius. The ACJ may be widened and there may be vertical displacement of clavicle. The diagnosis is made on the axial view, is difficult may need to be made clinically; Type V Radiography-clavicle is markedly elevated and coracoclavicular distance is more than double normal (> 25 mm); Type VI Radiography-clavicle inferiorly displaced under the coracoid, behind the intact coracobrachialis and biceps tendons. Periosteal Sleeve Injury and Pan-clavicular Dislocation are unusual variants. Treatment: Grade 1-2: non-operative; Grade 3: Controversial; Grade 4-6: mostly operative

Learning Objectives:
1. To become familiar with the usual mechanisms of injury.
2. To understand the imaging strategies available for diagnosis.
3. To become familiar with the imaging findings and classification of acromioclavicular joint injury.
4. To learn about the management of these injuries.

09:50

Panel discussion: Are these topics never to be forgotten?

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

Radiographers

RC 914

Enhancing patient safety culture in radiology

A-344 08:30

Chairmen's introduction

P. Bezzina[1], L. Donoso[2]; [1]*Msida/MT*, [2]*Barcelona/ES*

Ionising radiation is one of the most important diagnostic discoveries in the history of medicine. Without ionising radiation, most medical imaging examinations would not be possible. Unquestionably, ionising radiation saves lives. However, we need to ensure that as radiographers and radiologists, we deliver good practice within a safety culture. The aim of this session is to raise awareness amongst medical imaging professionals of some key issues in relation to what is patient safety and its importance in medical imaging, the implementation of such practice and the importance of teamwork for the smooth and effective running of an imaging department. Various legislations and policies affect our daily practice. We are professionally bound to work within the law in our practice. We are all too familiar with the use of audits, however, we question their use and sometimes we fail to understand their role in a clinical environment. Quality assurance is an essential aspect of our delivery of care within an environment that constantly uses equipment which requires systematic evaluation as a means to ensure and promote radiation safety. Medical imaging is a process which includes the justification, application of appropriate imaging modalities, optimisation and an outcome. There may be several barriers that we have to overcome and we need to take cognition and implement new strategies for improvement. This is only possible within a team. It is important to recognise that teamwork is a key concept in creating a patient's safety culture.

Session Objectives:
1. To understand the importance of patient safety in radiology.
2. To learn the fundamentals of implementing a patient safety culture.
3. To appreciate the importance of teamwork for developing a safe radiology department.

A-345 08:35

A. Patient safety culture: the importance of EU clinical audit guidelines

S. Mc Fadden; *Newtownabbey/UK (S.McFadden@ulster.ac.uk)*

Clinical audit of medical radiological procedures was introduced in Directive 97/43/Euratom in 1997. The guidelines on Clinical Audit for Medical Radiological Practices were subsequently published in 2009. These guidelines promote a culture of clinical audit to improve the quality and outcome of patient care by comparing local practice with agreed standards or guidelines. These standards or guidelines are considered to be "good/best practice" and are based on local, national and international regulations. More recently, Directive 2013/59/Euratom reiterates that it is mandatory for all EU member states to ensure that clinical audit is performed in accordance with national procedures. Clinical audit should be performed on the whole patient experience and incorporate the complete journey of the patient from referral to follow-up.This should include (i) Structure of the organisation e.g. material and human resources, organisational structure (ii) Process e.g. patients method of seeking care, staff activity in making a diagnosis, how a treatment is implemented (iii) Outcome e.g. the effect on the patient, improved knowledge, changed behaviour and patient satisfaction. All staff must be involved ensuring that the results are a true reflection of the multi-disciplinary and multi-professional operations within the department/hospital. Internal (within the healthcare unit ongoing annually) and external (external auditing body every 5 years) audits are recommended and the results should supplement each other.There is a clear need for European wide uniformity of understanding and practice of audit to ensure the basic safety standards are maintained.

Learning Objectives:
1. To learn about the importance of clinical audit under the new EU Basic Safety Standards.
2. To comprehend the role of clinical audit in radiology practice.
3. To understand how to facilitate clinical audit locally and nationally.

A-346 08:58

B. Quality assurance of radiology equipment: the first step to creating a safe working environment

J. Santos; *Coimbra/PT (joanasantos@estescoimbra.pt)*

In the last decades, the diagnostic radiology technology improvement increased the examinations frequency and quality. To promote the effective use of radiation for diagnostics, the equipment must follow all the quality assurance requirements. Quality control is the first step for radiation safety. The components of the radiological system need to be tested to make sure that the equipment is operating satisfactorily. Appropriate calibration, operation conditions, dosimetry and administrative procedures must also be checked. The dose determination allows the monitoring of diagnostic reference levels and procedure optimisation, reducing the patient dose and maintaining the image quality. The results of quality control procedures should be recorded, analysed and discussed. Quality audits must be implemented by a multidisciplinary teamwork. The professionals involved in quality control must be qualified experts in radiation protection and understand the different equipment instrumentation per modality. Radiographers must be involved in quality control teams and should frequently perform quality control procedures according to the international guidelines, standards and directives. Radiographers are the key player in this process that link patient safety and technology.

Learning Objectives:

1. To become familiar with international recommendations and guidelines for radiology quality control procedures.
2. To be aware of the importance of the radiographer in quality assurance of radiology equipment.
3. To recognise the need for quality assurance in systematic evaluation as a tool for promoting radiation safety.

A-347 09:21

C. From medical imaging referral to final outcome: a critical analysis of the process

D. Remedios; *Harrow/UK (denis.remedios@imperial.ac.uk)*

The initiation of a medical imaging request is but a measurable step in the process of requesting. The need for education and training in radiation safety in healthcare settings starts with awareness of the subject and a collective responsibility well before the request is made. Guidance for appropriate imaging is particularly relevant to non-specialist referrers. Such guidance is best provided through clinical decision support systems in workflow but may be also through clinical pathways. Justification balancing benefit with potential harms is ideally a joint-decision between referrer and radiologist. This step in the process may require 2-way dialogue and the ability of the justifying practitioner to amend the request to a more appropriate procedure in consultation with the referrer and patient. In practice, this may be needed in 9-12% of requests. Audit of the justification process will enable streamlining of the process. Optimisation of the procedure should be started at this stage with exam protocols identified. Such optimisation will also feedback into the justification decision. Further optimisation of complex procedures is done at the time of examination. The dose from the exposure should ideally be fed back to RIS-PACS and possibly to the national dose registry enabling a comprehensive record of national doses and auditing of data. Feedback from audit of the justification and optimisation steps should be to referrer, radiologist and indirectly to the regulator.

Learning Objectives:

1. To understand the requirements for justification.
2. To be aware of the need for appropriate imaging.
3. To recognise the barriers to appropriate imaging.
4. To appreciate the strategies for improvement.

09:44

Panel discussion: Teamwork as a fundamental concept for creating a patient safety culture in a medical imaging department: why and how?

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

EFOMP Workshop

EF 1

Multi-energy imaging: from physics to diagnosis I

Moderators:
P. Sharp; Aberdeen/UK
V. Tsapaki; Athens/GR

A-348 08:30

Chairman's introduction

P. Sharp; *Aberdeen/UK (p.sharp@abdn.ac.uk)*

Session Objectives:

1. To become familiar with the principles of multi-energy imaging.
2. To understand the applications of multi-energy CT.
3. To appreciate the advantages and limitations of multi-energy imaging.

A-349 08:35

Image-based material decomposition with energy-selective detectors in multi-energy CT: a review

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

Nowadays, diagnostic CT is dominated by single-energy scans. In some cases dual energy scans are performed. The systems, however, are not equipped with energy-selective detectors but rather with energy-integrating detectors that suffer from electronic noise and that need to rely on the differences in the incoming x-ray spectrum. Clinical dual energy CT is either implemented as dual source CT, as fast tube voltage switching CT, as sandwich detector CT, or as two separate single-energy CT scans. More than two energy levels are not realised yet. The advancing development of direct converting energy-selective photon counting detectors and their integration into prototype clinical CT systems opens a range of new possibilities and challenges in multi-energy CT. Photon-counting detectors allow for the simultaneous acquisition of counting data from multiple-defined energy windows (potentially more than two), thus requiring only one polychromatic x-ray spectrum for multi-energy imaging. The energy-resolved counting data enable material identification, e.g. visualising the contrast agent distribution. Potentially, even the differentiation of multiple contrast agents at the same time becomes possible when using elements with high atomic numbers. However, several degrading effects (pulse pileup, charge sharing, detector polarisation, K-escape, …) significantly affect the energy resolution of the semiconductor-based photon counting detectors. These need to be taken into account when considering the application of such detectors. The energy-selective data can be preprocessed in several ways to obtain material-specific CT images. This presentation reviews existing material decomposition methods and patient dose minimisation algorithms with a focus on image-based approaches.

Learning Objectives:

1. To understand how multi-energy CT can provide material identification and differentiation.
2. To understand the effect of detector choice on material identification.
2. To understand the issues of radiation dose.

A-350 09:05

Novel applications of multi-energy CT

J. Sosna; *Jerusalem/IL (jacobs@hadassah.org.il)*

In existing tube-based dual-energy CT (DECT), dual-energy protocols must be prescribed prospectively, before the scan is performed, to select tube voltage or operate the two tubes at different kVp values. Radiologists are thus forced to determine in advance cases in which dual-energy analysis may be beneficial, based solely on the indications for study. However, when DECT data are acquired using a novel system designed to enable simultaneous acquisition of high-energy and low-energy data, the radiologist can retrospectively select spectral DECT protocols and reconstruct DECT images after the study has been performed. The system uses a single x-ray tube with dual-layer detector which performs spectral separation at the detector level and not by the x-ray tube. Simultaneous spectral detector CT (SDCT) data can be used to retrospectively generate virtual mono-energetic images at any selected keV in a range of 55-200 keV. The virtual low keV imaging with its increased enhancement capabilities and the high KeV mono-energetic images with reduced beam hardening artefact allow better evaluation of findings. Material decomposition images and iodine concentration maps allow direct quantification of material concentration. A single contrast-enhanced DECT study can be performed and VNE images can then be generated to simulate the nonenhanced phase, reducing the radiation dose to the patient. The

retrospective approach can be used in up to 70% of cases and in half of them for findings not related to the direct clinical question. Thus, this approach may broaden the clinical use of spectral CT.

Learning Objectives:

1. To become familiar with the concept of virtual non-enhanced images.
2. To explore image segmentation techniques.
3. To learn about image artefacts.

Author Disclosure:

J. Sosna: Consultant; Philips Healthcare.

A-351 09:35

New frontiers in CT: functional and multi-energy imaging

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

Multi-energy and functional imaging CT has reached a robustness allowing the use of this new technology in clinical routine for a variety of different clinical questions. This presentation will discuss the basic principles, and the strengths and limitations of the techniques. Implementations of multi-energy methods for material characterisation, and of CT methods for functional imaging will be discussed. Contrary to normal single-energy CT systems multi-energy CT scanners allow simultaneous scanning at two peak x-ray energies. When the attenuation is measured at two energies, their values are not exactly proportional to each other, which open new diagnostic possibilities. Measurements at two spectra can be achieved using multiple kVp and/or filtration or with detectors with energy discrimination. These methods have different pros and cons such as sensitivity to subject motion and dose efficiency. Next generation of spectral CT with photon counting detectors will also be discussed. To be able to acquire functional data such as perfusion, images are acquired dynamically following the injection of a contrast agent and physiological models are used to convert the measured contrast agent concentration to perfusion estimates. Methods that acquire multiple images have the potential to increase the radiation dose to the patient so CT protocols needs to be optimised.

Learning Objectives:

1. To appreciate the advantages and limitations of multi-energy CT.
2. To learn about functional imaging in CT.
3. To understand the problems of radiation dose in these new techniques.

Author Disclosure:

A. Persson: Board Member; SECTRA. Grant Recipient; Siemens.

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

E³ - ECR Academies: Hybrid Imaging (basic)

E³ 918

Indications for hybrid imaging in …

Moderator:
T.H. Helbich; Vienna/AT

A-352 08:30

A. Oncology

N. Schwenzer; *Tübingen/DE (Nina.Schwenzer@med.uni-tuebingen.de)*

In the last years, whole body MR/PET has been introduced as a new hybrid modality. Since then, suitable clinical indications had to be defined. Although MR/PET means a combination of two pre-existing modalities, i.e. PET and MRI, the advantage over separate PET/CT and MRI still has to be defined. Based on the literature, MR/PET seems to have a place in organ systems and malignancies where MRI is superior compared to CT, i.e. brain imaging, pelvic region or paediatric oncology. However, most MR/PET centres use this new hybrid modality in research as well as in clinical routine. Due to the broad possibilities of multifunctional imaging, tumour characterisation as well as therapy monitoring are important topics for MR/PET. This also includes the combination of new PET-tracers with functional MR techniques (e.g. DWI, DCE or proton spectroscopy). Nevertheless, it has to be kept in mind that MR/PET goes along with longer examination times due to the MRI compared with PET/CT. Therefore, it is most likely that MR/PET will not replace but complement PET/CT for dedicated indications.

Learning Objectives:

1. To appreciate indications for PET/CT and MR/PET in oncology.
2. To become familiar with FDG- and non-FDG-indications in oncology.
3. To understand where MR/PET may be advantageous over PET/CT.

Author Disclosure:

N. Schwenzer: Research/Grant Support; Technical research contract Siemens Healthcare.

A-353 09:00

B. Neurology

A. Buck; *Zurich/CH (fred.buck@usz.ch)*

The major neurologic diseases which profit from a PET examination are brain tumours, dementias, epilepsies and movement disorders. Most patients will be examined using MR before PET. In many cases it is most helpful or even mandatory to coregister the PET to the MR for better diagnostic accuracy. This may be called 2-step hybrid imaging. With the advent of integrated PET-MR scanners, 1-step or simultaneous PET and MR imaging became possible. From a practical point of view this offers more comfort for the patient; from a clinical point of view the 2-step approach is probably sufficient in most cases. The lecture will concentrate on applications of PET-MR in brain tumours and dementias. In both areas PET offers true complementary information to MR with high impact on patient management. In dementia the role of the new amyloid avid tracers will be discussed and compared to [F-18] fluorodeoxyglucose.

Learning Objectives:

1. To learn about indications for PET/CT and MR/PET in neurology.
2. To appreciate the different radionuclides available for neurological imaging.
3. To understand where MR/PET may be beneficial over MRI alone.

A-354 09:30

C. Cardiology

S.G. Nekolla; *Munich/DE*

Cardiac hybrid imaging is a relatively new addition to our armamentarium and started almost a decade ago with PET/CT and SPECT/CT and recently PET/MR became a reality. Due to this rather short timespan and the fact that these innovations were primarily driven by oncologicy, their use in clinical cardiac imaging is still limited and large studies demonstrating the benefits of this approach are lacking. However, one can identify several areas where intensive research showed advantages. For SPECT/CT, the majority of clinical scans focus on perfusion and here the attenuation correction based on the CT allows the reduction of artefacts and specificity is enhanced with calcium scoring. Furthermore, the assessment of perfusion combined with innervation using iodine-labelled compounds together with morphological CT has shown relevance for electrophysiological interventions. For PET/CT, the primary application is FDG to characterise myocardial viability prior to revascularisation. In addition, dynamic measurement with tracer injections in the scanner allows the absolute quantification of myocardial blood flow. In conjunction with the delineations of epicardial vessels, this enables the non-invasive characterisation of hemodynamic relevance of a stenosis. Furthermore, non-perfusion tracers such as FDG or NaF for the characterisation of inflammatory processes within coronary plaques may help to identify patients being at high risk for developing acute ischemic syndromes. Finally, the newest member, PET/MR received immediate interest for the cross-validation of several imaging approaches. But also in the setting of more complex diseases centering on altered cardiac metabolism and inflammation, first studies point to incremental value.

Learning Objectives:

1. To learn about indications for SPECT/CT and PET/CT in cardiology.
2. To appreciate radionuclides available for cardiac hybrid imaging.
3. To understand potential indications for MR/PET.

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

E³ - ECR Master Classes (Vascular)

E³ 926c

Uterine and prostate embolisation

Moderator:
T. Sabharwal; London/UK

A-355 08:30

A. Symptomatic uterine fibroids
J.-P. Pelage; *Caen/FR (pelage-jp@chu-caen.fr)*

"no abstract submitted"
Learning Objectives:
1. To understand clinical indications and contraindications for UAE embolisation.
2. To become familiar with the technique of uterine artery embolisation.
3. To learn about complications and outcomes.

A-356 09:00

B. Benign hypertrophy of the prostate
H. Rio Tinto; *Lisbon/PT (hugo.tinto@gmail.com)*

Benign prostatic hyperplasia (BPH) has a prevalence of more than 50% in men over 60 years old. It is associated with lower urinary tract symptoms (LUTS). The indication for treatment depends on disease staging. Medical therapy is usually the first-line treatment. Transurethral resection of the prostate (TURP) is the gold standard surgical treatment for BPH. There are several minimally invasive treatments that offer safety and efficacy and are valid options without the burden and risk of operative morbidity. Prostatic arterial embolisation (PAE) for BPH has been shown as a safe and effective procedure after failure of medical therapy. Unilateral femoral approach is routinely used; a 5 F catheter is advanced to the anterior division of the internal iliac artery. First angiograms with specific angulations are performed to identify the prostatic arteries. Deep knowledge of the pelvic arterial anatomy is essential because there are several variations. Selective access is performed with a micro-catheter < 2.7 F. The embolisation material of choice is spherical particles. Controlled embolisation is crucial to avoid non-target embolisation until near stasis is achieved. It is a minimally invasive treatment that can be performed as an outpatient procedure. Short and mid-term studies have shown that PAE also improves LUTS related to BPH. Potential major complications are associated with non-target embolisation but in experienced hands the rate is extremely low. The most frequent minor complications are perineal pain, haematuria, haematospermia, transient urinary retention and others associated with femoral access.
Learning Objectives:
1. To understand clinical indications and contraindications for prostate artery embolisation.
2. To become familiar with the technique of prostate artery embolisation.
3. To learn about complications and outcomes.
Author Disclosure:
H. Rio Tinto: Advisory Board; Cook Medical. Speaker; Cook Medical, CeloNova Biosciences.

A-357 09:30

C. Post-partum haemorrhage (PPH)
T.J. Kroencke; *Augsburg/DE (thomas.kroencke@klinikum-augsburg.de)*

Post-partum haemorrhage (PPH) is a major cause of maternal morbidity and mortality worldwide, complicates 10% of all live births and accounts for 24% of all maternal deaths annually. PPH is divided into primary (≤ 24 h) and secondary (> 24 h after delivery until the sixth week of the puerperium). Primary PPH is in most cases due to uterine atony (67-80% of all PPH, 2-8% of all births), genital tract trauma, retained placental tissue, and abnormal placentation. Secondary PPH is mainly related to retained products of gestation or infection. Blood loss of > 500 ml for vaginal delivery and 1000 ml for a caesarean section are accepted definitions. Life-threatening PPH occurs in 1/300 pregnancies. The role of arterial embolisation has evolved as an established method in the management of PPH. Arterial embolisation for PPH in an emergency setting should be started with a pelvic arteriogram with the catheter tip above the origin of ovarian arteries. In the presence of active bleeding, selective embolisation should be performed. In the absence of any detectable source of bleeding the next step is to perform selective embolisation of both uterine arteries. If bilateral UAE is impossible or fails to stop bleeding, embolisation of the anterior bundle of the internal iliac arteries on both sides distal to the origin of the superior gluteal arteries is recommended. The embolic agent of choice in cases of non-selective embolisation is gelatin sponge. Clinical success rate is around 90%. Failure of haemostasis and consequent hysterectomy occurs at a rate of 8%.
Learning Objectives:
1. To become familiar with the clinical background of PPH.
2. To learn about different endovascular techniques to treat PPH.
3. To learn about complications and outcomes.

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

E³ - ECR Master Classes (Paediatric)

E³ 926a

Advances in paediatric imaging

Moderator:
P. Tomà; Rome/IT

A-358 08:30

A. The CNS
J.F. Schneider; *Basle/CH (jacques.schneider@ukbb.ch)*

Magnetic resonance imaging (MRI) allows detailed anatomic imaging of the central nervous system (CNS). Besides well-known contrast from sequences like T1-wi (before and after gadolinium enhancement), T2-wi or FLAIR, there is a wealth of so-called "advanced" imaging methods which give insight into the pathophysiology and metabolism of CNS. Particular strength of these methods lies in the combination of structural and metabolic information when analysed together with conventional MRI. In particular, diffusion-weighted (DWI) or diffusion-tensor imaging (DTI), MR spectroscopy (MRS), perfusion-weighted imaging (PWI) and susceptibility-weighted imaging (SWI) are powerful instruments. On one hand, DWI and DTI are used to probe cellular architecture, while MRS looks at intracellular metabolite composition. On the other hand, especially PWI and sometimes SWI can be used to estimate the dynamic vascular compartment. In all cases, the degree of brain maturation must be taken into account, as results vary considerably especially during the first two years of life. All these methods intend to analyse the range of metabolic activity from a different perspective, but they are rarely specific when taken alone. It is, therefore, necessary to implement all these complementary methods together when assessing any normal or pathological process. This presentation will review age-related normal CNS maturation and illustrate how advanced imaging can improve diagnostic confidence in selected cases of neurologic disorders, metabolic diseases and brain tumours.
Learning Objectives:
1. To become familiar with advanced imaging protocols.
2. To understand how best to use DTI, fMRI and spectroscopy.
3. To be able to recognise age-related normal patterns from disease.

A-359 09:00

B. The MSK - infectious inflammatory disorders
M. Alison, A. Tanase, A. Rega, L. Cardoen, G. Sebag; *Paris/FR (marianne.alison@rdb.aphp.fr)*

Infectious and inflammatory MSK disorders are frequent causes of functional disability in children. Imaging is crucial to early diagnose musculo-skeletal infections and their complications and to look for differential diagnosis. Radiographs and ultrasound are the first imaging tools. Radiological changes are delayed in acute infection, but demonstrate differential diagnosis such as trauma and tumour. Ultrasound should exclude articular effusion or subperiosteal collection, indicating emergency puncture in an inflammatory context. When first line imaging are normal, bone scan or loco-regional MRI should be performed to confirm the diagnosis of bone infection or to look for differentials. MRI is also the examination of choice to assess complications such as collection (subperiosteal, intraosseous or soft tissue), bone ischaemia or cartilage damage. Complications are more frequent with aggressive pathogens like MRSA. Bone marrow normal signal changes have to be known in children and are best assessed on T1-weighted sequences. Injection is required to assess complications. Bone scan and whole body MRI are useful to look for multifocal lesions. Multifocal involvement can be present in acute infection in some vulnerable settings (sickle cell, neonates) or in differential diagnosis like Chronic Recurrent Multifocal Osteomyelitis.
Learning Objectives:
1. To become familiar with the complementary role of US, bone scan and MRI.
2. To learn about optimised imaging protocols.
3. To be able to differentiate age-related normal patterns from disease.

A-360 09:30

C. The abdomen

M. Raissaki; *Iraklion/GR (mraissaki@yahoo.gr)*

Diseases and clinical conditions that may affect the paediatric abdomen have largely remained constant. However, imaging of the paediatric abdomen has evolved with evolution of technology and contrast media, in an effort to respond to multiplying and specific clinical questions and provide not only morphological but also quantitative/functional data. Indications for imaging the paediatric abdomen predominantly include abdominal trauma and other abdominal emergencies, characterising, staging and follow-up of tumours, imaging of urinary tract and GI tract abnormalities. The constantly evolving modalities when imaging the paediatric abdomen mainly include ultrasonography and MRI due to their advantage of operating without the risks of ionising radiation. In paediatric ultrasonography, elastography and contrast media, administered either intra-luminally or intra-vascularly possess a potentially increasing role in paediatric abdominal imaging. In paediatric MRI, evolving protocols with wide applications of diffusion imaging, quantification of iron overload, MR enterography and MR urography with post-processing, allow a one-stop-shop test, depending on the clinical question. In severe abdominal trauma which remains the primary indication for CT in the paediatric abdomen, split bolus techniques are an evolving solution for obtaining all important data with a single-phase scan.

Learning Objectives:

1. To become familiar with advanced imaging protocols.
2. To understand how best to use MR enterography and MR urography.
3. To understand the complementary role of high resolution ultrasonography and MRI in the investigation of the paediatric abdomen.

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

E³ - ECR Master Classes (Interventional Radiology)

E³ 926b

The leading role of interventional radiology in a major trauma centre

A-361 08:30

Chairman's introduction: logistics and imaging of trauma: what do we really need?

A.-M. Belli; *London/UK (Anna.Belli@stgeorges.nhs.uk)*

Rapid decision making and treatment to stabilise the patient in the hours immediately following injury is critical. Uncontrolled haemorrhage is life threatening and must be stopped as soon as possible. CT allows rapid, accurate diagnosis and increases the probability of survival of the patient with polytrauma, and should not be delayed in favour of ultrasound or plain radiography. Whole body contrast-enhanced MDCT is the default imaging procedure of choice in the severely injured patient. The CT scanner should be located near the emergency department for rapid access. There should be agreed written transfer protocols between the emergency department and imaging facilities. Imaging protocols should be clearly defined and uniform across a regional trauma network so that if a patient is transferred from another unit, repeat imaging is avoided. An IR team that is available at all times is a pre-requisite for any trauma centre. IR facilities should have modern equipment (< 10 years old), a full range of occlusion balloons, catheters, embolic materials and stent-grafts and be located as close as possible to the emergency department. Ideally, IR suites should be of theatre standard and have positive pressure air change. Radiologists have to be available at all times alongside emergency and surgical staff so that there is multidisciplinary co-operation and communication. Interventional radiologists are ideally placed to play a leading role in the management of trauma patients as they are trained in multimodality imaging as well as being able to advise on the appropriateness and feasibility of interventional radiology techniques.

Author Disclosure:

A.-M. Belli: Advisory Board; Boston Scientific. Investigator; Eurocor.

A-362 08:39

A. Chest trauma

J. Lammer; *Vienna/AT*

Trauma is the leading cause of hospitalisation, morbidity and death in the western population up to the fifth decade of life. Motor vehicle accidents account for 70% to 80% of blunt acute chest trauma. The interventional radiologist is an important partner in the trauma centre. Polytrauma patients may not be candidates for acute surgery in multiple organ areas. Thus, the interventional radiologist may take care of one problem such as chest bleeding while the surgeon will fix another trauma area such as a subdural haematoma. Typically bleeding control is an important task for the interventional radiologist. High-speed deceleration trauma may cause aortic dissection or rupture, which can be treated by endovascular techniques with stent grafts. Fracture of the clavicle and the ribs may cause bleeding of the subclavian artery or intercostal arteries. This can be treated by covered stents or arterial embolisation with plugs and coils. Laceration of an intercostal or internal mammarian artery my cause pleural haematoma, which can be treated by embolisation and a chest tube. Fluid collections such as pleural or pericardial haematoma may need percutaneous US or CT-guided tube drainage. Rib fractures after blunt chest trauma may cause pneumothorax, which can be treated by a CT-guided Heimlich valve tube. Penetrating trauma due to gunshots, stab wounds may cause bleeding, pneumothorax or oesophageal leakage. Iatrogenic chest trauma due to biopsies may cause intercostal artery bleeding and pneumothorax; endoscopy can cause oesophageal rupture (Boerhaave´s syndrome), which may need mediastinal tube drainage and gastrostomy.

Learning Objectives:

1. To learn about the importance of selecting the appropriate imaging technique to allow for the detection of arterial involvement in chest trauma patients.
2. To understand the most important information urgently needed for treatment decisions and planning.
3. To learn about basic and advanced techniques in the management of chest trauma and deceleration injuries.

A-363 09:06

B. Upper abdominal trauma

O.M. van Delden; *Amsterdam/NL (o.m.vandelden@amc.uva.nl)*

Interventional radiology is playing an increasing role in management of abdominal trauma. When properly indicated embolisation can prevent laparotomies, delay surgery until a more elective setting is obtained in a more stable patient and makes conservative non-operative treatment safer. In European trauma centers the spleen, liver and kidneys are the most frequently involved organs amenable to embolisation. Most often these injuries result from blunt trauma, such as traffic accidents or a fall from height. Fast and accurate imaging workup is mandatory to assess which patients can and should be treated by embolisation. Whole body MDCT is the preferred tool and should replace conventional imaging and FAST ultrasound as MDCT supplies vital information about the presence of traumatic bleeding, the nature of the bleeding (arterial versus venous) and the location (s) of the bleeding including a vascular road map prior to embolisation. Embolisation can be performed in stable as well as unstable patients depending on the infrastructure of the trauma department and angiography suite in particular. Splenic embolisation is used to both treat ongoing bleeding as well as prevent delayed rupture, thereby making spleen-preserving non-operative management safer. Liver and renal embolisations are used for the same purposes, although delayed rupture occurs less frequently in these organs. Haemostasis is obtained in > 90% of cases when embolisation is possible and clinically relevant end-organ ischaemia or non-target embolisation occurs in < 10% of cases.

Learning Objectives:

1. To be able to take part in decision making and to determine which cases deserve management by interventional radiology.
2. To learn about indications and techniques for endovascular treatment of traumatic abdominal haemorrhage.
3. To learn about results, the failures and complications of endovascular treatment of traumatic abdominal haemorrhage.

A-364 09:33

C. Pelvic trauma: not only arteries

R. Bale; *Innsbruck/AT (reto.bale@i-med.ac.at)*

Up to 40% of patients with pelvic fractures related to blunt traumatic injury experience intrapelvic bleeding, representing the major cause of death within the first 24 h. Additional extrapelvic traumatic lesions may be responsible for a life-threatening haemodynamic status. Thus, a correct and immediate diagnosis and therapy is required. In many major trauma centers multidetector computed tomography (MDCT) has largely replaced ultrasound as the imaging modality of choice for the diagnostic assessment of severely injured patients. It allows for rapid identification and assessment of haemorrhage, fractures and organ injuries. Preperitoneal pelvic packing with or without external fixation are effective tools to control venous bleeding and bleeding from the fractured bony surface in haemodynamically unstable patients. For the treatment of arterial haemorrhage in haemodynamically stable patients, angiography and embolisation techniques have become the gold standard. These techniques should be performed if an arterial blush is seen in the computed tomography scan. In addition to bleeding urine leaks from the kidney, ureter, bladder, and urethra have to be promptly diagnosed. If not, appropriately managed urinomas may lead to complications such as abscess formation and electrolyte imbalances. To exclude urinomas MSCT with delayed contrast phase and/or retrograde urethrography is required. Urine leakage may be treated conservatively, surgically or percutaneously. The interventional radiologist may

place percutaneous urinoma drainage catheters or percutaneous nephrostomy catheters. In addition, in the subacute setting CT-guided percutaneous stabilisation of nondislocated pelvic fractures may be performed by an interdisciplinary team.

Learning Objectives:

1. To learn the appropriate diagnostic imaging techniques and protocols in major pelvic trauma and how to modify them according to clinical requirements.
2. To learn about results, the failures and complications of endovascular treatment of traumatic pelvic haemorrhage.
3. To learn about non-endovascular techniques that can be used in pelvic trauma to deal with pelvic bone and genitourinary injuries.

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

Emergency Radiology

RC 917

Acute pain: your friend and enemy in emergency radiology

A-365 08:30

Chairman's introduction: patients with acute pain - management and therapeutic pathways

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

Pain has always been a sort of a road sign for physicians depending on its location, intensity, character, duration, and onset characteristics and associations. Pain can further serve to tailor the appropriate diagnostic approach to the problem at hand. Pain in each particular region can mean a different thing; for instance, a thunderclap headache, often described as "the worst headache of my life," often heralds a subarachnoid bleed. Even without neurological deficits headache must warn us of the possibility of subarachnoid bleeding and hence a non-contrast CT is a must! Even if no blood is detected on a native CT, we must analyse the CSF for Xanthochromia and perform an angio CT. Pain in the cervical spine can also represent intracranial bleeding. In 2007 Kreist/Lancet wrote about 1600 admissions to the ER with headache, of which 7% were subarachnoid bleeding. 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 the primary goal of non-invasive imaging is to exclude acute coronary syndrome and other serious conditions (such as pulmonary embolism or aortic pathology). Pain is a diagnostic friend of the clinically inclined radiologist. It turns out that, paradoxically, pain, if appropriately recognised, can also very much be a friend to the patient.

A-366 08:35

A. Head

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

Causes for acute headache or pain vary and can be related to for example traumatic conditions, underlying infection, tumour or intracranial bleeding which all are easily detected with radiological examination. Depending on the clinical scenario the most common initial radiological examination is CT that can evaluate for traumatic injuries as well as subarachnoid haemorrhage (SAH), intracerebral haemorrhage (ICH) and subdural haematoma (SDH). CT has also the possibility to demonstrate tumours, bacterial meningitis or brain abscesses. However, for further evaluation of lesions such as tumour, infection and meningitis MRI is considered the method of choice. Other causes of acute headache can be related to metabolic changes or PRESS and in these cases MRI is the better method for diagnosing pathology. In some other pain conditions for example migraine neither CT nor MRI is very helpful. In this presentation, typical clinical condition resulting in headache will be reviewed and proper imaging modality as well as findings will be discussed.

Learning Objectives:

1. To be familiar with common clinical conditions resulting in acute headache.
2. To understand the choice of the best-suited proper imaging modality.
3. To learn typical imaging findings in the most common clinical scenarios.

A-367 08:59

B. Chest

J.E. Wildberger, S.C.A.M. Bekkers; *Maastricht/NL (j.wildberger@mumc.nl)*

Acute chest pain is one of the most common reasons for emergency department visits worldwide. Stable patients with low and intermediate risk for coronary artery disease (CAD) should be evaluated carefully to minimise the risk of missing a life-threatening condition. The primary goal of non-invasive imaging is to safely exclude acute coronary syndrome and other serious conditions (such as pulmonary embolism and aortic pathology) rather than to detect CAD. Abnormal laboratory findings without evidence of ST-elevation, ST-depression and/or negative T-waves (NSTEMI) remain a diagnostic challenge: high-sensitive troponins (hs-Tn) have substantially improved the early detection of myocardial injury. However, they are not specific. This urges the need for additional testing. The latter must be balanced against recognition of patients with non-critical syndromes for whom hospitalisation and extensive evaluation are unnecessary, expensive, potentially hazardous, and an ineffective use of limited resources. From a pure technical standpoint, imaging modalities as CCTA might serve as the method of choice for the safe discharge of patients. The pre-test probability has important implications for choosing the optimal imaging modality, as well as for interpretation of test results. Even in large prospective trials, event rates for major adverse cardiac events among all patients (whether the patients underwent CCTA, stress testing, or no testing at all) were (too) low, less than 1% had MI and no patients died. To overcome this impasse, a joint multidisciplinary approach in dedicated cardiovascular teams should work best.

Learning Objectives:

1. To be familiar with clinical conditions resulting with acute pain in chest.
2. To understand which additional data influence on choosing the proper imaging modality.
3. To learn the typical imaging findings in patient with acute chest pain.

Author Disclosure:

J.E. Wildberger: Research/Grant Support; Institutional research grants: Agfa Healthcare, Bayer Healthcare, GE Healthcare, Philips Healthcare, Siemens Healthcare. Speaker; Speaker's bureau: Bayer, GE, Siemens.

A-368 09:23

C. Abdomen

R. Basilico; *Chieti/IT (r.basilico@radiol.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. 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 be familiar with common clinical conditions resulting in acute abdominal pain.
2. To know which clinical information influence the choice of the best suited imaging modality.
3. To learn typical and untypical imaging findings in patients with acute abdomen.

09:47

Panel discussion: Where does radiology fit in the pathway?

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

E³ - ECR Academies: Diagnostic Urogenital Radiology

E³ 920

Gynaecology

Moderator:
T.M. Cunha; Lisbon/PT

A-369 08:30

A. MR imaging techniques and normal anatomy of the female pelvis
C.S. Balleyguier, S. Canale, E. Zareski; *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 undeterminate 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 choosen. 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 to 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.

A-370 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 the FIGO classification system. However, this does not integrate the prognostically important finding of lymph node metastases. Tumour size, tumour stage and presence of lymphnode 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 clinically stage 1b2 or higher for the assessment of locoregional tumour spread. If fertility preservation is an issue, MRI plays a crucial role in 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. There is debate on the additional value of GdT1WI and DWI. 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 be familiar with the spread of disease.
3. To understand the impact of imaging on therapeutic decision making.

A-371 09:30

C. Differential diagnoses of adnexal masses
S. Swift; *Leeds/UK (sarah.swift@leedsth.nhs.uk)*

The management of adnexal masses demonstrated on imaging depends on their nature and mode of presentation. The widespread use of imaging within multiple patient investigation pathways results in increasing numbers of adnexal abnormalities being detected as incidental findings, the question is then what are they and what should be done about them. Symptomatic adnexal masses will usually be removed, the major decision being whether this is undertaken as a benign or cancer-type procedure with its consequent implications for fertility and morbidity. Imaging has a pivotal role to play in defining this surgical approach by assisting identification of the organ of origin, allowing characterisation of the lesion and demonstrating any secondary signs or complications. Although ultrasound is usually the primary imaging modality for assessing the gynaecological structures, CT is often used when patients present emergently or via the surgeons. MRI is superior to CT by having the ability to distinguish whether lesions are uterine, ovarian or tubal in origin due to its multiplanar capacity and using T1W, T2W, fat-suppressed and contrast-enhanced sequences to assess the nature of the mass. The addition of diffusion-weighted and dynamic contrast-enhanced sequences assists discrimination between benign and malignant lesions. The imaging route the patient takes will depend on the clinical history and mode of presentation. Crucially the modalities are complementary, MRI can allow confident benign diagnoses to be made thereby ensuring the patients receive appropriate, and potentially, conservative management.
Learning Objectives:
1. To understand 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 to differentiate between benign surgical and non-surgical lesions.

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

E³ - ECR Academies: Interactive Teaching Sessions

E³ 1021

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

A-372 10:30

A. Imaging after surgical treatment
M. Lell; *Erlangen/DE (michael.lell@uk-erlangen.de)*

The ability to 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 edema 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: Consultant; Bracco, Guerbet. Research/Grant Support; Bayer, Siemens. Speaker; Bayer, Siemens.

A-373 11:15

B. Imaging after radiotherapy/chemotherapy
T. Beale; *London/UK (timothy.beale@uclh.nhs.uk)*

The lecture will concentrate on the post-radiotherapy/chemotherapy MRI and CT appearances of patients treated for head and neck squamous cell carcinoma. The lecture will demonstrate how to try and differentiate expected post-treatment changes from residual or recurrent disease. The timing of post-treatment imaging and differing imaging protocols will be discussed including the use of diffusion-weighted imaging. The role of PET-CT and PET-MRI in the post-treatment neck will be discussed. In addition to the common squamous cell carcinoma the post-treatment appearances of rarer head and neck malignancies such as sarcomas and salivary malignancies will be demonstrated. Pitfalls in assessing the post-treatment neck will be highlighted and the lecture will finish with some case studies reinforcing the topics discussed.
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.

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

ESR meets Germany

EM 1

Tradition goes digital: getting ready for the future

Welcome by the ESR President:
L. Bonomo; Rome/IT
Presiding:
B. Hamm; Berlin/DE
N. Hosten; Greifswald/DE

A-374 10:30

Introduction

N. Hosten; *Greifswald/DE (hosten@uni-greifswald.de)*

This session presents topics from the world of German Radiology that may be of interest for international audience. Topics vary between more general ones like state of population imaging in Germany; and more special ones like the birthplace of Wilhelm Conrad Röntgen. The latter is owned by the German Röntgen Society and offers fascinating insights into the world where the discoverer of x-rays came from.

Session Objectives:

1. To present landmark projects established by Deutsche Röntgengesellschaft.
2. To show how landmark projects can enhance the standing of a national society in a competitive environment.
3. To discuss ideas for these and similar projects.

Author Disclosure:

N. Hosten: Author; Springer Heidelberg. Research/Grant Support; Siemens AG Bayer AG. Shareholder; Siemens AG.

A-375 10:35

State-of-the-art teaching in German radiology: Akademie online

M.G. Mack[1], F. Mayer[2], A. Aschoff[3], M. Uder[4]; [1]*Munich/DE*, [2]*Osnabrück/DE*, [3]*Kempten/DE*, [4]*Erlangen/DE (m.mack@radiologie-muenchen.de)*

Starting in the year 2008 we started with a biweekly educational program for German-speaking radiologists, which was completely done online. The participants have the possibility to hear and see the educational lecture under relaxed conditions at home, in the office or wherever they like with a mobile device like smartphone or tablet computer. The program was extended to technicians and students as well in 2011. In the year 2014, we accommodated a total of 25 educational lectures for radiologists and radiologists in training, 8 courses for technicians and 8 courses for students. All lectures were delivered via the GoToWebinar software of Citrix. In the meantime always between 300 and 1000 participants are logged in. The big advantage is that the participants have the possibility to get education without significant cost for traveling and accommodation. Furthermore, they have the possibility to participate in an interactive part with MC questions and an extensive chat discussion with the speaker, which is highly appreciated and very well evaluated by the participants. During this lecture, we will provide you with some technical and handling details as well.

Learning Objectives:

1. To learn about the concept of an internet-based teaching platform.
2. To understand the potential and risks of web-based teaching and education.
3. To appreciate the improvement in flexibility of course delivery and the reduction in education costs.

A-376 10:55

Interlude I: Radiation protection: the concept of 'justifying indication'

R.W.R. Loose; *Nuernberg/DE (loose@klinikum-nuernberg.de)*

The three basic principles of radiation protection in medicine are justification, optimisation and dose limitation. The application of the principle of justification remains a national responsibility of the EU member states. It is generally accepted that an exposure to ionising radiation is justified if weighing the total diagnostic or therapeutic benefit against the individual detriment shows a sufficient net benefit. In addition to official health screening programs like mammography screening, an arising discussion is justification of examinations of healthy individuals for early detection of diseases. The acceptance of justification of such "pseudo screening" examinations is different between EU member states. The new EU-BSS recommend: "Art. 45 2. (h) Any medical radiological procedure on an asymptomatic individual, to be performed for the early detection of disease, shall be part of a health screening programme, or shall require specific documented justification for that individual by the practitioner, in consultation with the referrer, following guidelines from relevant professional bodies and competent authorities." This can be the entrance to MDCT "screening" for coronary heart disease, early detection of lung nodules in smokers and virtual colonoscopy. Anyhow, the level of justification should always be a function of the patient exposure and associated risks. In this process the role of referrers and patients is more important in future. "Art. 57 1. (c) The referrer and the practitioner are involved, as specified by Member States, in the justification process of individual medical exposures".

Learning Objectives:

1. To learn about the concept of justifying radiological examinations and interventions.
2. To understand the level of justification and associated radiation risks.
3. To understand the impact of the new European Basic Safety Standards (EU-BSS).

A-377 11:03

Population-based MRI: SHIP (study of health in Pomerania) and the national cohort

K. Hegenscheid; *Greifswald/DE (katrin.hegenscheid@uni-greifswald.de)*

Prospective, population-based studies investigate the interaction between genetic predisposition for a disease, exposure to environmental factors and disease risk. They are a prerequisite for the development of prevention strategies. In the last decades due to its non-ionising, examiner-independent, and high-resolution nature MRI has been implemented increasingly in epidemiological research. The development of parallel acquisition and continuous table movement techniques, together with multi-channel receiver coils now allow the examination of different organ systems in a whole body approach within a reasonable scanning time. The study of health in Pomerania (SHIP) was the first prospective population-based cohort study that offered a standardised whole body MRI protocol for 3,772 participants aged 21 to 90 years. In 2014, the baseline examinations of the German national cohort started. In 18 study centers across Germany, a representative sample of the general population will be randomly drawn to include a total of 200,000 participants aged 20 to 69 years. A subset of 30,000 subjects will be recruited to undergo whole-body MRI in five dedicated MR imaging centers. The primary objective of epidemiologic whole body MR imaging is to phenotype a large subset of participants and to establish a comprehensive morphologic and functional imaging bio-repository. However, while the scientific potential of epidemiological MR imaging is understood, there are some ethical and procedural challenges, e.g. the occurrence of incidental findings and the acquisition, storage, and processing of large image data. In this presentation we describe the rationales and designs of the MRI study in SHIP and the German national cohort.

Learning Objectives:

1. To present the objectives, concepts, and infrastructure of population-based imaging studies in Germany.
2. To learn about the potential of population-based versus clinical imaging research.
3. To understand special ethical implications of population-based imaging.

A-378 11:23

Interlude II: The Röntgenhaus: Wilhelm Conrad Röntgen's birthplace

B. Lewerich; *Berlin/DE (bernhard.lewerich@t-online.de)*

Röntgen's discovery of the x-rays is the foundation of profound changes in science, medicine, and life itself. But the man behind this discovery mostly remained in the dark. This reclusiveness was partly due to Röntgen's aversion to publicity. Therefore, it is all the more important that today all radiologic societies and their members meet the obligation of keeping Röntgen's memory alive. In 2011, the German radiological society has acquired Röntgen's birthplace in Lennep (Germany). The society thereby helped to create a landmark which on the one side helps to commemorate W.C. Röntgen and on the other hand supports the formation of a meeting place for national and international scientists of radiology and physics. The far-reaching renovation work has already started, and the restoration of this over 250-year-old house should be finished by 2015/2016. This challenge certainly demands professional skills and willing hearts to succeed! The German radiological society has set up a foundation and calls for givers, patrons, donors as well as for sponsors and cooperating societies. The progress of all this work is well documented on a special website (http://www.roentgen-geburtshaus.de/en-GB/427/welcome), both in German and English. There is also a continuously updated list of all donors and sponsors. An important first step has been done with the acquisition and the beginning of the renovation works. To achieve our goal, however, the commitment of all those who are dedicated to the legacy of W. C. Röntgen is required.

Learning Objectives:

1. To learn about the history of the 250-year-old house where W.C. Roentgen was born.
2. To appreciate the importance of scientific landmarks for creating enduring public and political interest.
3. To invite and motivate radiologists to support the activities of the Röntgen House Foundation.

A-379 11:31

MRI-PET: A new modality for clinical imaging

C.D. Claussen, N. Schwenzer;
Tübingen/DE (claus.claussen@med.uni-tuebingen.de)

New whole body MR/PET scanners offer the possibility to combine MR and PET for numerous extracranial applications. This is a challenge for both modalities: MRI has to provide excellent anatomical images with high resolution. Additionally, not only diffusion-weighted imaging (DWI), proton spectroscopy, but also dynamic contrast-enhanced imaging is an essential part. As to PET, the technical challenge mainly consists in obtaining a MR-based attenuation correction for the PET data. Concerning workflow, PET/MR has to deal with longer examination times due to the duration of the MR sequences. To date, it is not clear which MR sequences are mandatory in clinical examinations. Potential clinical applications of MRe in the field of paediatric oncology, certain tumour entities (e.g. neuroendocrine tumours, pelvic cancer, brain tumours) and systemic inflammatory diseases. The development of new PET tracers in correlation with specific MR techniques might also extend the use of this promising new imaging technique. Simultaneous MR/PET offers additional possibilities such as the possibility of performing an MR-based motion correction for PET data. To assure acceptance of this new technique in clinical routine, prospective large scale studies performed as team play by radiologists and nuclear medicine physicians have to be launched.

Learning Objectives:
1. To understand the technical requirements of hybrid MR/PET.
2. To realise the impact of MR/PET on workflow.
3. To learn about potential clinical applications of MR/PET.

11:51
Panel discussion: Cross-linking radiology: opportunity or threat?

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

EFOMP Workshop

EF 2

Multi-energy imaging: from physics to diagnosis II

Moderators:
J. Damilakis; Iraklion/GR
A. Torresin; Milan/IT

A-386 10:30

Chairman's introduction

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

Dual-energy-computed tomography (CT) was first developed in the 1980s. Using conventional CT scanners, operators had to carry out two scans one after the other. This technique was not very successful due to image registration and other problems. New CT technology allows almost simultaneous image acquisition at two energies. This is possible using scanners with two x-ray tubes or using scanners with a single x-ray tube capable of tube potential (kVp) switching. Materials can be distinguished based on their different energy attenuation profiles. Invited lectures of this session will present underlying principles in using multi-energy CT for tissue detection and characterisation and also applications in the thorax, in oncology and in digital mammography. It is true that multi-energy scanning may be advantageous for several clinical cases. However, careful justification of these examinations is needed. According to radiation protection principles, benefits must always be weighed against potential radiogenic risks. Dose optimisation of multi-energy examinations is an area of great interest for both medical physicists and radiologists. Methods to reduce radiation doses will be discussed during the session.

Session Objectives:
1. To explore the clinical applications of multi-energy CT.
2. To assess the role of multi-energy in the management of patients.
3. To explore the problems raised by radiation dose.

A-387 10:35

Multi-energy imaging in the thorax

P. Vock; *Spiegel/CH (peter.vock@med.unibe.ch)*

After a short discussion of the potential of dual-energy radiography of the chest, this presentation will be dedicated to multi-energy CT. While three technical approaches have been described, most publications have used the dual-source approach. For the lung, the unique combination of high-resolution morphologic images with perfusion and pulmonary blood volume maps is primarily adequate in circulatory disease, such as acute and chronic pulmonary embolism. Lung nodule characterisation in case of a suspected neoplasm is another major indication. Combining perfusion mapping with ventilation studies using Xenon inhalation is more demanding and not used regularly in clinical evaluation. Producing virtual non-enhanced images and monochromatic images, on the other hand, is helpful in the daily routine. Applications to the heart will briefly be discussed as well as artefacts and ways to keep radiation exposure low.

Learning Objectives:
1. To learn about the application of multi-energy CT in the thorax.
2. To appreciate its effect on patient management.
3. To understand image artefacts.
4. To learn about reducing radiation dose.

A-388 11:05

Dual-energy CT in oncology

C.N. De Cecco; *Rome/IT (carlodececco@gmail.com)*

Dual energy CT (DECT) is an innovative imaging technique, whose basic principle is the application of two distinct energy settings making it possible to distinguish materials with different molecular compositions on the basis of their attenuation profiles and thus operating a transition from density-based image to spectral imaging. DECT applications are based on two distinct capabilities: 1) material differentiation, which means achieving material-specific imaging with separation of distinct materials, for example iodine, calcium, and uric acid, within an image obtained during a single examination and 2) material identification and quantification, which means accurate assessment of the presence and amount of iodine within a target lesion. In particular, with DECT acquisition multiple datasets such as elemental decomposition analysis, iodinated density map, virtual monochromatic images or virtual unenhanced images can be obtained simultaneously making the radiologist able to address different diagnostic problems and improving lesion detection and characterisation. These technical characteristics make DECT an innovative imaging modality particularly useful in oncologic imaging, having clear advantages in tumour detection, lesion characterisation, evaluation of response to therapy, and detection of oncologic-related disease.

Learning Objectives:
1. To learn about the application of multi-energy CT in oncology.
2. To explore the possibilities of material identification and differentiation with multi-energy imaging.
3. To appreciate the effect on the management of cancer patients.

A-389 11:35

Clinical application of multi-energy imaging in digital mammography

C. Dromain, J. Arfi-Rouche, A.-M. Tardivel, J.-R. Garbay, S. Delaloge, C.S. Balleyguier; *Villejuif/FR (dromain@igr.fr)*

Breast cancer is the most common cancer and the leading cause of cancer death in women in France. Mammography is currently the imaging technique of choice for screening and diagnosis. However, it has some limitations especially in high-density breasts. The contrast-enhanced spectral mammography (CESM) is a recent development of mammography coupling x-rays breast imaging and the use of intravenous iodinated-contrast agent. This technique is based on dual-energy exposure acquisitions using spectra with energies predominantly below (low-energy LE) and above (high-energy HE) the iodine K-edge at 33.2 keV. By wisely selecting the x-ray spectra, both morphological and functional images can be obtained. A breast morphology image, similar to a standard mammogram, can be provided by the LE image. An image of iodine contrast agent uptake can be obtained by applying an appropriate recombination algorithm to the LE and HE images. In the recombined image, the background tissue is suppressed and the signal intensities are proportional to the surface iodine concentration. CESM has the potential to increase cancer detection rate, to improve their staging and to improve the selection of patient for biopsy. Key publications have shown that CESM offers superior clinical performance (sensitivity and specificity) versus mammography alone and versus MX+US. More data collected in a prospective multicenter study assessing the respective accuracy of CESM and MRI for breast cancer staging have shown that CESM has the same sensitivity than MRI for primary cancer, slightly lower for secondary foci, and a superior PPV than MRI.

Learning Objectives:
1. To learn about the application of multi-energy imaging to mammography.
2. To appreciate how multi-energy imaging compares with other mammographic imaging modalities.

Author Disclosure:
C. Dromain: Grant Recipient; GE Healthcare. Speaker; GE healthcare, Guerbet. **C. Balleyguier:** Research/Grant Support; GE healthcare.

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

E³ - ECR Academies: Diagnostic Urogenital Radiology

E³ 1020

Emergencies

Moderator:
R.H. Oyen; Leuven/BE

A-390 10:30

A. Male pelvis emergencies
M. Bertolotto; *Trieste/IT (bertolot@univ.trieste.it)*

Acute scrotum is clinically defined by presence of acute scrotal pain, oedema and redness. The most common differential diagnoses 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. Color 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 color 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 be familiar with various male pelvis emergencies.
2. To learn about the correct imaging techniques.
3. To understand the differential diagnoses.

A-391 11:00

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 emergencies of the female pelvis.
2. To learn about the correct imaging techniques.
3. To understand the differential diagnoses.

A-392 11:30

C. Imaging of obstetric and puerperal emergencies
J. McHugo; *Birmingham/UK (jo.mchugo@bwhct.nhs.uk)*

Emergencies in pregnancy and the puerperium. Pregnancy is a normal state for fertile women. However, for a successful delivery of a full term normal infant dramatic physiological changes need to occur. There is a 30-40% increase in plasma volume, cardiac output and renal blood flow. The developing fetus demands increased blood flow to the uterus. The size of the gravid uterus alters respiratory function and tends to obstruct the ureters. Alteration in the immune system to maintain the fetus must occur to accommodate a genetically separate individual. Whereas the clotting mechanism must change to ensure placentation and a safe delivery. All of the above result in potential stresses to the mother's health which often present acutely. These emergencies can be broadly divided into the following: emergencies specific to pregnancy, emergencies associated with pregnancy, emergencies unmasked by pregnancy, emergencies - not associated Imaging plays a vital role in all of the above. The wellbeing of not only the mother, but also the unborn baby need to be considered in any imaging strategy. This lecture will address these issues.
Learning Objectives:
1. To learn about the imaging techniques performed in pregnancy.
2. To learn about the differential diagnosis of obstetric and puerperal emergencies.
3. To become familiar with typical imaging findings of most common pathologies.

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

Plenary Session

HL 2

Wilhelm Conrad Röntgen - Honorary Lecture

Presiding:
B. Hamm; Berlin/DE

A-393 12:15

Hybrid imaging: let the two worlds of radiology and nuclear medicine come together!
G. Antoch; *Düsseldorf/DE (antoch@med.uni-duesseldorf.de)*

The history of fusing morphology and function has evolved dramatically over the past twenty years. In the beginning some thoroughgoing idealists invested uncountable hours into the development and implementation of manual image fusion algorithms requiring aids like external positioning markers, specific custom-made software, and, in particular, time. Thus, indications for image fusion were mainly scientific in nature rather than clinical. 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 experise 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, just hybridising imaging systems is not enough. To guarantee high-quality hybrid imaging in the future, hybridisation will have to include the physicians involved!
Learning Objectives:
1. To acknowledge that expertise in function and morphology is essential to read and interpret hybrid imaging data sets.
2. To learn about ways of cooperation between radiology and nuclear medicine.
Author Disclosure:
G. Antoch: Speaker; Bayer Healthcare, Siemens Medical Solutions, BTG.

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

E³ - The Beauty of Basic Knowledge: Breast Imaging

E³ 25C

Breast cancer staging: why and how

Moderator:
J. Camps Herrero; Alzira/ES

A-394 12:30

Breast cancer staging: why and how
K. Kinkel; *Chêne-Bougeries/CH (karen.kinkel-trugli@wanadoo.fr)*

Breast cancer staging and treatment depend on the extent of pathologically proven tumour burden assessed clinically and by image-guided biopsy. Although MRI is more sensitive than the combination of mammography and ultrasound in tumour detection and staging, its current use is controversial due to absent evidence of improved survival and contradictory results of whether it decreases re-excision rates. In patients with dense breasts, invasive lobular cancer, familiar risk or discrepancy in tumour extent by more than 10 mm between mammography and US, MRI is superior to conventional imaging techniques to determine tumour size, multifocality and occult contralateral breast cancer. The use of MRI leads to an increase in additional needle biopsy for suspicious MRI findings and a change in treatment in 20-30% of patients due to additional disease in 20% or contralateral cancer in 3-5%. When biopsy is used for suspicious MRI findings there is no increase in the overall mastectomy rate. MRI is more sensitive than conventional imaging in diagnosing an extensive intraductal component and DCIS without microcalcifications. MRI is useful for planning nipple-sparing mastectomy because of a 97% negative predictive value for lesions larger than 2% when measuring the distance to the nipple/areolar complex. Technical aspects for breast MRI follow EUSOBI recommendations using a dedicated bilateral breast coil, sufficient spatial resolution, at least one pre- and two post-contrast acquisitions and the availability of MRI-guided breast biopsy. For interpretation the BIRADS lexicon and breast MRI reading experience are mandatory.
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.

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

E³ - The Beauty of Basic Knowledge: Skeletal Radiology

E³ 24C

Inflammatory/infectious disorders

Moderator:
V. Cassar-Pullicino; Oswestry/UK

A-395 12:30

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

There are a host of inflammatory and infective insults that can manifest focally or diffusely within the musculoskeletal system. The appearances of the underlying pathological processes in both the soft tissues and skeleton cover a very wide imaging spectrum. The appearances vary depending on the timing and degree of inflammatory insult and the host response in the involved tissues. The approach of this lecture will cover the imaging manifestations using all modalities covering radiography, ultrasound, CT, scintigraphy and magnetic resonance imaging. The basic knowledge that is required will be displayed in 4 major musculoskeletal categories covering disorders involving the soft tissues, joints, bones and entheses. The imaging manifestations will also be linked with the evolution of the pathological processes covering acute, sub-acute and chronic stages of the inflammatory/infective disorders. By the end of the session the audience should have a clear understanding in making best use of the imaging modalities in the correct diagnosis of a wide variety of inflammatory and infective conditions that can affect the musculoskeletal system.
Learning Objectives:
1. To learn about the pathomechanisms involved in inflammatory and infectious disorders.
2. To understand the imaging appearances and their differential diagnosis in the acute, sub-acute and chronic phases of infection.
3. To become familiar with the spectrum of imaging features of inflammatory disorders in the axial and peripheral skeleton.

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

EFRS meets Germany

EM 5

High-end and hybrid technology in clinical and research work of radiographers in Germany

Presiding:
C. Vandulek; Kaposvár/HU
A. Ohmstede; Oldenburg/DE

A-396 14:00

Introduction
C. Vandulek[1], A. Ohmstede[2]; [1]*Kaposvár/HU*, [2]*Oldenburg/DE*

During the EFRS meets Germany session, radiographers have the opportunity to get information about the clinical and research role of radiographers in Germany. 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 German radiographers pertaining to high-end and hybrid technology in clinical and research areas. The first half of the session will introduce the use of VERT (virtual environment for radiation therapy training) in the education of radiographers in the field of radiotherapy followed by a presentation on selective internal radiation therapy (SIRT). The second half of the session will focus on the characterisation of the crucial role of radiographers in hybrid technology encompassing PET-CT and PET-MR. The session will be seasoned with a presentation on current research in the field of radiology in respect to Wilhelm Conrad Roentgen.

A-397 14:05

Teaching and learning with VERT (Virtual Environment for Radiation Therapy Training)
C. Garske; *Berlin/DE (c.garske@lette-verein.de)*

VERT is the acronym for vertual environment for radiotherapy training. The system was developed by the English company vertual limited for visualising the treatment plans during patient information or for teaching and training purposes. Teaching and training with VERT prepare students perfectly for their work at the patient. Handling the linacs technology so quickly gives them the possibility to focus on the human aspects of their job. Training und teaching with VERT allow the teacher to put the main emphasis on training skills and know-how in learning fields in an active approach. It is easier to get insight views for the students. They can learn to create and insert treatment plans. In addition they can practice the implementation of electron fields. One other extra is the physics tool, which enables the students to carry out quality tests on the virtual linac on their own. This way they can understand depth of dose gradients and dose profiles in the planning of treatments. Vertual limits is leading in the field of virtual exercises for radiotherapy. The company is based in Hull and was founded in 2007 by James W.Ward (Research Lecturer Department of Computer Science, University of Hull, Head of Research & Development and Founder), Professor A.W.Beavis (CSO, Radiotherapy Director an Founder), Professor Roger Philips (Resaerch Professor Department of Computer Science, University of Hull, Managing Director and Founder).
Learning Objectives:
1. To learn about our work with VERT.
2. To understand the advantages of VERT.
3. To appreciate the better preparation of our students for the practical course.

A-398 14:23

Selective Internal Radiation Therapy (SIRT)
B. Kulitzscher; *Berlin/DE (berit.kulitzscher@charite.de)*

Selective internal radio therapy (SIRT) or radioembolisation is a new palliative treatment option in patients with unresectable hepatic tumours, e.g. hepatocellular carcinoma or colorectal metastases to the liver. SIRT is performed in a multidisciplinary setting of interventional radiology, nuclear medicine and medical physics experts. Attendants of the lecture will learn why patients have to come at least twice to angiography and which specific protection requirements have to be fulfilled. We will also discuss the relationship of SIRT and volcanic eruptions.

Learning Objectives:
1. To learn about the procedure background.
2. To become familiar with the material used.
3. To appreciate the outcome of SIRT.

A-399 14:41

Interlude: German Röntgen Museum

U. Busch[1], B. Lewerich[2]; [1]*Remscheid/DE,* [2]*Berlin/DE*

What Wilhelm Conrad Roentgen would have said about the development of his groundbreaking discovery during the last century? He definitely would have been excited about the today's spectra of using his rays in so many, even all, natural sciences. Using this magnificent tool, scientists are able to unlock some of the secrets of nature, following Roentgen's footsteps. Nowadays the applications of x-rays are diverse. They extend from the micro to the macrocosmos. Some of their objects of study are smallest cell structures and magnetic domains, molecules and crystals, substances and materials, fossils and archaeological finds, art and mummies, humans and animals, luggage and containers, stars and galaxies. The x-ray technique used for this purpose is as diverse as highly engineered. The paper will give an insight into some of these fantastic current researches.

Learning Objectives:
1. To learn about highly sophisticated non medial applications of X-rays
2. To understand other methods of producing X-rays
3. To appreciate the benefits of non-medical technical applications

A-400 14:54

PET-CT

K. Hägele; *Böbingen/DE (KatrinHaegele@gmx.de)*

This talk is about the 1) technique and benefit of a PETCT examination (early detection of malign tissue, avoiding operations). 2) Discussion of common radiopharmaceuticals (FDC + FEC) and indications for a PETCT (tumours, metastases, inflammation). 3) Explanation of patient preparation and PETCT procedure, image acquisition and fusion with CT images. 4) Short introduction into radiation protection aspects.

Learning Objectives:
1. To demonstrate the use of PET-CT in oncology.
2. To learn about the tracers used in PET.
3. To understand the principle and technique of the examination.
4. To become familiar with the process (patient preparation and aftercare).
5. To appreciate the benefits of the examination.

A-401 15:12

MRI-PET

V. Diehl, C. Franzius, M. Lentschig; *Bremen/DE (volker.diehl@zemodi.de)*

The hybrid technology MR/PET allows the acquisition of a number of parameters within one single examination. Technically, both modalities are the same as in stand-alone scanners. The challenge of the combined technology is among others to provide an attenuation correction matrix for the PET data volume without acquisition of CT data. This is solved by calculation an attenuation correction matrix (so-called µ-MAP) using an MRI DIXON sequence. Using the MR/PET hybrid system, the morphological imaging technique allows an exact localisation of the functional PET information. Thereby, the diagnostic specificity and accuracy of the PET is increased. MR/PET is used in clinical applications for only a few years now and is still in the initiation phase. A larger data basis regarding the advantages of the combined MR/PET is required. However, up to now some clinical key applications for MR/PET become apparent: This is for instance staging and therapy control of malignant diseases in children and young adults and the detection and restaging of relapse in prostate cancer. This presentation gives and comprehensive overview of the technique and application of multiparametric imaging using MR/PET.

Learning Objectives:
1. To learn about the basics of the combination of MRI and PET.
2. To understand the simultaneous acquisition of morphology and metabolism.
3. To appreciate the clinical applications with the example of oncologic imaging and neurological imaging.

14:00 - 15:30 **Studio 2015**

Joint Session of the ESR and ESMRMB

The ABC and 123 of perfusion MRI: DSC, DCE and ASL explained

Moderators:
X. Golay; London/UK
M. Smits; Rotterdam/NL

A-402 14:00

Perfusion MRI: DSC, DCE and ASL

L. Knutsson; *Lund/SE (linda.knutsson@med.lu.se)*

Tissue capillary blood flow or perfusion is important in maintaining tissue viability since the blood carries oxygen and nutrition to the tissue. Using MRI, perfusion estimates can be obtained using endogenous or exogenous contrast agents/tracers. Arterial spin labelling (ASL) is a perfusion MRI methodology where magnetically labelled arterial water is used as an endogenous tracer. Labelling is achieved by applying an inversion or saturation pulse to a tissue-feeding artery, and when the labelled water reaches the brain tissue, water will exchange between blood and tissue. The resulting difference in image intensity between a control experiment (i.e., without labelling) and a labelling experiment is directly proportional to blood perfusion. Perfusion and other perfusion-related parameters can also be assessed by dynamic tracking of an injected exogenous contrast agent in combination with appropriate tracer kinetic modelling. Dynamic susceptibility contrast MRI (DSC-MRI), using T2/T2*-weighted imaging, and dynamic contrast-enhanced MRI (DCE-MRI), using T1-weighed imaging, are MRI methods in which exogenous contrast agents are employed.

Learning Objectives:
1. To understand the basic principles of dynamic susceptibility contrast (DSC), dynamic contrast-enhanced (DCE) and arterial spin-labelling (ASL) perfusion MRI.
2. To know the perfusion MRI protocols and post-processing.
3. To know the parameters that are derived from perfusion MRI, e.g. cerebral blood volume (CBV), cerebral blood flow (CBF), and ktrans.

A-403 14:30

Clinical applications of brain perfusion MRI

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. DSC 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 ASL has been applied in neuro-oncology with good evidence that rCBF measurements obtained by ASL correlate well with rCBV measurements of DSC. 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 know the current indications for brain perfusion MRI in the clinical routine.
2. To understand which perfusion MRI technique and parameters to use for which indication.
3. To learn about future applications of brain perfusion MRI in clinical practice.

A-404 14:55

DCE-MRI in oncology - when is quantitative imaging essential?

A.R. Padhani; *London/UK (anwar.padhani@stricklandscanner.org.uk)*

Using perfusion imaging in clinical practice should not be delayed/hindered by the complexities of the technique. Introducing quantitative perfusion MRI into the clinic has to go through validation and clinical deployment phases. The validation phase is quantitative but clinical deployment can be qualitative or semi-quantitative. Complex quantitative analysis has roles in validation, drug development and is needed for multiparametric assessments. Future work should now focus on incorporating perfusion imaging as part of multiparametric assessments towards improving understanding of tumour heterogeneity, including response in the era of targeted/precision medicine.

Learning Objectives:

1. To show that the implementation of perfusion DCE-MRI into clinical practice has been delayed/hindered by the complexities of the technical analysis.
2. To demonstrate that complex quantitative analysis has roles in validation, drug development and is needed for multiparametric assessments.
3. To illustrate that the key role of quantitative DCE-MRI is in the validation phase of biomarker development but that clinical deployment can be reductive provided that sensitivity is maintained.
4. To discuss future work, which should focus on incorporating perfusion imaging as part of multiparametric assessments so as to improve understanding of tumour heterogeneity, including response in the era of targeted/precision medicine.

15:20
Panel discussion

14:00 - 15:30 **Room L 1**

EIBIR Session

EIBIR 3

MITIGATE consortium: state of the art imaging and therapy in GIST

Moderators:
S.O. Schönberg; Mannheim/DE
I. Virgolini; Innsbruck/AT

A-405 14:00

Selective internal radiotherapy in GIST patients

S.J. Diehl; *Mannheim/DE (Steffen.Diehl@umm.de)*

Gastrointestinal stromal tumours (GISTs) spread frequently to the peritoneum and the liver. If resection of metastases or tyrosine kinase inhibitors (TKIs) fails, interventional ablation techniques are considered. Main topic of the presentation is the application of Selective Internal Radiotherapy (SIRT) for liver metastases in GIST patients. Our outcome data will be presented. SIRT offers a safe and effective treatment for patients with GIST liver metastases who do not show a response to TKIs. The results might challenge the notion that GISTs are resistant to radiation therapy. Another focus of the lecture is on the combination of SIRT with other local ablative therapies, like Microwave-Ablation or Irreversible Electroporation (IRE). By showing different case studies the use of minimal-invasive therapies in GIST patients will be demonstrated.

A-406 14:30

Multimodal imaging in GIST

D.L. Longo; *Turin/IT (dario.longo@unito.it)*

Gastrointestinal stromal tumours (GIST) develop from interstitial cells of Cajal in the gastrointestinal tract and typically express activating mutation in the c-KIT oncogene leading to tumour cell growth proliferation and survival. Although tumour response to chemotherapy have long been determined using conventional anatomic imaging techniques, such as computed tomography (CT) and magnetic resonance imaging (MRI), volume changes in GIST response to imatinib treatment occur late and are often only detected several months after the treatment start. This interval can be a significant amount of time, in which a patient may be receiving an ineffective treatment intervention. This problem is even more an issue when evaluating newer drugs. Development of preclinical tumour model, on the other hand, allows to address novel targeted cancer therapeutics. In this situation, novel or alternative imaging methods may be advantageous in assessing drug efficacy. Besides metabolic imaging using fluorodeoxyglucose-based positron emission tomography (FDG-PET), MRI offers several approaches and techniques which measure changes in vascularity, cellularity and pH.

New Gd-based contrast agents dedicated for preclinical imaging allow to improve DCE-MRI procedures for a better assessment of tumour vascular permeability. In addition, contrast agents exploiting the chemical exchange saturation transfer (CEST) mechanism allow to report on the extracellular tumour pH, thus linking the metabolic activity measured by FDG-PET with tumour acidosis.

A-407 15:00

Principle of X-Nuclei MR imaging: what the radiologist should know

L.R. Schad; *Mannheim/DE (lothar.schad@medma.uni-heidelberg.de)*

Sodium (23Na) ions play an important role in cellular homoeostasis and cell viability. In healthy tissue, the extracellular sodium concentration ([Na+]ex = 145 mM) is about ten times higher than the intracellular concentration ([Na+]in = 10-15 mM). Using sodium MRI, volume- and relaxation-weighted signal of these compartments can be measured. Thus, sodium MRI is a promising diagnostic tool, since pathological processes can alter this ion gradient. A density-adapted 3D radial projection reconstruction pulse sequence (DA-3DPR) is presented that provides a more efficient k-space sampling than conventional 3D projection reconstruction sequences (3DPR). The gradients of the DA-3DPR sequence are designed such that the averaged sampling density in each spherical shell of k-space is constant. Benefits for low SNR applications are demonstrated with the example of sodium imaging. In simulations of the point-spread function (PSF), the SNR is increased by the factor 1.66 for the DA-3DPR sequence. Using analytical and experimental phantoms, it is shown that the DA-3DPR sequence allows higher resolutions and is more robust in the presence of field inhomogeneities. High-quality in vivo images of the human brain are acquired at 3 and 7 Tesla with up to a factor of 1.80 higher SNR and better anatomical detail resolution for DA-3DPR. First clinical/experimental results for measuring tissue viability are presented in volunteer/patient brain examinations at 3 Tesla and accompanying animal studies (rat/mouse) in experimental studies at 9.4 Tesla together with promising new developments for human whole body sodium imaging.

14:00 - 15:30 **Room MB 2**

EuroSafe Imaging Session

EuroSafe 2

EuroSafe imaging call for action

A-408 14:00

Chairman's introduction

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

The ESR launched EuroSafe imaging, an ambitious radiation protection initiative, at ECR 2014 as a driver for improved quality and safety in medical imaging in Europe. Within this framework, a call for action was issued in September 2014 comprising 12 action items with concrete projects and specific goals to deliver this mission. The call for action was designed to support the implementation of the Bonn call for action, launched by the IAEA and the WHO in 2012, setting priorities for stakeholders regarding radiation protection in medicine. EuroSafe imaging's action plan covers topics such as clinical audit, up-to-date imaging equipment, clinical decision support, education and training, and communication activities. Work has already begun on several items, including the development of European imaging referral guidelines for the ESR's planned clinical decision support product, data collection through the 'Is your imaging EuroSafe?' survey, or the publication of the ESR economics working group's paper on the renewal of imaging equipment in Europe. The cooperation between the research platform MELODI and several medical associations including the ESR was launched at a meeting in October 2014. This variety of actions and the range of different stakeholders involved in EuroSafe imaging reflect the ESR's inclusive and holistic approach to medical radiation protection.

Session Objectives:

1. To learn more about the ESR's strategy to establish a new quality and safety culture across Europe through the EuroSafe Imaging campaign.
2. To learn about CT practices in Europe based on the results of an ESR data collection survey.
3. To learn more about EuroSafe Imaging's training and education activities in the area of radiation protection.
4. To understand that medical radiation protection is a multi-disciplinary team effort.

A-409 14:05

EuroSafe imaging call for action

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

The EuroSafe imaging call for action was issued in September 2014 to achieve EuroSafe imaging's objectives of promoting appropriateness in radiological imaging, maintaining radiation doses within diagnostic reference levels, using the ALARA principle and promoting the use of up-to-date equipment, empowering patients, and joining forces with various stakeholders. Designed to support the IAEA and WHO's Bonn call for action, which formulates ten priority areas for stakeholders regarding radiation protection in medicine, the EuroSafe imaging call for action consists of 12 items ranging from topics such as clinical audit, up-to-date imaging equipment and clinical decision support to education and training, communication activities and research cooperation. Significant progress has already been made on several items of the call for action. The ESR's clinical decision support product for imaging referral guidelines in Europe is set to be introduced later this year, and first results of the data collection through the 'Is your imaging EuroSafe?' survey are already available. The ESR economics working group's paper on the renewal of imaging equipment in Europe, published in October 2014, serves as the basis for engaging with European institutions and other stakeholders on this issue. The cooperation between the research platform MELODI and several medical associations including the ESR was launched in October 2014. The first year of EuroSafe imaging has been active and yielded some promising results. The call for action forms the basis for continuing the work to deliver the ESR's mission of improving quality and safety of patients in Europe.

Learning Objectives:

1. To learn about EuroSafe Imaging's strategy to establish a patient safety culture in Europe.
2. To understand how EuroSafe Imaging's Call for Action will contribute towards the implementation of the IAEA and WHO 'Bonn Call for Action'.
3. To learn more about the specific plan of activities of EuroSafe Imaging.

A-410 14:15

EuroSafe imaging training and education activities and data collection project "Are you EuroSafe?"

P. Vock; *Spiegel/CH (peter.vock@med.unibe.ch)*

On a long-term, education and training promise a most effective approach to building a new radiation protection culture. Action 6 of the ESR call for action (matching action 4 of the Bonn call for action) asks for "organising radiation protection training courses and developing e-learning material to promote a safety culture and raise awareness of radiation protection". The presentation will show the identity of the ESR Training curriculum and the European guideline, based on knowledge, skills and competences. Beyond this theoretical guidance, the ten modules of e-learning in radiation protection offered at the ESR website and the interactive training courses.will be reviewed. In the second part, the ongoing EuroSafe Imaging survey will be presented. For a few important clinical questions, European imaging departments are currently asked to contribute the CT examination protocols used and the radiation metrics applied to five patients each. This anonymous collection of the status quo in CT practice will progressively allow for building European diagnostic reference levels (DRLs), provide benchmarking feedback to the departments, and give some information on the status of the equipment. The first results of the survey and potential consecutive actions will be presented.

Learning Objectives:

1. To have an overview of the EuroSafe imaging education activities.
2. To understand the importance of training and education to improve radiation protection practices.
3. To learn more about CT practices in Europe based on the results of the survey.
4. To understand what action needs to be taken as a result of the data collection.

A-411 14:30

Role of radiographers in medical radiation protection in the context of EuroSafe imaging

G. Paulo; *Coimbra/PT (graciano@estescoimbra.pt)*

Technological evolution and new scientific developments have increased the organisational complexity of the healthcare. The major contributor is the influence of medical imaging technology development. This change of paradigm is a key driver for a (n) (r)evolution in the daily practice of radiographers, since they are the interface between the patient and technology and the gatekeeper regarding radiation protection. This demands for a permanent focus on patient care and safety, based on high professional standards. The roles and tasks performed by radiographers are manifold and varied. According to the European federation of radiographer societies (EFRS), radiographers are the healthcare professionals responsible for performing safe and accurate procedures, using a wide range of sophisticated technology; are professionally accountable for the patients' physical and psychosocial well-being, prior to, during and following diagnostic and radiotherapy procedures; take an active role in justification and optimisation of medical imaging and radio-therapeutic procedures; are key persons in the radiation safety of patients and other persons. The radiographer is a healthcare team member who interacts with other professionals to provide an optimum diagnostic and/or therapeutic outcome for the patient. To err is human, thus healthcare in general and medical imaging and radiotherapy in particular are also prone to human error. The best medical imaging and radiotherapy department is the one that errs least. To achieve excellence, it is essential to build a well-functioning teamwork between radiographers and radiologists, 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 understand the role of radiographers in medical radiation protection.
2. To learn more about the 'division of labour' between radiologists and radiographers.
3. To learn more about the impact technical issues and quality of equipment have on radiation protection.

A-412 14:45

Role of medical physicists in medical radiation protection in the context of EuroSafe imaging

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

In line with its holistic approach to medical radiation protection and to increase awareness of the importance of radiation protection and to promote quality and safety in medical imaging, the European society of radiology launched the Eurosafe imaging campaign at the ECR 2014. The European federation of organisations for medical physics (EFOMP) has supported this very worthwhile campaign since its launch. Medical physics experts (MPEs) are involved in medical imaging departments to measure the radiation output to estimate the radiation dose, monitor doses using dose tracking methods, maintain patient doses within diagnostic reference levels, reduce doses while maintaining the image quality needed for diagnosis, establish appropriate acquisition techniques and train staff in radiation protection. These activities are of great importance for CT and interventional radiology, where radiation doses are high. MPEs are experts in radiation physics, radiation protection and technology applied to medical exposures. The requirements for the involvement of the MPEs in medical exposure procedures have been changed in the newly published Euratom BSS, increasing their presence in diagnostic and interventional radiology practices. Undoubtedly, MPEs can play a major role in radiation protection in the context of EuroSafe imaging campaign. MPEs, radiologists, radiographers and equipment vendors should work together to develop effective dose reduction strategies.

Learning Objectives:

1. To understand the role of medical physicists in medical radiation protection.
2. To learn more about the added value medical physicists provide in radiology departments.

A-413 15:00

New European approaches to medical low-dose research

J. Repussard; *Paris/FR (jacques.repussard@irsn.fr)*

Advanced technologies have allowed immense progress in medical imaging techniques using ionising radiation, which are today available to a majority of the European population for an ever wider scope of diagnostic procedures. Similarly, radiotherapy saves thousands of lives every year, with improved technologies allowing better preservation of surrounding healthy tissues. However, as medical radiation becomes the main source of radiation exposure for a growing fraction of the population, it is worth noting that there are still significant knowledge gaps in the understanding of the biological and possible health effects of low doses of ionising radiation. Typically, little is known about the factors that determine individual radiosensitivity. Or about the relative toxicity, at low doses of radiations emitted by different radioelements. Or about the interaction between radiation and cellular and intercellular basic mechanisms governing homeostasis. Improved knowledge would permit further improvement of protocols for a safe use of radiation in the medical sector and other fields, consolidate radiation protection practice and build-up trust in society. European research is currently preparing to confront this scientific challenge. Medical sciences are part of the disciplines which need to get together for this purpose. Data available from patients exposed to ionising radiation constitute a unique resource to test scientific hypothesis. The European low-dose research association MELODI has initiated a cooperation process with European medical associations, of which ESR is at the forefront, to develop and implement common research strategies, with the support of the European Commission and of EU Member States.

Learning Objectives:
1. To raise awareness about existing knowledge gaps, and related research programs.
2. To learn about the opportunities for participation to research project with field.

15:15
Panel discussion: EuroSafe Imaging - feedback, contributions, future activities, endorsement
N. Bedlington; Vienna/AT (European Patients Forum)
N. Denjoy; Brussels/BE (COCIR)
G. Simeonov; Luxembourg/LU (European Commission)
M. Perez; Geneva/CH (WHO)
O. Holmberg; Vienna/AT (IAEA)

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

E³ - ECR Academies: Interactive Teaching Sessions

E³ 1221
Unexpected findings on brain MRI

A-414 16:00
A. Large ventricles: normal or abnormal?
S. Langner; *Greifswald/DE (soenke.langner@uni-greifswald.de)*

The ventricular system is composed of both lateral ventricles, the third and the fourth ventricle with the latter communicating with the third ventricle by the aqueduct. The lateral ventricles are communicating with the third ventricle via the foramina of Monroi. Enlargement of the ventricles can be related to physiologic changes, e.g. age-related atrophy, or due to pathologic conditions. Different physiological and pathological conditions causing enlargement of the ventricles will be presented and the imaging landmarks will be discussed. Algorithms for the diagnostic workup will be provided.
Learning Objectives:
1. To learn the anatomy and physiology of the ventricular system.
2. To differentiate hydrocephalus from physiologic changes.

A-415 16:45
B. Incidental lesions on a brain MRI
E.T. Tali; *Ankara/TR (turgut.tali@gmail.com)*

Incidental lesions on a brain MRI can be categorised according to lesion type as congenital or acquired. Generally 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 does not have associated clinical finding. Majority of these congenital lesions such as hamartomas, dysplasias 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 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.
Learning Objectives:
1. To identify incidental findings on a brain MRI.
2. To learn how to characterise the lesions.
3. To learn how to handle the incidental findings.

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

ESR meets EAU

EM 2
Joint ESR-EAU prostate cancer session

Welcome by the ESR President:
L. Bonomo; Rome/IT
Presiding:
P.-A. Abrahamsson; Malmö/SE
B. Hamm; Berlin/DE

A-416 16:00
Introduction
P.-A. Abrahamsson[1], B. Hamm[2]; [1]*Malmö/SE*, [2]*Berlin/DE*

Session Objectives:
1. To understand therapeutic decision-making from the urologist's point of view.
2. To understand the role of imaging in the early detection of prostate cancer.
3. To learn about the new role of imaging in active surveillance.

A-417 16:05
PSA screening: the EAU view
P.-A. Abrahamsson; *Malmö/SE (Per-Anders.Abrahamsson@skane.se)*

The American association of urology has recently released new guidelines for the early detection of prostate cancer. In brief, the new guideline does not recommend prostate-specific antigen (PSA) screening in men under 40 years of age, does not recommend PSA screening in men between ages 40 to 54 years at average risk, does recommend a shared decision-making for men aged 55 to 69 years, does recommend a screening interval of ≥ 2 years and does not recommend PSA screening in men aged 70+ or in men with a life expectancy < 10 to 15 years. Based on the current evidence in the literature the EAU has a different recommendation for the early detection of prostate cancer. The updated EAU guidelines do not recommend widespread mass screening for PCA and early detection in well-informed men is strongly recommended. A baseline PSA determination at age 40 to 45 years has been suggested upon which the subsequent screening interval may then be based. Furthermore, the EAU guidelines do not use a specific chronological age as a threshold for screening but screening in men with a life expectancy > 10 years is recommended independent of chronological age.
Learning Objectives:
1. To be aware of the limitations of PSA.
2. To understand how to personalise prostate cancer screening.
3. To understand the indications for prostate MRI from the urological point of view.

A-418 16:23
Role of a multiparametric MRI in early detection
G.M. Villeirs; *Gent/BE*

Prostate multiparametric magnetic resonance imaging (mpMRI) consists of morphologic T2-weighted MRI (T2w), supplemented with at least two functional techniques: diffusion-weighted MRI (DWI), dynamic contrast-enhanced MRI (DCE) and magnetic resonance spectroscopic imaging (MRSI). T2w MRI provides good sensitivity for overall prostate cancer detection, but suffers from low specificity (false positives), therefore, requiring functional imaging tools. DWI is a marker of cellular density and improves specificity, but also correlates with tumor aggressiveness (the lower the ADC, the higher the Gleason grade). DCE is a marker of neoangiogenesis and is useful for the peripheral zone only; in the central gland, it notoriously suffers from enhancement overlap with benign prostatic hyperplasia. MRSI depends on tumor metabolism and primarily increases specificity, being especially sensitive to high-grade cancers. The minimal technical requirements for mpMRI are defined in the ESUR-guidelines (Eur Radiol 2012;22:746). A standardised reporting system (PIRADS) has been proposed in the same paper, relying on a 5-point probability scale of harbouring clinically significant prostate cancer. Validation studies using this system have shown promising results (accuracy up to 86%) both in men with a negative prior biopsy and in biopsy-naïve men. Using a summary PIRADS cutoff scale of 4, a high sensitivity (> 90%) for detecting high-grade prostate cancer and a very high negative predictive value (99%) for excluding high-grade prostate cancer have been reported. mpMRI can thus be used to guide a biopsy needle towards a suspicious area in case of a positive mpMRI, or to avoid a biopsy in case of a negative mpMRI.
Learning Objectives:
1. To understand the basic principles of mpMRI.
2. To be aware of the advantages and limitations of each MR technique.
3. To understand the PIRADS classification system.

A-419 16:41

Active surveillance strategies in prostate cancer

A. Villers; *Lille/FR (arnauld.villers@wanadoo.fr)*

Active surveillance (AS) for low-risk, localized prostate cancer may reduce overtreatment of clinically insignificant prostate cancer while retaining the option of definitive therapy for those patients who are reclassified at higher risk over time. Various criteria of eligibility for AS based on systematic biopsy results are reported. Often, it includes a PSA < 10 ng/ml, ≤2 positive biopsy cores, no Gleason grade 4/5 and ≤5 mm involvement of any biopsy core. However, these criteria are not very accurate, and the issue is how to better identify patients harbouring very low risk or insignificant disease using the current diagnosis pathway (12-core systematic biopsy), which misclassifies tumour volume and/or grade in up to 30% of cases. It was shown that reclassification of patients is mainly due to under sampling of significant tumours at initial biopsy rather than progression of indolent disease during surveillance lead time Therefore, there is a growing interest for multi-parametric MRI as a diagnostic tool that improves the prediction of tumour grade, tumour extent and help in better selecting patients for AS or other management modality. The rate of reclassification using MRI-targeted biopsy in patients potentially eligible for AS based on 12-cores transrectal ultrasound-guided SB was studied. MRI-targeted biopsy re-staged 10% of patients to a higher stage, improving the selection of patients considered for active surveillance for clinically low-risk prostate cancer based on SB. Its incorporation to AS eligibility criteria may reduce the risk of reclassification during surveillance. MRI might have also a role as a surrogate for biopsy during follow-up.

Learning Objectives:

1. To understand the paradigm shift from invasive treatment to active surveillance (rationale for active surveillance).
2. To learn how to select patients for active surveillance (comparison between the different available criteria).
3. To identify triggers for active treatment (tumour progression).

A-420 16:59

Role of imaging 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. However, what combination of MRI features best predict treatment-free survival and is MRSI an essential component of baseline examinations are unanswered questions. Changing mpMRI phenotype during AS period should prompt additional histological sampling (not a trigger for active treatment by itself). However, how much & which mpMRI component change is pathologic/clinically significant, dealing with missing mpMRI components during follow-up studies and the frequency for imaging follow-up remain open questions. Physician communication via structured, pictorial reporting is key to the successful implementation of mpMRI for active surveillance programs.

Learning Objectives:

1. To discuss the role of mpMRI for confirming eligibility for active surveillance (which means to highlight the benefits of mpMRI for detecting cases at higher risk and thus unsuited for active surveillance).
2. To monitor patients under AS.
3. To optimise biopsy targeting during monitoring on AS.

17:17

Panel discussion: When should MRI be used? Before or after prostate biopsy? Qualitative or quantitative MRI reading? Cost-effectiveness of mpMRI for as a tool for prostate cancer screening. Can mpMRI detect clinically significant prostate cancer?

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

E³ - ECR Academies: Modern Imaging of the GI Tract

E³ 1222

Perianal fistula disease: all you need to know

Moderator:
D. Weishaupt; Zurich/CH

A-421 16:00

A. Perianal anatomy and imaging techniques

K. Horsthuis; *Amsterdam/NL (k.horsthuis@amc.uva.nl)*

The inner layer of the anal canal consists of squamous and columnar epithelium with the transitional zone at the dentate line. The muscular component of the anal sphincter consists of an inner layer of circular smooth muscle (internal sphincter), extending downward from the rectum, and an outer striated muscular layer extending downward from the levator ani muscle, comprising the puborectalis muscle and the external sphincter. Between these layers is the fat-containing intersphincteric space, including the continuation of smooth-muscle fibres of the longitudinal muscle of the rectum. Outside the anal sphincter is the fat-containing ischioanal space. Magnetic resonance imaging (MRI) and endoscopic ultrasonography have become the mainstay for preoperative imaging of perianal fistulas. For complex tracts, MRI seems preferable. MRI can be performed using an endoluminal coil or a phased-array surface coil. A state-of-the-art imaging protocol should include T2 TSE sequences in three orthogonal planes, with the axial and coronal sequences angulated at the anal canal. Addition of a fat-saturated T2 TSE sequence is recommended for optimal conspicuity of inflammatory changes, post-contrast T1-weighted imaging also can be helpful. Intersphincteric infection is the principal feature of perianal fistulas; this is generally not found in other conditions. Veins can be mistaken for fistulas, but in contrast to fistulas, veins usually are thin-walled, tortuous, symmetric structures. A pilonidal sinus may resemble a fistula, but absence of extension to the intersphincteric space helps one to discriminate. Haemorrhoids and anal tags may resemble small submucosal fluid collections but are easily diagnosed at clinical examination.

Learning Objectives:

1. To understand anal canal anatomy.
2. To become familiar with state-of-the-art protocols for imaging the anal canal.
3. To learn about normal variants which mimic anal disease.

A-422 16:20

B. Perianal fistula disease: the basics

S. Halligan; *London/UK (s.halligan@ucl.ac.uk)*

This lecture will describe the pathogenesis of fistula-in-ano, with a focus on cryptoglandular disease, so that the radiologist can understand how the various classifications of fistulas arise. The Park's classification for fistula-in-ano will be described with reference to cryptoglandular disease and other aetiologies. The surgical questions that need to be answered by imaging will be presented, followed by a description of what the radiologists need to include in their report for it to be clinically useful. The role of anal ultrasound and MRI for preoperative fistula imaging will be described, with explanation as to why the latter is fundamental to modern management of the disease.

Learning Objectives:

1. To understand the pathophysiology and classification of perianal fistula disease.
2. To become familiar with the role of US and MRI in assessing fistula disease.
3. To learn about the basic reporting of non-complex fistula disease.

A-423 16:40

C. Perianal fistula disease: advanced

F. Maccioni; *Rome/IT (francesca.maccioni@uniroma1.it)*

Perianal fistulising disease develops in approximately half of adult and paediatric patients affected by Crohn's disease (CD), with a relevant impact on their quality of life. Complex ramified anal fistulas with abscesses (type 3-4 of Parks' classification, type 4-5 of S.James Hospital classification) are more frequently observed in patients with CD in than other patients, particularly those with severe fistulising ileal or colo-rectal CD. Definitely, perianal disease represents a severe complication of CD, which frequently modifies disease management, requiring specific pharmacological and/or surgical treatments. A non-responsive perianal disease may eventually lead to total proctectomy with definitive ileostomy. In these patients, MRI represents the gold standard diagnostic modality, because it provides a comprehensive staging of both enteric and perianal disease, with high accuracy and without invasiveness. Moreover, MRI is the ideal tool for monitoring disease response to therapy, being able to detect the inflammatory activity of perianal fistulas with high sensitivity. Thus far, several clinical indexes have been proposed to measure fistula's activity, including the perianal disease activity index (PDAI); similarly, several MRI scores of fistula's activity have been proposed, although a widely accepted score is not available yet. Several cases of complex perianal fistulising CD of increasing severity, with anatomical and clinical correlations, will be shown. Of each case, staging and activity will be described, integrated with information on the clinical history and treatment. Finally, differential diagnoses with other benign conditions which may affect the anal canal, including infective diseases, hidradenitis and pilonidal disease will be discussed.

Learning Objectives:

1. To learn about complex perianal fistula disease, notably extensions and abscesses.
2. To understand the role of imaging in patient follow-up and treatment monitoring.
3. To learn about benign inflammatory conditions which may affect the anal canal, including hydradenitis and pilonidal disease and how they are differentiated from perianal fistulae.

A-424 17:00

D. Interactive case discussion
D. Weishaupt; *Zurich/CH*

The interactive case discussion will highlight clinically relevant aspects of perianal fistula disease in selected clinical cases. A patient case of each of the subtopics of the categorical course is presented.
Learning Objectives:
1. To become familiar with typical cases demonstrating the crucial role of imaging perianal fistula disease.
2. To learn about typical imaging findings.
3. To be aware of potential pitfalls in imaging perianal fistula disease.

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

Professional Challenges Session

PC 12b

Medicolegal aspects in daily practice

A-425 16:00

Chairman's introduction
J.I. Bilbao; *Pamplona/ES (jibilbao@unav.es)*

In daily practice, radiologic interpretations produced by radiologists contain errors. Some of them may be catalogued as "negligent conduit" and others may not. These differences in the perception of the judge will have, or will not have, important consequences for the affected radiologist. Such an important topic may then have the possibility to be evaluated by the most objective methods. Errors in perception may occur in the absence of negligence and it is well known that a retrospective review of the images once the final diagnosis has been established may elucidate the findings not well understood or non-detected before. The important issue is to establish, to know or to define which is the standard of care that a regular physician must deliver to the community and which is the normal level of knowledge, abilities and aptitudes that a radiologist needs to have whilst producing reports, performing procedures or interacting with the patients and other medical colleagues. It seems clear that the harmonisation of the training programmes as well as the objective evaluation of the individuals' knowledge will favour to establish the standardisation of care that the community requires from us.
Session Objectives:
1. To understand the consequences of misinterpretation.
2. To learn about the concepts of error, undesirable results and malpractice.
3. To become familiar with the point of view of the lawyer.
Author Disclosure:
J.I. Bilbao: Speaker; Sirtex medical europe, Terumo.

A-426 16:05

Inadequate consent, missed lesions and misinterpretation: legal challenges in radiology
E.J. Adam; *London/UK (drjaneadam@gmail.com)*

No-one is perfect, things go wrong however hard we try. Lesions are missed, complications happen, and patients may suffer. We can try to identify the root cause of error, learn from those which are made, and design systems and working practices to minimise them. Sometimes legal cases are brought against radiologist, and in some countries this is increasing. Can openness and saying sorry help? Do we need to reduce patient expectation of the accuracy of imaging? These and other issues will be explored.
Learning Objectives:
1. To understand the need to accurately inform the patient about the procedure and the expected results.
2. To know how to deal with lesions which have been missed in a report.
3. To become familiar with the consequences that a misinterpretation may have in the process of attending to a patient.

A-427 16:25

When is a radiologic error simply an error and when is it malpractice?
A. Cannavale, M. Santoni, F. Fanelli; *Rome/IT (alessandro.cannavale@hotmail.com)*

Radiology decision-making is always under some degree of uncertainty, and therefore cannot always produce unerring interpretations or reports. The interpretation of a radiologic study or performing an interventional procedure is not a simple process but is affected by many variables such as clinical information and patient general condition. Errors in radiology practice are quite common, amounting to about 4% of radiologic interpretations rendered by radiologists. A recent review outlined that both in US and in European countries the most common error is failure to diagnose, particularly in breast and skeletal radiology. Complications related to interventional procedures (most frequently vascular injuries) represent the second most frequent cause of claims made. Actually most of the committed errors are of such minor degree or are resolved before a patient's injury may happen. When the "missed" radiographic diagnosis or complication in Interventional Radiology may constitute malpractice? Malpractice may be defined as an active disregard for the necessary steps to provide accurate and ethical health assistance. Negligence happens when there is a breach of duty or a failure to comply with certain standards of care. The standard of care may be defined as "the watchfulness, attention, caution and prudence that a reasonable person in the circumstances would exercise; failure to meet the standard of care is called negligence." Standard of care is practically represented by the current Radiology and Interventional Radiology guidelines, that have the role to guide radiologists and referring physicians in making decisions; nevertheless, they should be applied according to each particular situation.
Learning Objectives:
1. To understand that some errors may be the result of negligent conduct of the radiologist.
2. To understand that some undesirable results are not malpractice.
3. To become familiar with the concept of "standard of care" in daily clinical practice.

A-428 16:45

The lawyer's point of view
M. Ludvik; *Vienna/AT (markus.ludvik@anwaltludvik.at)*

Due to new examination and treatment methods, the radiologists´ professional role has been changed rapidly over the last years. An increasing involvement in the comprehensive clinical treatment of the patient implicates new duties and liabilities, accompanied with increasing risks of legal claims. As radiology is one of the specialties most liable to claims based on medical malpractice, it is of crucial importance to face the radiologists´ risks of their clinical role and how to protect from potential lawsuits. Lawsuits are commonly related to inappropriate medical care, a faint physician-patient relationship and last but not least to a breach of the legal obligation of physicians to disclose information to patients. Main causes of legal actions against radiologists will be presented to increase the awareness and sensitivity and to lower risks and consequences of malpractice lawsuits. The lecture provides a survey of basic principles of medical malpractice law - including the description of some useful medicolegal terms. Furthermore, concepts for relevant medical records, information for patients and adequate malpractice insurances and the "legal standard of care" will be presented.
Learning Objectives:
1. To understand the legal concept of malpractice.
2. To become familiar with the point of view of a lawyer about 'standard of care' in clinical practice.

17:05
Panel discussion: How present are medicolegal aspects in our daily clinical practice?

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

Physics in Radiology

RC 1213

Good radiation and bad radiation? How to assess and communicate radiation risk to patients and referring physicians

Moderator:
O. Ciraj-Bjelac; Belgrade/RS

A-429 16:00

A. Radiation risk: a patient's perspective
E. Briers; *Hasselt/BE (erikbriers@europa-uomo.org)*

A patient who is visiting the radiology department is not always aware of the eventual radiation risks that she or he will be submitted to. Many patients have a very limited knowledge of radiation. They get the information from the internet and from sources aimed at the general public. This information is sometimes very biased. For patients, however, there should always be a balance between risk and benefit of a treatment technique. It is for a patient obvious that every treatment technique carries some risk but that on the other side of the balance there is benefit. It is at the same time an observation that for the patient the comparator for this is strongly influenced by the severity of his disease. Cancer patients are willing to accept a bad benefit/risk ratio as it could mean the difference between life and death. Today, life and death are equal to "quality of life" after treatment. So in communicating radiation risk to

patients a discussion of this ratio is important, a patient is willing to undergo a radiation treatment if it could improve his quality of life in treating his cancer. The question is different if a patient would be willing to undergo repeated organ scans as a screening for a cancer they may not have and may never have. The communication should be evidence based on both aspects: the benefit and the risk; otherwise, an empowered patient could find other information and lose faith in his treatment team.

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-430 16:15

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: pregnant patient undergoing a CT scan; child undergoing a CT brain scan; adult undergoing a high-dose fluoroscopy procedure.

A-431 16:40

C. Risk in MRI

R. Peeters; *Leuven/BE (ronald.peeters@uzleuven.be)*

With the trend of using high magnetic field scanners in clinical practice and the construction of 'MRI compatible' implanted devices, the list of do's and don'ts whilst 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 and local legislation 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 assess possible contraindications in advance. Whilst 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 electronic devices introduces new challenges in patient safety. In fact, most of these devices are only safe in certain conditions 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 this equipment.

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-432 17:05

D. Communicating risks to patients and the public

N. Leitgeb; *Graz/AT (norbert.leitgeb@tugraz.at)*

Risk communication means communicating controversial and/or emotionally loaded issues. It is hindered by the emotion of the audience which may considerably impair its cognitive performance and the complex mechanisms of risk perception which uncouple the perceived risk level from quantitative scientific risk estimates. Pitfalls of risk communication are discussed and the challenge to adequately adapt risk communication to the target audience, in particular to lay people, is demonstrated with regard to data presentation. In addition, how to communicate cancer risks from breast cancer screening is discussed. Another example demonstrates pitfalls in communicating epidemiological evidence such as for childhood leukaemia risk from magnetic fields, e.g. from power lines. It is demonstrated that in addition to sound factual knowledge, risk communication requires specific skills to help avoiding the numerous communication pitfalls such as using inadequate language, in particular gobbledygook, incorrect simplifications, inadequate parameters, misleading wording, tricky comparisons, results manipulation, results picking, misleading data presentation and ambiguous messages. Risk communication is much more than just talking about facts. It needs to be based on adequate risk assessment, highlight the strength of evidence and remaining uncertainties and avoidance of the numerous pitfalls. However, besides factual knowledge and empathy it requires specific communication skills, the awareness of the risk perception process and of the manifold communication pitfalls.

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 threat/hazard and parents' perception regarding imaging of their child.
4. To learn how to select a risk-communication strategy suited to parents and children.

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

E³ - ECR Academies: Image-Guided Interventions in Oncology

E³ 1219

The cutting-edge technologies in image-guided tumour therapy

A-433 16:00

Chairman's introduction

M. Krokidis; *Cambridge/UK (mkrokidis@hotmail.com)*

Interventional oncology is one of the most advanced areas of interventional radiology, offering minimal invasive treatment to cancer patients. Several novel techniques are lately developed and integrated in clinical practice. The role of this session is to explore the characteristics of high-intensity focused ultrasound (US and MRI guided) and of irreversible electroporation and to delineate the current evidence on these emerging technologies.

Session Objectives:

1. To become familiar with the new emerging image-guided techniques in oncology.
2. To learn about physical and technical basics of the presented techniques.
3. To understand the clinical and technical indications for these new technologies.

A-434 16:03

A. HIFU: The ultrasound guidance

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

High-intensity focused ultrasound (HIFU) is a highly precise medical procedure using focused ultrasound energy for burning and destroying the tumour tissue at depth within the body, selectively and without harming overlying and adjacent structures within the path of the beam. Unlike radiofrequency or cryoablation, HIFU is completely non-invasive and can be used to reach tumoral areas that are deep within the body, if there is an acoustic window for allowing the transmission of ultrasound energy. Ultrasound guidance for HIFU, due to the real-time feature which allows for safety ablation of abdominal moving organs, is up to now the most used imaging technique for treating tumour within the liver and the pancreas. Real-time imaging ensures that HIFU beam targeting is maintained within the correct area throughout the procedure. Moreover, sonographic guidance provides the benefit of using the same form of energy that is being used for therapy. The significance of this is that the acoustic window can be verified with sonography. Imaging methods for assessing the outcome after HIFU treatment are similar to those usually employed after other methods of ablation such as radiofrequency ablation and include contrast-enhanced CT and MRI. In addition, the use of micro-bubbles ultrasound contrast-enhanced is also being used as a method for evaluating efficacy of HIFU treatment during the procedure itself.

Learning Objectives:

1. To understand physical and technical basics of ultrasound-guided high intensity focused ultrasound (USgHIFU).
2. To become familiar with the current indications in oncology.
3. To consolidate knowledge of results from personal experience and from the literature.

A-435 16:32

B. HIFU: The magnetic resonance guidance

A. Napoli, G. Brachetti; *Rome/IT (alessandro.napoli@uniroma1.it)*

Magnetic resonance (MR) imaging-guided focused ultrasound is an alternative noninvasive method for reducing the pain in skeletal metastases. The concentration of acoustic energy on the cortical bone produces a rapid temperature increase that mediates critical thermal damage to the adjacent periostium. Clinical data include an evaluation of a visual analog pain score (VAS), changes in the drug schedule, and improvements in quality of life. This technique has also a potential role in achieving local tumour control, potentially allowing de-novo mineralisation of trabecular bone or reduction in lesion size; lesion changes were evaluated according to MD Anderson criteria. The modulation of treatment parameters for tumour control relies on system tuning to increase the acoustic energy levels and duration of sonication and decrease the frequency, which allows heating beyond the cortex. In our department, we are evaluating the safety and efficacy of MRgFUS treatment for pain palliation in patients with malignant (bone metastases) and also benign bone lesions (mainly osteoid osteoma). MRgFUS can be performed safely as an non-invasive procedure in patients with symptomatic osteoid osteoma. The major advantages of MR imaging-guided focused ultrasound include MR-guided three-dimensional visualisation for precise treatment planning, real-time monitoring of thermal damage in the target zone with MR thermometry, continuous temperature mapping of treated tissue, and immediate assessment of therapy. During treatment, real-time multisection MR thermometry is used to evaluate the temperature rise of the tissue. On the basis of this feedback, real-time MRI allows increased safety and effectiveness profile of the procedure.

Learning Objectives:

1. To understand physical and technical basics of magnetic resonance-guided high intensity focused ultrasound (MRgHIFU).
2. To become familiar with the current indications in oncology.
3. To consolidate knowledge of results from personal experience and form the literature.

A-436 17:01

C. Update on irreversible electroporation

A. Nilsson; *Uppsala/SE (anders.nilsson@radiol.uu.se)*

Irreversible electroporation (IRE) is a new method for tumour ablation that does not involve heat, as in RFA or microwaves, or cold as in cryoablation. Instead, electric pulses of a high voltage but relatively low energy are sent between needle-shaped electrodes placed around the tumour. A minimum of 2 and up to 6 electrodes may be used for each ablation. The electric pulses will create small pores in the cell membranes and if the current is set correctly, these pores will remain open even after the treatment pulses have stopped. This will cause cell death, apoptosis, in the area chosen by the needle placement. However, contrary to other ablation techniques and because there is no heat involved, the tissue structure remains unchanged, for e.g. the collagen skeleton of a vessel remains undamaged and the vessel stays open. Thus, tumours growing around critical structures like bile ducts, blood vessels, etc. can be treated without any effect other than cell death, killing the tumour but leaving the tissue structure intact. This potentially means that primary tumours/metastases that cannot be surgically removed, treated with radiation or ablated with RFA or microwaves still can be accessed in an attempt to make the patient tumour free.

Learning Objectives:

1. To understand the physical and technical basics of irreversible electroporation (IRE).
2. To become familiar with the current indications in oncology.
3. To consolidate knowledge of results from personal experience and from the literature.

16:00 - 17:30 **Studio 2015**

E³ - Rising Stars Programme

Basic 3: Oncologic imaging

A-437 16:00

Prostate cancer

J.O. Barentsz; *Nijmegen/NL (J.Barentsz@rad.umcn.nl)*

Prostate cancer is surpassing by the number of breast cancers diagnosed and due to an aging population has become a major health problem. Current diagnosis is suboptimal, inconvenient and imprecise. It can be improved with modern multi-parametric MRI methods for detection, staging and biopsy of the prostate tumour (s). With multi-parametric (mp) MRI a precise and accurate, simple and fast diagnosis of cancer can be made with subsequent minimally invasive image-guided therapies. With mpMRI it is possible to treat prostate cancer effectively with minimal side effects. Scientific research has shown that the specificity and sensitivity of the new method exceeds that of the standard techniques. Furthermore, a recent systematic review has shown that diagnostic MR-guided biopsy of prostate tumours is accurate and safe.

Learning Objectives:

1. To learn the full spectrum of mpMRI of the prostate through detailed explanation of selected cases.
2. To support progressive improvement of the attendees' interpretive expertise with the PIRADS scoring system.
3. To increase confidence in reading mpMRI's.
4. To improve skills in early detection of intermediate to high grade prostate cancers.
5. To appreciate the clinical relevance of mpMRI.
6. To emphasize the importance of multimodality approach to workup cases in a multidisciplinary environment.

A-438 16:30

Pancreatic cancer

F. Caseiro-Alves; *Coimbra/PT (caseiroalves@gmail.com)*

Despite advances in cross-sectional techniques imaging has still difficulties on assessing pancreatic cancer and in particular adenocarcinoma. The main problems remain the early detection of small tumours and the clearcut definition of patients that are amenable to curative surgery. The lecture will address the strategies that may be used to maximise tumour conspicuity in a multi-modality perspective that also encompasses uprising techniques such as dual energy CT, perfusion CT/MR and diffusion-weighted MRI. The concept of borderline resectable pancreatic cancer will be explained as well the key points for image interpretation in the setting of clinical decisions for patient management. Also, the current role of adjuvant or neoadjuvant therapy will be shortly addressed especially concerning its imaging implications.

A-439 17:00

Musculoskeletal neoplasms

M.F. Reiser; *Munich/DE (Maximilian.Reiser@med.uni-muenchen.de)*

"no abstract submitted"

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

Musculoskeletal

RC 1210

Sports injuries to the knee: improving my report

Moderator:
P. Robinson; Leeds/UK

A-440 16:00

A. Reporting meniscal tears: pitfalls and how I avoid them

G. Andreisek; *Zurich/CH (gustav@andreisek.de)*

Standardised image evaluation and interpretation as well as reporting are crucial for proper diagnosis as well as communication amongst healthcare 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 the 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 how to avoid them.

Learning Objectives:

1. To understand the normal anatomy which may simulate meniscal tears.
2. To understand pitfalls in the diagnosis of meniscal tears.

A-441 16:30

B. The collateral ligaments and posterolateral corner: what are they, why do they matter and how do I assess them?

V. Vasilevska Nikodinovska; *Skopje/MK (v_vasilevska@yahoo.com)*

The anatomy and injuries' pattern of collateral ligaments and of posterolateral corner of the knee, mechanism of injuries, biomechanical impact on knee instability and MR imaging findings will be reviewed. Knowledge of the complex anatomy of supporting structure of the knee, the medial collateral ligament (MCL), lateral collateral ligament (LCL) and posterolateral corner is crucial for

accurate analysis of MR images of the knee. MCL is located in the deep aspect of the superficial fascia and is composed of superficial and deep parts. Injury to the MCL is the most common injury to knee ligaments. The injury grading system, imaging tips and diagnostic pitfalls of MCL will be discussed. The structures of posterolateral corner are important stabilisers of the knee, against varus and external rotation. Posterolateral knee stability is provided by the complex network of static and dynamic stabilisers that compose the posterolateral corner. Static components are LCL, popliteofibular ligament, arcuate ligament complex, fabelofibular ligament and posterolateral capsule. Dynamic stabilisers are biceps tendon, iliotibial tract and popliteus muscle tendon complex. The most important contributors to the stability are LCL and popliteus complex, especially popliteofibular ligament. Injuries of these structures may be seen in conjunction with anterior or posterior cruciate ligament injury. The discussion will focus on anatomy of the posterolateral corner and its biomechanical properties. MR imaging findings of injuries of posterolateral corner will be reviewed. Accurate MR imaging is invaluable in evaluating normal anatomy and diagnosing injuries to the collateral ligaments and posterolateral structures of the knee and in providing essential preoperative information.

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-442 17:00

C. The patellofemoral joint and osteochondral injuries: how do I assess and what do I report?

S. Waldt; *Munich/DE (Waldt@roe.med.tum.de)*

Patellofemoral instability remains a diagnostic and therapeutic challenge due to its multifactorial aetiology. Imaging plays a key role in the analysis of underlying structural abnormalities, such as trochlear dysplasia, patella alta, tibial tuberosity-trochlear groove (TT-TG) distance, rotational deformities of the lower limb and patellar tilt. In this refresher course, standardised imaging methods will be discussed to assess these predisposing abnormalities. In the diagnosis of acute and often overlooked lateral patellar dislocation MR imaging provides critical information. With MRI the characteristic pattern of injuries and the severity of lesions can be assessed accurately. Articular surface lesions that have a traumatic aetiology and involve both the cartilage and subchondral bone are referred to as "osteochondral lesions." In the radiology report, size, stability, viability of the bone fragment, integrity of the overlying cartilage and integrity of the cartilage of the opposite articular side should be addressed to determine the severity of the disease and thereby enable a stage-related therapy.

Learning Objectives:

1. To improve the reporting of osteochondral injuries.
2. To improve the reporting of patellofemoral abnormalities.

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

Special Focus Session

SF 12

Interventional radiology in venous thromboembolism and chronic venous disease

A-443 16:00

Chairman's introduction

D.K. Tsetis; *Iraklion/GR (tsetis@med.uoc.gr)*

The role of percutaneous catheter-based intervention is expanding due to the increasing recognition of the public health importance of venous diseases. There is continuous evolution of sophisticated endovascular venous-specific devices, however, the application of existing and new technologies to the venous system must follow a rational evidence-based path. The availability of new dedicated venous stents in conjuction with catheter-directed thrombolysis and percutaneous mechanical thrombectomy offers the option of minimally invasive percutanous removal of acute thrombus from lower limb deep venous system as well as recanalisation of chronic DVT. Regarding protection against pulmonary embolism when anticoagulation is contra-indicated, there are established guidelines and indications for placement and removal of temporary IVC filters; in addition, the interventional radiologist must be familiar with different filter devices and advanced techniques for their retrieval. Furthermore, endovascular approaches for safe and effective adjunctive treatment of submassive and massive PE, include catheter-directed thrombolysis and mechanical options to accelerate clearance of blood clot from the pulmonary arterial circulation. Regarding endovenous thermal ablation, the interventional radiologist must be familiar with the risks and benefits of each ablation method for the treatment of incompetent lower extremity veins, as well as indications-contraindications, side effects, complications and results.

Session Objectives:

1. To understand when the interventional radiologist should intervene to treat venous thromboembolism and venous insufficiency.
2. To learn about the principles and procedural challenges of the different endovascular techniques.
3. To appreciate the importance of building a dedicated interventional radiological service.

Author Disclosure:

D.K. Tsetis: Consultant; Bard Hellas AE, Qualimed innovative Medizinprodukte GmbH. Speaker; TriVascular.

A-444 16:05

Current endovascular treatment in iliofemoral DVT

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

Lower limb deep vein thrombosis (DVT) causes significant morbidity and mortality. Systemic anticoagulation therapy is the standard treatment utilised by most physicians for the management of DVT. Many patients, in particular, those with severe and extensive ileo-femoral DVT, this may result in poor recanalisation of the occluded deep veins and result in loss of valve function with 95% of patient with ileo-femoral DVT having valve incompetence at 5 years. Consequently, a considerable proportion of these patients eventually develop post-thrombotic syndrome (PTS). PTS has been reported to occur in 20-40% of patients who have DVT and this is severe in 5-10% particularly, in ileo-femoral DVT. This may result in chronic lower limb pain, trophic skin changes, oedema, ulceration, and venous claudication. Significant impact on the quality of life may be seen in 33-87% of patients with DVT. Minimally invasive endovascular techniques may result in rapid clearance of thrombus with partial or complete clearance of thrombus in 80-90% of patients and consequently result in better preservation of valve function leading to improved patient outcomes. These techniques are constantly evolving and include catheter-directed thrombolysis, percutaneous mechanical thrombectomy devices with adjuvant venous angioplasty and stenting.

Learning Objectives:

1. To learn about the typical clinical and imaging features of acute and chronic iliofemoral DVT.
2. To become familiar with common interventional techniques in acute and chronic iliofemoral DVT.
3. To understand current evidence and management recommendations based on this evidence.

A-445 16:25

Vena cava filters: an update

M.J. Lee; *Dublin/IE (mlee@rcsi.ie)*

IVC filter use has grown considerably, partly due to the insertion of optional IVC filters and the increasing use of these optional filters in patients with relative or prophylactic indications. Accepted indications include patients with acute pulmonary embolus or proximal DVT with contraindications to anticoagulation and recurrent VTE despite adequate anticoagulation. Relative indications include: proven VTE with limited cardiopulmonary reserve, poor compliance with anticoagulation, high risk of complications with anticoagulant therapy, ilio-caval DVT, thrombolysis for ilio-caval DVT and massive PE treated with thrombolysis/thrombectomy. Prophylactic indications include; trauma, bariatric surgery, cancer patients with high risk of venous thromboembolism and medical conditions with high risk of VTE. However, filter use is not recommended by existing guidelines in these conditions. Despite this, the most rapid growth in IVC filter use, is in the relative and prophylactic categories. The success rate for filter retrieval is in fact quite high, with one large filter registry (CIRSE IVC Filter retrieval registry) showing a 92% success rate for retrieval in a series of over 600 patients. Complications from filters are rare, but there is a reported IVC filter thrombosis rate of 6%-30%, depending on the filter used, post-thrombotic Syndrome in 5%-10%, and IVC perforation in a limited number. Filter migration is rare. Until rigorously designed clinical trails are performed in patients with prophylactic or relative indications, the evidence for retrievable IVC filter use in these particular patients is unknown. Caution is advised in placing retrievable filters at the present time.

Learning Objectives:

1. To learn about indications and contraindications of IVC filters.
2. To become familiar with different IVC filter types.
3. To highlight tips and tricks regarding IVC placement and retrieval.
4. To understand current evidence regarding safety and efficacy of IVC filters.

A-446 16:45

Interventional treatment of severe/massive pulmonary embolism

G. Carrafiello; *Varese/IT (g.carrafiello@uninsubria.it)*

Massive pulmonary embolism (PE) is a highly lethal condition caratherised by haemodynamic instability, acute right ventricular (RV) failure, and cardiogenic shock. Submassive PE, as defined by RV failure or troponin elevation, can result in life-threatening sequelae if treatment is not initiated promptly. Recent guidelines have recognised catheter-based interventions or percutaneous catether based thrombectomy (PCBT), as an alternative when there is contraindication or no effectiveness with thrombolysis and when the surgery is impractical. Loco-regional fibrinolysis, mechanical fibrinolysis and rheolytic fibrinolysis are the PCBT available. The intrathrombus infusion can be delivered using a standard infusion catheter or in combination with high-frequency, low-power ultrasound waves system. Catheter-directed fragmentation, frequently performed using rotating pigtail catheter, allows rapid maceration of large emboli, decreasing RV strain. Rheolytic thrombectomy is employed when the methods described earlier are not sufficient; it consists of specialised catheter employing positive pressure for the saline spray, and negative pressure to suck the clots using the Bernoulli's principle. Risks and complications of the PCBT may be related to the delicate technique and clots lysis: injuries to the ventricle, arrhythmia, fluid overload and bleeding due to anticoagulation. The assistence of cardiopulmonary anaesthetists is recommended. In presence of local expertise and availability of devices, the current evidence suggests that modern PCBT to achieve rapid central clot debulking should be considered as an early or first-line treatment option for patients with acute massive PE; and emerging evidence suggests a catheter-directed thrombolytic infusion should be considered as adjunctive therapy for many patients with acute submassive PE.

Learning Objectives:

1. To understand the indications and contraindications for IR treatment in severe/massive pulmonary embolism.
2. To become familiar with the techniques of catheter-directed thrombolysis and percutaneous thrombectomy in pulmonary embolism.
3. To learn about safety and efficacy of IR treatment for pulmonary embolism.

A-447 17:05

Techniques and tools in endovenous thermal ablation

D.J. West; *Stoke-on-Trent/UK (david.west@veincentre.com)*

Endovenous thermal and non-thermal methods have now become the gold standard treatment for venous insufficiency of the lower limbs. This talk will explain the basic principles of all the common forms of ablation, review the benefits and risks of each and explain the use of adjunctive procedures to ensure a long-lasting result and good cosmesis.

Learning Objectives:

1. To understand the principles of endovenous thermal ablation.
2. To become familiar with the procedural technique.
3. To learn how to build a dedicated service.

Author Disclosure:

D.J. West: Owner; Veincentre Ltd, EVLAExpert laser supplies.

17:25

Panel discussion: What does the interventional radiologist need to know about modern anticoagulation treatment?

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

State of the Art Symposium

SA 12

Fleischner guidelines for nodules: theory and practice

A-448 16:00

Chairman's introduction

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

Intrapulmonary nodules belong to the most frequent incidental findings on chest CT. Lessons learned from screening-detected lesions and studies with patho-radiological correlation fostered the importance of CT morphological criteria and the value of CT as imaging biomarker. The Fleischner society proposed recommendations for follow-up of solid lesions in 2005 and subsolid lesions in 2013. They were based on best scientific evidence and expert opinion at the time of publication. Literal adherence to the Fleischner guidelines means a substantial amount of follow-up CT examinations causing financial expenses, radiation dose and potential patient discomfort which need to outweigh the diagnostic information provided by the CT follow-up. Purpose of the session is to provide the rationale for the management recommendations proposed by the Fleischner society from a pathological and radiological view point and discuss options but also limitations. Within that scenario, the role of emerging computer analysis for risk stratification of nodules will be presented and discussed.

Session Objectives:

1. To learn about the patho-radiological correlation during the development of pulmonary adenocarcinomas.
2. To realise the value of CT as an imaging biomarker for the detection of early lung cancer.
3. To become familiar with the content of the Fleischner guidelines and how to apply them in various clinical situations.
4. To learn about the options and limitations of using CT for growth assessment and nodule character.
5. To learn about the fine line between estimation of risk, necessity to control and performance of imaging features.

A-449 16:05

The 2011 classification of adenocarcinomas: rationale and implications for nodule management

A. Nicholson; *London/UK (a.nicholson@rbht.nhs.uk)*

Rapid developments in managing patients with lung cancer necessitated updating the WHO 2004 classification for adenocarcinoma (ADC), published in 2011 and serving as the template for the next edition of the WHO classification in 2015. The most controversial recommendation was to discontinue using the term 'bronchioloalveolar carcinoma (BAC)', primarily because of the lack of standardised criteria across disciplines. Localised tumours without invasive components, that are ≤3 cm, should be termed adenocarcinoma in situ (AIS), with an additional "minimally invasive" category (invasive area of ≤5 mm). For resected invasive tumours (those typically seen in most diagnostic practices), non-mucinous tumours should be assessed in relation to five major patterns, micropapillary being added to lepidic (formally BAC), papillary, acinar and solid. Of these, the predominant histological pattern should be documented as it is related to prognosis, predicting recurrence in pT1-3 tumours, commoner gene mutations and gene profiling data. Mucinous adenocarcinomas are viewed as a separate group, often presenting with multicentric consolidation. The 2011 classification also recommends specific terminology for handling of biopsies, principally to minimise classification as non-small cell carcinoma, not otherwise specified (NSCLC-NOS). This classification allows greater precision in determining the prognostic relevance of solitary pulmonary nodules and provides uniform terminology in relation to comparative imaging studies. It may also be important in terms of the size and morphology of invasive components in relation to the need for limited versus anatomic resection as well as providing a template for assessing multiple nodules and whether they are synchronous primaries or satellite nodules.

Learning Objectives:

1. To become familiar with the most recent pathological classification of pulmonary adenocarcimomas and to understand the rationale behind it.
2. To understand how pathologists determine the histological composition of a nodular lesion and its implication on nodule management, tumour staging and patient prognosis.

A-450 16:30

The Fleischner guidelines for solid and subsolid nodules: theory and practice

A.A. Bankier; *Boston, MA/US (abankier@bidmc.harvard.edu)*

The presentation will summarise the history, genesis and intentions of the current Fleischner Society Guidelines for pulmonary nodules. It will discuss its potential applications and limitations, based on scientific evidence and detail the lessons learned from feedback received by users. Finally, the presentation will indicate potential areas of future updates.

Learning Objectives:

1. To illustrate the role of CT as an imaging biomarker with examples of patho-radiological correlation.
2. To become familiar with and understand the rationale behind the content of the Fleischner guidelines for solid and subsolid nodules.
3. To realise the impact of applying the Fleischner guidelines in clinical practice.
4. To learn how the Fleischner guidelines may have to be adapted to incorporate the most recent knowledge about the biological behaviour of pulmonary nodules.

Author Disclosure:

A.A. Bankier: Author; Elsevier. Consultant; Spiration, Olympus Medical.

A-451 16:55

Estimating the risk for malignancy of pulmonary nodules

B. van Ginneken; *Nijmegen/NL (bram.vanginneken@radboudumc.nl)*

Pulmonary nodules are a challenge for radiologists in both clinical practice and in screening programs. Guidelines for management take into account the size of nodules, their growth rate, the type of nodules and certain morphological characteristics. Most if not all of these can potentially be assessed by computer analysis. This lecture will review the state of the art with respect to volumetric nodule segmentation, segmentation of the solid core in subsolid lesions, computerized assessment of the type of nodule and computer analysis of morphological aspects of nodules. For assessment of the probability of malignancy of a nodule, either direct computer estimation can be used or computer assessment of characteristics that allow the application of guidelines or multivariate regression models, such as the recently presented McWilliams model. Examples and the pros and cons of these approaches and also their potential and limitations will be discussed.

Learning Objectives:

1. To learn about 2D and 3D methods of assessing nodule growth and their accuracy.
2. To understand the different demands of solid and subsolid nodules with respect to growth assessment.
3. To learn about the role of computers in assessing the risk of malignancy of pulmonary nodules.

Author Disclosure:

B. van Ginneken: Founder; Thirona. Grant Recipient; Mevis Medical Solutions AG, Delft Imaging Systems, Toshiba Medical Systems. Shareholder; Thirona.

17:20

Panel discussion: Fleischner guidelines: what have we learned?

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

Professional Challenges Session

PC 12a

Harmonised approach for imaging in Europe: myth or reality?

A-452 16:00

Chairman's introduction

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

In autumn 2014 the ESR issued a Call for a European Action Plan for Medical Imaging, urging EU institutions to address the current heterogeneities between EU member states in regard to quality of care and patient safety. A pan-European approach is needed to reduce heterogeneities in medical imaging with regard to education and training, research, technology, quality of equipment and practice. The ESR is of the opinion that a change in paradigm is needed to overcome the rigid division of responsibilities between the European Commission's Directorates-General as increased collaboration would strengthen the implementation of the EU Agenda on Quality of Health Care and Patient Safety. Amongst the disparities to be addressed are the divergent numbers of imaging professionals relative to population and the varying income levels for radiology trainees in different European countries. Stark variations also exist with respect to imaging equipment, which is distributed and used unevenly. The lack of a common thesaurus of imaging names leads to stark differences in coding whilst electronic patient records' utility is hampered by interoperability problems at the technical, semantic and organisational levels. The era of personalised medicine has led to a diverse heterogeneity of data, necessitating the integration of 'omics' and imaging biobanks. Education and training in Europe, both in terms of duration and quality, also differ significantly from country to country. Harmonisation at the European level would not only help to improve standards, but also facilitate the mobility of radiologists across national borders.

Session Objectives:

1. To present the basis for a Call for Action for medical imaging in Europe and beyond.
2. To highlight the current European disparities in terms of manpower, education and training, and equipment.

A-453 16:05

Current heterogeneities in imaging in Europe

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

Several heterogeneities exist regarding imaging in Europe. These imbalances with regard to education and training, research, technology, quality of equipment and practice should be addressed at the European level to improve healthcare standards and reduce differences between European countries. The ESR is of the opinion that a change in paradigm and increased collaboration at European level would strengthen the EU Agenda on quality of health care and patient safety put forward by DG Health and Consumers and would facilitate the implementation of the opinion and actions recommended by the independent Expert Panel advising the European Commission on effective ways of investing in health in October 2014 to improve quality of care and patient safety. Disparities also exist with regard to the distribution, use and age of imaging equipment. For example, Greece has almost ten times as many MRI units per million inhabitants as Romania, and the divergence in the number of CT scanners is no less pronounced. The frequencies for different modalities and effective doses caused by imaging examinations also differ starkly between countries. The number of radiologists for a given population differs widely in Europe, as do the income levels of radiology trainees. Radiology also exhibits differences in daily practice, as picture-archiving systems (PACS) are used in 97% of hospitals in the UK, whereas less than half of French hospitals use this technology. The use of electronic patient records' utility is often affected by interoperability problems at the technical, semantic and organisational levels.

Learning Objective:

1. To provide information on the status of EU Member states regarding key issues: equipment distribution, manpower, practices and compliance with EURATOM Directives.

A-454 16:20

Imaging equipment: an ESR perspective

B. Brkljacic; *Zagreb/HR (boris@brkljacic.com)*

Patients and healthcare authorities are demanding the best for the patient in most European countries. This can only be achieved using the state-of-the-art imaging technologies. Although rapid technological development created new imaging modalities and methods, the same progress speed resulted in accelerated technical and functional obsolescence of equipment, creating a need for renewal. Older equipment has a high risk of failures and breakdowns, which might cause delays in diagnosis and treatment, and safety problems both for the patient and the medical staff. However, the constrained healthcare budgets create dilemma almost in all countries and practice in Europe is very diverse regarding the renewal of radiology equipment, as the consequence of considerable differences amongst healthcare systems in different states, percentage of GDP allocated for the healthcare in specific counties, reimbursement policies, access rationalisation and equipment use optimisation. In some countries austerity and efficiency policies are severely restricting the available finances for capital equipment. The ESR strongly promotes the use of up-to-date equipment also in the context of the EuroSafe Imaging Campaign as this equipment will improve quality and safety in medical imaging. The ESR's general position is that equipment that is up to 5-year old has the state-of-the-art technology. Properly maintained equipment which is between 6- and 10-year old is still suitable for the use. However, a replacement strategy has to be developed. If equipment is older than 10 years, it is not accepted as the state-of-the-art equipment and replacement is essential.

Learning Objective:

1. To present the ESR policy regarding the standards of equipment.

A-455 16:35

Equipment age - COCIR

N. Denjoy; *Brussels/BE (denjoy@cocir.org)*

COCIR Installed-base figures reveal a dramatic inequality in access to healthcare across Europe, the oldest recorded Installed-base in many countries, a growth in use of technologies more than 10 years old, an overall slowing in uptake of technologies that enable better access & quality and that some countries still not addressing lack of MR and PET. The age analysis comparing 2008 with 2013 data shows that the percentage of the installed base units aged 6 years or older has increased for each of the key modalities, and within this category those units older than 10 years have also increased with the exception of Angiography. Also, all modalities show a decrease in the percentage of total units aged between 1-5 years, showing that the rate of purchase of new or replacement equipment has fallen throughout Europe during the period of economic pressure. Finally, there are few examples of countries, like Poland, France and Denmark where some healthcare providers have sought to engage in capital financing programmes that can protect against technical obsolescence, resulting in an installed base that is not as aged as elsewhere. COCIR drafted a pragmatic and prudent set of 'golden rules' to further support the evaluation of medical equipment installed-base and to aid procurement decisions. These rules are that 1) At least 60% of the installed equipment base should be younger than 5 years, 2) Not more than 30% should be between 6 - 10 years old, 3) Not more than 10% of the age profile should be older than 10 years.

Learning Objective:

1. To provide information on the age of CT equipment across Europe.

A-456 16:50

Training and certification

B. Ertl-Wagner; *Munich/DE (Birgit.Ertl-Wagner@med.uni-muenchen.de)*

Training in radiology in Europe is currently still rather heterogeneous. Both length and content of training for becoming a radiologist vary markedly between European nations. The European Training Curriculum (ETC) for Radiology aims to harmonise training in radiology in Europe. The ETC recommends a five-year training scheme in radiology with three years of Level I training and two years of Level II training. After a five-year training period in radiology, the trainee can sit for the European Diploma in Radiology (EDiR). To achieve a more homogeneous training situation across Europe, it is also important to have accreditation and certification programmes for the training sites. The European Training Assessment Programme (ETAP) offers an assessment of individual training sites in conjunction with the National societies. In addition to the Level I and II curricula of the ETC, level III curricula for subspecialty training and an undergraduate (U level) curriculum are currently being prepared.

Learning Objective:

1. To provide information on the training and certification disparities in Europe, and to present the ESR tools to support harmonisation in this area.

A-457 17:05

Issues related to coding terminology and IT access

P. Mildenberger; *Mainz/DE (peter.mildenberger@unimedizin-mainz.de)*

Interoperability is a key issue in modern healthcare, including different levels from regulatory aspects down to technical solutions. For radiology and radiologists, exchange of reports and image is the standard procedure today. However, there are limitations in full integration and workflow supports due to several issues. Part of these is missing or limited solutions for semantic interoperability including coding systems, vocabularies and standardised communication templates. These solutions are not only relevant for billing, but also used in ordering procedures, in clinical decision support, in reporting based on structured templates, for benchmarking and last not least in research. A comprehensive overview on different systems related to coding terminology and IT access issues will be presented.

Learning Objective:

1. To highlight the current European disparities in coding and to propose a unified approach for imaging.

17:20

Panel discussion: A global plan for imaging

J. Griebel; Neuherberg/DE (HERCA Chair of the Working Group on Medical Applications - BfS, Germany)
T. Peetso; Brussels/BE (Policy Officer of Unit 'Health and Wellbeing' - DG CNECT, European Commission)
A. Rys; Brussels/BE (Director Health systems and products - DG SANCO, European Commission)
G. Simeonov; Luxembourg/LU (Policy Officer Radiation Protection Unit - DG ENER, European Commission)

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

Chest

RC 1204

Mediastinal disease revisited

Moderator:
J. Dinkel; Heidelberg/DE

A-458 16:00

A. The crucial role of chest x-ray: mediastinal lines and stripes

J. Cáceres; *Barcelona/ES (josecac@gmail.com)*

Common practice states that mediastinal lesions are discovered in the conventional chest radiographs and then characterised by cross-sectional imaging, either CT or MRI. What happens if the lesion is not obvious and it is overlooked in the chest radiograph? In this case the diagnostic circuit is interrupted, cross-sectional imaging will not be done and the diagnosis will be missed. In this presentation I intend to review basic mediastinal landmarks in the chest radiograph, whose knowledge will prevent overlooking subtle mediastinal processes.

Learning Objectives:

1. To become familiar with the signs that indicate mediastinal pathology.
2. To confidently identify and localise a mediastinal mass on chest plain films.

A-459 16:30

B. Mediastinal masses: role of CT

V.E. Sinitsyn; *Moscow/RU (vsini@mail.ru)*

CT is a basic imaging modality for detection and characterisation of mediastinal masses. In all patients with suspected mediastinal masses, chest CT must be performed with bolus injection of contrast media in arterial and venous phases. Special measures should be taken to decrease radiation exposure to patient. There are several key factors for confident diagnosis of the mediastinal masses. Location of the mass according to compartments of the mediastinum (anterior, middle, and posterior, superior and inferior) is important. Presence of fat, cysts or calcifications inside the lesion helps to narrow down the differential diagnosis. Opacification of thoracic vessels and enhancement pattern of the lesion are important for differential diagnosis. Age of patients and clinical manifestations of the disease must be taken into consideration in every case. The most frequent lesions of the anterior mediastinum are thymomas, lymphomas and teratomas. Neurofibromas and schwannomas are the most common lesions for posterior mediastinum. Middle mediastinal masses could be of metastatic origin. Radiologists must be aware of anatomical variants, mimicking mediastinal lesions. Primary tumours of heart and pericardium should be differentiated from mediastinal masses. Quite often CT alone is sufficient for the diagnosis and staging of the mass. New developments in CT (dual energy CT, gated whole chest scans) may enhance diagnostic accuracy of CT. Chest MRI or hybrid imaging can give additional information about the nature of the lesions in difficult cases. CT is an important tool for pre-operative staging, planning of biopsy and follow-up of patients with mediastinal masses.

Learning Objectives:

1. To learn the most common causes of mediastinal masses.
2. To recognise signs which allow us to characterise mediastinal lesions.

A-460 17:00

C. A new look at the mediastinum: role of MRI and PET/CT

E.J.R. van Beek; *Edinburgh/UK (edwin-vanbeek@ed.ac.uk)*

Mediastinal pathology usually presents itself on chest radiographs and subsequently is primarily investigated using (contrast-enhanced) computed tomography. Magnetic resonance imaging has the capability to assess morphology, extent of the lesion, blood supply, cellularity and can predict level of malignancy. It is useful in both malignant pathologies and benign pathologies, such as mediastinitis. PET-CT is increasingly used to determine level of malignancy, is capable of assessing whole body alternative diagnoses or metastases, and can assist in direct assessment of treatment response. This presentation will address some of the key diagnostic aspects of mediastinal pathologies using MRI and PET-CT as modalities to offer additional diagnostic information as well as their application for monitoring of treatment response.

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.

Author Disclosure:
E.J.R. van Beek: CEO; Quantitative Clinical Trials Imaging Services Ltd. Founder; Quantitative Clinical Trials Imaging Services Ltd. Speaker; Toshiba Medical Systems.

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

E³ - ECR Master Classes (Genitourinary)

E³ 1226a

Urogenital radiology in 2015: beyond morphology?

Moderator:
H.C. Thoeny; Berne/CH

A-461 16:00

A. Where are we in measuring kidney function with imaging?

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

A simple, accurate and reproducible method for measuring renal function remains a Graal for nephrologists. Reference methods usable in clinics are either absent (for perfusion or oxygenation) or complicated to implement in clinical practice (for filtration). Therefore, measuring functional parameters of the kidney with imaging remains a hope and a challenge. Today, dynamic contrast-enhanced MR imaging is able to measure renal perfusion and glomerular filtration rate but the methods and models used need to be better evaluated in term of reproducibility and reliability before to be proposed for evaluation of patients. Arterial spin labelling is an attractive alternative but difficult to implement for kidney evaluation. Therefore, more experience and

more correlation with reference methods when available are required in these fields. Conversely, measurement of differential renal function is now ready for clinical application because it is recently validated with renal scintigraphy, providing similar results. Diffusion-weighted sequences provide markers of renal microperfusion and tissue water exchanges which are important in kidney. These parameters are involved as soon as renal function is impaired, but without any specificity. Information on renal tissue fibrosis in chronic kidney diseases is given by diffusion tensor imaging measuring tissue anisotropy, but this biomarker has also to be better evaluated. Finally, renal hypoxia is an important player in the pathophysiology of acute kidney injury and its progression to chronic kidney disease. The link between BOLD MR imaging measuring renal T2* and tissue pO_2 needs to be better understood before to be transferred into the clinic in a comprehensive way.

Learning Objectives:

1. To become familiar with the renal physiological parameters to be quantified.
2. To learn about the techniques available for evaluating the function.
3. To understand the limitations of each technique in clinical applications.

Author Disclosure:

N. Grenier: Advisory Board; Supersonic Imagine. Speaker; Bracco.

A-462 16:30

B. The added value of DWI in gynaecological malignancies: the ADC and beyond

A.G. Rockall; *London/UK (a.rockall@imperial.ac.uk)*

The development of robust diffusion-weighted imaging (DWI) techniques suitable for the abdomen and pelvis has opened up the possibility of increasing the clinical utility of MRI in gynaecologic malignancies. In ovarian cancer, the most lethal of the gynaecologic malignancies, DWI has an established role in the characterisation of adnexal masses, and there is now substantial on-going research in the evaluation of DWI in delineating the extent of peritoneal disease and in the assessment of response to chemotherapy. In endometrial cancer, DWI has been found to aid the pre-operative staging accuracy. In the case of cervix cancer, there is evidence supporting the role of DWI in the identification of patients who are poor responders to radiotherapy treatment. DWI may be helpful in the early detection of relapsed disease, but the evidence supporting this role is currently limited. Future developments with whole body DWI and PET/MRI remain exciting areas of development.

Learning Objectives:

1. To describe the role of diffusion weighed MRI (DW-MRI) in lesion detection and characterisation.
2. To review the added clinical value of DW-MRI in staging and follow-up of patients with gynaecologic malignancies.
3. To highlight technical and interpretation challenges of DW-MRI in evaluation of gynaecologic malignancies.

A-463 17:00

C. Will genomics change imaging? Renal cancer as a case study

P.L. Choyke; *Bethesda, MD/US (pchoyke@nih.gov)*

We are about to enter a new world in which genomics will play a major role in the diagnosis and treatment of patients. No where will the impact of genomic medicine be more felt than in imaging not only in the germ line mutations (hereditable disease) but also in tumour genomics (acquired cancers). We can gain insights into the future impact of genomics by the study of hereditary renal cancer. Each renal cancer mutation is associated with a highly increased risk of renal cancer of a particular histology (e.g. clear cell vs. papillary vs. chromophobe, etc). and aggressiveness. For instance, the gene coding for fumarate hydratase (FH) is mutated in hereditary leiomyoma renal cell carcinoma. Not only are patients with FH mutations prone to early onset of skin and uterine leiomyomas, but they also develop a particularly aggressive form of renal cancer which exhibits Warburg physiology on FDG PET. Genomics also inform the imaging of sporadic renal cancer where specific mutations predict the likelihood and location of metastases. Additionally, characterisation of metastatic lesions with functional and anatomic studies imaging may serve as surrogates for genomics predicting response to molecular therapies. Careful correlation of responding and non-responding lesions may enable imaging to substitute for repeated tissue biopsies, while enabling whole body monitoring. Thus, knowledge of the genomics of hereditary and sporadic renal cancers serves as a model for how genomics will influence imaging in the future.

Learning Objectives:

1. To identify the major genetic abnormalities associated with renal cancer.
2. To discuss how these genetic abnormalities affect the imaging of renal cancer.
3. To describe how the interplay between genomics and imaging affects management of patients.

Author Disclosure:

P.L. Choyke: Other; Non Financial Research Agreements with General Electric, Siemens, Philips, inVivo, Aspyrian, iCAD and Aura.

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

E³ - ECR Academies: Hybrid Imaging (advanced)

E³ 1218

MR/PET - the future of hybrid imaging?

Moderator:
R.A. Coulden; Edmonton, AB/CA

A-464 16:00

A. For which indications is MR/PET better than PET/CT?

L. Umutlu; *Essen/DE (Lale.Umutlu@uk-essen.de)*

Simultaneous PET/MRI is considered a new and highly promising imaging technique, opening new horizons for various application fields including oncologic, cardiovascular and neurodegenerative diseases. While the PET component enables the assessment of tumour metabolism, the integrated 3 Tesla MR scanner replaces the CT component for anatomical correlation, enabling simultaneous high spatiotemporal morphological as well as functional imaging. Hence integrated PET/MRI enables a unique, simultaneous analysis of morphological, functional and metabolic features bearing the potential for improved diagnostics. Initial studies mostly focused on oncologic application fields, demonstrating the comparable robustness of PET/MRI towards PET/CT as well as its diagnostic superiority in specific diagnostic questions, such as assessment of tumour extent and infiltration, metastatic spread as well as improved diagnostic confidence. Particularly MR-based imaging fields, such as cardiac MRI, the field of female oncology (breast and female pelvis) as well as brain applications are expected to strongly benefit from simultaneous PET/MRI due to the innovative multimodality approach including high-soft-tissue-contrast MR imaging. Furthermore, due to the significant reduction of ionising radiation (in comparison to full-dose PET/CT), paediatric diagnostics as well as therapy monitoring under systemic or radiation therapy are important application fields of simultaneous PET/MRI.

Learning Objectives:

1. To understand the advantage of using MRI instead of CT together with PET.
2. To become familiar with scanner technology.
3. To consolidate the situation in advanced hybrid imaging.

Author Disclosure:

L. Umutlu: Speaker; Bayer Healthcare.

A-465 16:30

B. MR/PET technology: state of the art

A. Cuocolo, C. Nappi, R. Assante; *Naples/IT (cuocolo@unina.it)*

Different magnetic resonance (MR)/positron emission tomography (PET) devices are currently available: the sequential hybrid imaging systems from Philips (Ingenuity TF PET/MR) and General Electric Healthcare (Discovery 750w 3 T combined with TOF PET/CT Discovery 690), and the fully integrated system (Biograph mMR) from Siemens. A major challenge encountered in simultaneous MR/PET system design concerns to the major effects that the magnetic field has on electrons travelling in vacuum inside the photomultiplier tubes that transform the visible light produced in the scintillator into an electric signal detectable by PET electronics. Several detector designs have been developed to address this limitation. The most advanced system, using avalanche photodiode detectors, is not sensitive to magnetic fields. Numerous benefits are provided by simultaneous MR/PET system; among these the high spatial resolution and the high signal-to-noise ratio are the most promising. However, inevitable cardiac and respiratory motions and partial volume effect deteriorate image resolution. Further, although MR/PET allows reducing the total radiation dose associated with PET studies by eliminating the computed tomography (CT) component, the lack of an electron density map (as is the case with PET/CT) compromises PET data attenuation correction. Strategies to overcome this limitation have been proposed, such as the use of atlas registration, the segmentation of the MR image into different tissue with different attenuation coefficients or, alternatively, the use of a reference MR image, previously registered to a reference CT image. In this lecture we will present the state of the art of MR/PET consolidating knowledge of this novel technique.

Learning Objectives:

1. To understand the different demands of a PET System with MR instead of CT.
2. To become familiar with challenges in attenuation correction in PET/MR.
3. To consolidate knowledge of the new technique.

A-466 17:00

C. Diffusion-weighted MRI vs PET in oncology

F. Giesel[1], A. Mehndiratta[2], C. Kratochwil[1]; [1]*Heidelberg/DE*, [2]*Dehli/IN (f.giesel@dkfz.de)*

The clinical acceptance and applications of diffusion-weighted MRI for cancer diagnosis and therapeutic monitoring have increased tremendously in the recent times. The methodology is quick, reliable and capable of providing both the structural and the functional information of cancer characterisation (primary tumour, grading and recurrence). However, lack of standardisation and compatibility within vendors limits the use of this novel technique in clinical practice beyond research studies. In contrast, PET and its imaging surrogates (18 F-FDG, 68Ga-DOTATOC, 68Ga-PSMA, 18 F-FET) is a reproducible imaging modality and is already well used in clinical routine. Furthermore, the variations in tracer properties used in PET imaging enable it for personalised patient care, referred to as theragnostic. PET-MR hybrid imaging is now available for clinical use and thus will be beneficial in validation and standardisation of the diffusion-weighted imaging protocols in combination with the PET tracers.

Learning Objectives:

1. To learn about Diffusion-weighted MRI.
2. To understand the differences from PET.
3. To consolidate the use of advanced imaging protocols in oncology.

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

E³ - ECR Master Classes (Molecular Imaging)

E³ 1226d

Chemical exchange saturation transfer (CEST): a new toy for molecular imaging?

Moderator:
O. Clément; Paris/FR

A-467 16:00

A. Physical principle

M. Bock; *Freiburg/DE (michael.bock@uniklinik-freiburg.de)*

Chemical exchange saturation transfer (CEST) magnetic resonance is able to detect the MR signal of exchangeable protons that resonate at a chemical shift that is distinguishable from the resonance of bulk water. Using radio-frequency saturation pulses applied at the frequency of the exchangeable protons, the saturation is transferred into the bulk water pool, and a reduced equilibrium magnetisation is detected. Thus, the concentration and distribution of various small endogenous macromolecules or exogenous CEST agents can be detected. In addition, the CEST contrast depends on bio-physiological parameters of the micro-environment such as temperature or pH, the latter being of considerable interest in tumour studies. For CEST MRI several different pulse sequences have been developed. Frequency-selective narrowband saturation pulses have been used to label the exchangeable protons followed by spin echo or gradient echo sequences for image acquisition. To reduce the long image acquisition times caused by the labelling pulse trains, fast image acquisition techniques have been used such as balanced steady-state free precession MRI. To detect the small signal variation caused by the CEST effect, often a complete off-resonance spectrum (or z-spectrum) is acquired, and the CEST effect strength is determined by a fit to the theoretical spectrum of the molecule under investigation. Several advanced post-processing techniques have been developed to separate the tiny CEST effect from artefacts caused by B0- and B1-inhomogeneities.

Learning Objectives:

1. To understand the physical principle of CEST imaging.
2. To understand the requirements for a molecule to be suited for CEST imaging.
3. To learn about MR sequences used for CEST imaging.

Author Disclosure:
M. Bock: Research/Grant Support; Siemens Healthcare.

A-468 16:30

B. Probes

S. Aime; *Turin/IT (silvio.aime@unito.it)*

Chemical exchange saturation transfer (CEST) contrast agents have attracted interest in recent years because of their unique "frequency encoding" properties. The latter feature associates each CEST agent with its defined frequency-encoding property, thus opening the field to multiplex detection of different contrast agents in the same anatomical region. A unique advantage of CEST agents relies on the possibility of assessing physico-chemical (e.g. pH and temperature) and biological (e.g. an enzymatic activity) parameters by setting up ratiometric methods that are independent of the actual concentration of the agent in the region of interest. Much work has been devoted to develop methods able to report on pH mapping in kidney and tumour regions. Moreover, I will report on the interesting case of the use of paraCEST agents to label ex vivo different types of cells to track their localisation when transplanted in mice, and on the novel class of highly sensitive HYPER-CEST agents, based on hyperpolarised Xe-129 encapsulated in molecular cages.

Learning Objectives:

1. To learn about available endogenous and exogenous contrast agents and probes.
2. To understand the advantages of para-CEST agents.
3. To discuss the potential of hyper-CEST.

A-469 17:00

C. Clinical applications

S. Walker-Samuel; *London/UK (simon.walkersamuel@ucl.ac.uk)*

Chemical exchange saturation transfer (CEST) MRI has undergone a surge of interest in recent years, due to its proposed ability to detect a range of molecules (or molecular groups) at relatively low concentrations. Many of the applications of CEST have been evaluated in animal models, at high field strengths, and there is now a drive to translate such techniques into patients. However, a number of challenges exist in the conversion to lower, clinical magnetic field strengths, such as shorter T1 times and reduced chemical shift. Despite this, CEST is still proving to be a useful technique in clinical research, where it has been applied to characterise a number of diseases, such as cancer and stroke.

Learning Objectives:

1. To understand the clinical potential of CEST.
2. To learn about gluco-CEST.
3. To discuss CEST applications in the orthopaedic and oncologic field.

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

E³ - ECR Master Classes (Cardiac)

E³ 1226c

Cardiac MR imaging

Moderator:
P. Croisille; Saint-Etienne/FR

A-470 16:00

A. T1 and T2 mapping

C. Lücke; *Leipzig/DE (neep@gmx.de)*

Classical approaches for tissue characterisation by cardiac magnetic resonance imaging (cMRI) are based on qualitative assessment of T1- and T2-weighted sequences and of the distribution of gadolinium-based contrast media, i.e. late gadolinium enhancement (LGE). These methods are reliable and robust in the daily clinical routine for the detection and differentiation of various cardiac diseases. However, they may be prone to diffuse and subtle alterations of the myocardium. This is especially important when a reference region is also affected, like the skeletal muscle in myocarditis. Quantitative approaches, as T1 and T2 mapping offer the possibility to assess these diffuse alterations of the myocardium. T1- and T2-mapping are more user independent and allow quantitative comparisons between patients. Native T1-mapping and the assessment of the extracellular volume (ECV) after administration of contrast media have prognostic relevance. Different methods have evolved in the last years to assess T2-, native T1- times and ECV.

Learning Objectives:

1. To understand the principles of T1 and T2 mapping.
2. To learn about the current insights and potential role of T1 and T2 mapping.

A-471 16:30

B. Quantification of myocardial perfusion by MRI

K. Kitagawa; *Mie/JP (mie.kitagawa@outlook.com)*

Myocardial perfusion magnetic resonance imaging (MRI) is increasingly used to measure myocardial blood flow (MBF) in units of mL/min/g by means of fully quantitative analysis. There are two major points that should be considered to perform adequate quantification of MBF by perfusion MRI: 1) how to keep the linear relationship between signal intensity and contrast concentration in the left ventricular blood pool and myocardium, and 2) which mathematical model to use to fit the kinetics of the gadolinium contrast medium. There are several approaches to maintain linear relationship of signal intensity such as the dual-bolus method and dual-T1 sensitivity method. The linearity of signal intensity is a prerequisite for MBF quantification regardless of the mathematical model to employ. There are essentially two main methods for quantification of absolute MBF: the compartment model-based approaches and deconvolution method.

In compartment model-based approaches, one-way transfer constant from the LV blood to the myocardium (K1) can be calculated using Patlak plot analysis or modified Kety model. Converting from K1 to MBF is the major remaining problem with compartment model approaches. In the deconvolution method, MBF can be directly calculated as the initial height of myocardial input impulse. The deconvolution can be solved by analytical (model-dependent) technique such as Fermi function model or algebraic (model-independent) technique. This presentation covers the different approaches to quantification of myocardial perfusion by MRI and potential clinical application of MBF quantification will be discussed.

Learning Objectives:

1. To understand the different approaches to quantification of myocardial perfusion by MRI.
2. To learn about the clinical potential of imaging perfusion quantification.

Author Disclosure:

K. Kitagawa: Research/Grant Support; Philips Electronics Japan.

A-472 17:00

C. 4D MR perfusion imaging of the myocardium

R. Manka; *Zurich/CH (robert.manka@usz.ch)*

Cardiovascular magnetic resonance imaging (CMR) is increasingly established as an important method in the diagnosis of cardiovascular disease. First-pass myocardial perfusion CMR imaging yields higher diagnostic accuracy for the detection of coronary artery disease (CAD). However, standard 2D multi-slice CMR perfusion techniques provide only limited cardiac coverage and hence considerable assumptions are required to assess myocardial ischaemic burden. To address the limited coverage of 2D multi-slice myocardial perfusion CMR techniques and four-dimensional (4D) methods have been developed based on recent advances in CMR scan acceleration methodology. Whole-heart coverage may be achieved by employing data undersampling strategies in combination with appropriate image reconstruction techniques.

Learning Objectives:

1. To understand the disadvantages of standard approaches to MR perfusion imaging.
2. To learn about the clinical potential of 4D perfusion imaging.

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

Computer Applications

RC 1205

Update on computer-aided diagnosis (CAD)

A-473 16:00

Chairman's introduction

M. Langer; *Freiburg/DE (mathias.langer@uniklinik-freiburg.de)*

Computer-aided diagnosis is based on an adequate computer-aided detection (CADe). Different algorithms are available for detection of pathologies especially in thoracic or mammographic imaging. These technologies identify and differentiate pathological structures from benign or normal variance. Computer-aided diagnosis (CADx) is the computer analysis and evaluation of pathologic structures detected with CADe. Typically morphological changes or irregularities in appearance or additional features for example microcalcifications are analysed in detail. Additionally to this computer-based analysis of functional parameters such as perfusion data or alterations in the diffusion coefficient in MRI can be added to the differentiation process. Typical steps in the processing pipeline are (1) preprocessing for elimination of artefacts and noise reduction, (2) segmentation for differentiation of anatomic or pathologic structures in the images and matching with an anatomic database, (3) analysis of segmented structures using varying feature sets, (4) evaluation and classification using statistical methods or some kind of artificial intelligence. Nevertheless, the computer-aided diagnosis technologies today are still not a tool which is regularly used in clinical reporting. This can be explained on one side by the necessity of large data bases to compare the likelihood, on the other hand the manipulation and the computer-aided analysis are time consuming and not very well suitable for routine use. This might probably change with the increased use of combined technologies such as PET-CT and PET-MR and the combined analytical process of these simultaneously acquired imaging parameters in addition to functional and structural data of the tumour.

Session Objectives:

1. To give an overview of the most important clinical applications of CAD.
2. To describe results of clinical trials that use CAD for lesion detection and interpretation.
3. To summarise advantages and limitations of CAD technology.

A-474 16:05

A. CT colonography and CAD

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

In recent years, several computer-aided diagnosis (CAD) software solutions have been devised for CT colonography (CTC). Algorithms differ, but most essentially work on the principle that colonic polyps and masses distort the usual smooth regular contour of the colonic wall, and protrude into the lumen. Additional layers of sophistication allow some CADs to detect polyps submerged under tagged fluid, and to discount colonic residue, increasing specificity. All colonic CADs generate false positives which in general are easily dismissed by the reporting radiologist, although most data report a small drop in specificity when using CAD. Conversely, there are now robust data that CAD increases radiologist sensitivity, particularly for medium-sized polyps, and for those with less experience of reading CTC. It is clear however that radiologists must still be trained in CTC interpretation, and CAD alone cannot replace this training need. Most data suggest that the positive effect of CAD on radiologist performance is diluted if used concurrently (i.e. at the same time as the radiologist read), and the diagnostic benefit is maximal when CAD is employed in a second read paradigm (i.e. only activated after the radiologist has completed their first read). However, recent work suggests that the diagnostic advantage afforded by CAD is maintained when employed using a very time-efficient primary read paradigm as long as the read is supplemented by a rapid 2D review of the case. Recent technical advances in CTC CAD include automated registration of CAD prompts on supine and prone datasets.

Learning Objectives:

1. To describe the reading paradigms of CAD applied to CT colonography.
2. To present the results of clinical trials adopting CAD as an additional tool to report CT colonography.
3. To describe indications, advantages and pit-falls of using CAD in clinical practice.

A-475 16:28

B. CAD for lung nodules

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

The main use of CAD (Computer-aided Detection) and CADx (Computer-aided Diagnosis) systems in chest diseases is for improving diagnostic accuracy and confidence in the identification and characterisation of pulmonary nodules. CAD systems mainly rely on densitometric grey-level thresholding mechanism and complex analysis of the structure shape to discriminate nodules. Mathematical principles, underlying artificial intelligence systems, are instead applied for nodule characterisation in terms of probability of malignancy. CAD may be used as "second reader" or as "concurrent reader" for nodule identification. CAD as "second reader" increases radiologist's sensitivity, specifically for small nodules and for less experienced readers, although this modality is burdened with long times of reading. On the other hand, CAD used as "concurrent reader" reduces the reading time but the radiologist's sensitivity is substantially similar to that reached without CAD. Some limitations of CAD systems still remain, particularly as regards false results, the lack in specificity and difficulties in identifying ground glass nodules. One of the major applications of CAD in the clinical practice is the automatic calculation of nodule volume doubling time and the assessment of growth over time, which is different according to the nodule appearance (solid, ground glass or part solid) and its prevalence of malignancy. There is also evidence of significant benefits of CAD used in the screening programs, demonstrating its accuracy in evaluating small nodules, and with the advantage of reducing radiation dose. To implement the routine use of CAD, the integration with picture archiving and communication systems should be improved.

Learning Objectives:

1. To describe CAD algorithms for nodule detection and volume measurement.
2. To underline advantages and limitations of the use of CAD for lung nodule detection.
3. To review the importance of lung nodule volume measurements.

A-476 16:51

C. CAD for breast cancer detection

U. Bick; *Berlin/DE (Ulrich.Bick@charite.de)*

In mammography screening, computer-aided diagnosis (CAD) can help improve breast cancer detection by pointing out potential lesions to the radiologist, which otherwise would have been missed. Current commercial CAD systems achieve a sensitivity of more than 98% for microcalcifications and 80-90% for masses. The sensitivity of CAD schemes for the detection of microcalcifications is so high, that some groups have proposed to used CAD as a preprocessing tool for microcalcifications in soft-copy reading, showing only those areas of the digital mammogram in full resolution, where potential microcalcifications were found by the computer. Several clinical studies have demonstrated that using CAD for mammography, more and smaller cancers can be detected, usually at the expense of a slightly higher recall rate. The

usefulness of CAD will vary with the experience of the reader and thorough training in the use of the CAD system will improve results. One major problem of CAD is the still relatively high number of false-positive computer marks, on average between one and two per case, which means that in a screening situation often less than 1 in 100 computer prompts will actually represent cancer. With breast cancer screening increasingly moving towards modern 3D imaging techniques such as digital breast tomosynthesis, 3D-ultrasound and breast MRI, the role of computer support in image reading may increase, since a much larger number of images will have to be processed by the reader, increasing the likelihood of oversight.

Learning Objectives:

1. To describe different types of CAD algorithms for detection and characterisation of breast lesions.
2. To review the results of clinical trials that use CAD for detection of breast lesions.
3. To give an overview of the potential role of CAD applied to new technologies.

Author Disclosure:

U. Bick: Equipment Support Recipient; Hologic, Toshiba. Patent Holder; Hologic. Research/Grant Support; Siemens.

17:14

Panel discussion: Is CAD ready for prime time?

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

E³ - ECR Master Classes (Emergency Radiology)

E³ 1226b

Acute postoperative complications in the abdomen: from diagnosis to therapy

A-477 16:00

Chairman's introduction: the role of imaging in the early detection of postsurgical complications

D.R. Kool; *Nijmegen/NL (dignakool@gmail.com)*

Diagnostic imaging plays an important role in the detection of post-surgical complications after abdominal surgery and CT is the preferred imaging method for most of the post-operative complications. For the correct interpretation of these postoperative imaging studies, it is mandatory to know the different surgical procedures, concomitant expected changes in anatomy and normal postoperative findings related to abdominal surgery in general and the surgical procedure performed in particular. Also a thorough knowledge of the possible complications of the surgical procedures and their image features is necessary. For the efficient use of imaging, it is important to realise that different types of postoperative complications follow a predictable timeline. Using this timeline, in relation to the clinical signs and symptoms of the patient gives us the opportunity to choice the preferred image modality and optimise the image protocol but also adjust the timing of the study, accordingly. In this interactive ECR master class the surgical techniques, normal postoperative findings and postoperative complications of surgery of the gastrointestinal tract, liver and pancreas and genitourinary tract with their image features will be shown and discussed. The impact on patient management and especially the indications for surgical and/or image-guided intervention will be addressed.

A-478 16:05

A. Gastrointestinal tract

M.A. Patak; *Zurich/CH (michael.patak@hirslanden.ch)*

Acute postoperative complications are often an emergency situation for the team of treating doctors. It is of utmost importance to know the operation what has been performed and the anatomical consequences of it. We will get to know some of the most frequently performed gastrointestinal operations. For all these operations, there are known weak spots that have to be checked with the use of radiology. CT is the most used modality in such a situation. We will analyse the imaging features of the most common complications for the most common performed gastrointestinal operations.

Learning Objectives:

1. To describe the main techniques for surgery and list their potential complications.
2. To become familiar with imaging features of postoperative complications.
3. To understand the indications and contraindications for interventional and surgical procedures.

A-479 16:29

B. Liver and pancreas

S. Wirth, M. Rentsch; *Munich/DE (swirth@med.uni-muenchen.de)*

The broad available thin-section cross-sectional imaging led to considerable advances in pre-operative planning which, besides more advanced surgical techniques, may contribute to continuously increasing survival rates. On the other hand, this also leads to an older and larger patient collective which may be the most probable cause for an increase in absolute numbers of post-surgical complications. Typical examples are organ impairment, haemorrhage, insufficiency of anastomoses, biliary or pancreatic secret retention or leakage or fistulas, biliary or vascular stenosis, cholangitis, delayed gastric emptying, arterial pseudoaneurysms, thrombosis, pleural effusion, infection and abscess formation. Corresponding rates reach up to 40% and were mainly treated by revision or radiological intervention. Advances in diagnostic imaging allow for fast and exact diagnosis of complications. The radiological treatment is mainly needed in early and thus more acute complications including the typical interventional spectrum: angiographic, fluoroscopic and CT-guided interventions like PTCD, other drainage placement, balloon dilatation of blood vessels, bile system or intestinal structures and respective stenting.

Learning Objectives:

1. To be familiar with surgical procedures and their common complications.
2. To learn typical imaging findings in patients with postsurgical complications.
3. To learn the guidelines for interventional radiological procedures.

A-480 16:53

C. Genitourinary tract

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

Surgical morbidity after urological and gynaecological surgery seems to be low, yet is significant when reported using a standardised methodology. The majority of complications are low grade. Acute complications include haemorrhage, urinary leakage and collections/abscesses. Partial nephrectomy cases have more procedure-related complications compared to radical nephrectomy (9% versus 3%) including (active) bleeding and urinary leakage and the reintervention rate is higher (2.5% versus 0.6%). Reinterventions for partial nephrectomy involve either endoscopy or interventional radiology. With haemorrhagic complications optimised imaging technique is required to recognize active bleeding and to evaluate whether dedicated interventional procedures are indicated. 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. When collections are expected, appropriate imaging studies are crucial to define further therapeutic management, and in selected cases, imaging-guided percutaneous treatment can be performed in the same setting. In acute scrotum after surgery it is crucial to assess the viability of the ipsilateral testis. In patients with renal grafts there is a low rate of major surgical complications, including perirenal collections, leakage, and thrombosis. Biopsy related complications, arteriovenous fistula with or without pseudoaneurysm, are uncommon, occurring between 0.34% and 6.3% of cases. Most of these vascular lesions have little clinical relevance and simply require observation and monitoring. However, they can cause kidney graft dysfunction, high blood pressure or serious bleeding requiring urgent treatment.

Learning Objectives:

1. To be familiar with surgical procedures often resulting in clinical complications.
2. To learn how to choose the best imaging modality to diagnose these complications.
3. To understand the impact of imaging findings on further management of patients.

17:17

Panel discussion: Time is gold - where and when can we go faster?

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

Paediatric

RC 1212

Hepatobiliary imaging in children

Moderator:
D. Akinci; Ankara/TR

A-481 16:00

A. Imaging of liver masses
D.J. Roebuck; *London/UK (derek.roebuck@gosh.nhs.uk)*

Although nearly all solid liver masses in children are neoplastic, most of those diagnosed in infancy are benign. The vascular tumours of infancy are the most important lesions to be able to diagnose on imaging grounds. Nearly all of these lesions are either infantile haemangiomas (which are typically multifocal or diffuse) or rapidly involuting congenital haemangioma (which is usually solitary). These lesions rarely require biopsy. The major malignant primary tumours are hepatoblastoma, hepatocellular carcinoma, rhabdoid tumour, and undifferentiated (embryonal) sarcoma. The intrahepatic extent of the tumour is described by the PRETEXT category, a Roman numeral from I to IV that roughly corresponds to the difficulty of surgical resection. Various other imaging findings are also recorded. Ultrasound (US) is the best first test for a child with a suspected abdominal mass. The hepatic origin of the tumour can be confirmed, and a preliminary diagnosis made. The use of contrast enhancement may improve the diagnostic accuracy of US for certain lesions. In general, MRI is preferable to CT for evaluation of liver tumours. This means that children with malignant liver tumours require all three modalities (US, chest CT and MRI) for optimal imaging.
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-482 16:30

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-483 17:00

C. Intervention in the hepatobiliary system
S. Franchi-Abella, D. Pariente; *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 to minimise the risk of complication. Percutaneous core needle biopsy is usually performed using 18 G needles in infants and 16 G 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.

Saturday, March 7

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

E³ - ECR Academies: Interactive Teaching Sessions

E³ 1321
Diagnostic evaluation of bone tumours

A-484 08:30
A. Bone tumours: benign or malignant?
H.-J. van der Woude; *Amsterdam/NL (h.j.vanderwoude@olvg.nl)*

Most high-grade malignant bone tumours and typical benign lesions can be recognised based on radiographic features regarding origin, margins and transitional zone, pattern of bone destruction, involvement of cortical bone and soft tissues and periosteal reaction. Challenge is the large group of abnormalities consisting of aggressive benign lesions, low-grade malignant tumours and many 'tumour-like lesions', including reactive processes (e.g. secondary to trauma or infection,) that may show overlapping imaging characteristics. Since lesions in the latter group are not infrequently encountered it is important to be aware of their appearance. Adequate plain radiographs in two directions remain the cornerstone in the making of bone tumour differential diagnosis in general. Interpretation has to be combined with additional (statistical) information concerning patient's age, lesion location (within axial or peripheral skeleton and within bone) and relevant clinical history. Proper use of these data and reading images in a structured manner results in an accurate assessment of three categories: certain benign and certain malignant lesions and a group of uncertain lesions that need further workup. Computed tomography can be reserved for more insight into the integrity of cortical bone, more definite tumour origin and matrix formation. Magnetic resonance imaging has the ultimate locoregional staging properties for uncertain and malignant tumours. It may assist in narrowing a differential diagnosis demonstrating certain morphologic and/or tissue-specific features of a lesion (fat, fluid, blood, cartilage, etc)., reactive changes like edema and (dynamic) enhancement characteristics.
Learning Objectives:
1. To learn the features on conventional radiographs that distinguish benign and malignant bone tumours.
2. To learn the features on MRI and CT that distinguish benign and malignant bone tumours.

A-485 09:15
B. Pseudotumours: mimic bone tumours
F.M.H.M. Vanhoenacker, B. Peters; *Antwerp/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 hydroxy-apatite disease, brown tumours, hemophilic pseudotumour). Another group of tumour-like conditions are nonneoplastic in nature, including dense bone islands, fibrous dysplasia, non-ossifying fibroma, intraosseous ganglion cyst, Langerhans cell histiocytosis, (post-traumatic) bone cyst, etc. Considering a pseudotumoral 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 tumoral lesions. The absence of aggressive imaging features on plain radiographs is a major key. Some pseudotumoral 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 hydroxy-apatite disease. In some specific scenario's, 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 recognise the range of lesions which mimic tumours of the bone.
2. To learn the features that identify pseudotumours of the bone.

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

Abdominal Viscera

RC 1301
Pancreatic inflammation
Moderator:
G. Morana; Treviso/IT

A-486 08:30
A. Acute pancreatitis
M. Zins; *Paris/FR (mzins@hpsj.fr)*

The original Atlanta classification of acute pancreatitis established in 1992 is outdated. In 2012, an international working group has modified the Atlanta classification for acute pancreatitis to update the terminology and provide new morphologic classifications. The revised classification of acute pancreatitis identified two phases of the disease: early (first week) and late (after the first week). Acute pancreatitis is subdivided into two types: interstitial oedematous pancreatitis and necrotising pancreatitis. If the diagnosis of acute pancreatitis is established by abdominal pain and by increases in the serum pancreatic enzyme activities, a contrast-enhanced CT is not usually required for diagnosis in the early phase. This revised classification introduces new terminology for pancreatic fluid collections. Depending on presence or absence of necrosis, acute collections in the first 4 weeks are called acute necrotic collections or acute peripancreatic fluid collections. Once an enhancing capsule develops, persistent acute peripancreatic fluid collections are referred to as pseudocysts and acute necrotic collections, as walled-off necrosis. All can be sterile or infected. This classification of acute pancreatitis allows a consistent, worldwide classification and should avoid confusion in the terminology of pancreatic fluid collections.
Learning Objectives:
1. To learn how imaging should be scheduled for patients with acute pancreatitis.
2. To become familiar with the imaging features and the terminology proposed in the Atlanta classification.

A-487 09:00
B. Chronic pancreatitis and IPMN
C. Matos; *Brussels/BE (cmatos@ulb.ac.be)*

The role of diagnostic imaging in chronic pancreatitis and IPMNs is to detect structural changes of the ducts and of pancreas parenchyma, to detect associated complications, and to assist in management. These goals are generally fully achieved using MDCT and MR imaging. In this lecture, the advantages and the limitations of each technique will be discussed and illustrated. Key features allowing differential diagnosis of both entities will be underlined.
Learning Objectives:
1. To learn the classical aspect of IPMN on imaging.
2. To learn how it merges with chronic pancreatic disease and how we can differentiate both.
3. To understand the role of different imaging techniques in assessing both diseases.

A-488 09:30
C. Paraduodenal and autoimmune pancreatitis
S.A. Jackson; *Plymouth/UK (simon.jackson1@nhs.net)*

Autoimmune pancreatitis (AIP) was first described in 1961 and represents a rare form of immune-mediated chronic pancreatitis which is characterised by a marked infiltration of lymphocytes and plasma cells into pancreatic tissue. Whilst the majority of cases present with diffuse gland involvement, approximately 30% of patients demonstrate either segmental or focal involvement of the pancreas. Clinical presentation is very variable with patients describing a range of symptoms. Imaging plays a central role in the diagnosis and management of AIP and knowledge of the radiological appearances, which can vary significantly due to the various degrees of fibrosis and inflammatory infiltrate, is critical. Cardinal features include focal or diffuse pancreatic enlargement with the loss of normal lobular architecture. In addition, pancreatic duct involvement as demonstrated by single or multiple focal strictures with limited more proximal dilatation is common as well as infiltration of the biliary tree. Whilst these appearances may suggest a diagnosis of AIP correlation with clinical history, serology and histopathology is mandatory to accurately diagnose atypical cases. In contrast, paraduodenal pancreatitis is a specific and rare form of segmental chronic inflammation characterised by fibrous tissue formation in the "groove" area between the duodenum, head of pancreas and lower common bile duct. The pathology was first described in 1973 and has since been subdivided into pure, segmental and non-segmental

forms. Whilst the radiological diagnosis of both AIP and paraduodenal pancreatitis can be challenging, the presentation will emphasise the important imaging strategies.
Learning Objectives:
1. To become familiar with the clinical presentation and the radiological signs that may be observed in autoimmune pancreatitis.
2. To become familiar with the diagnostic criteria for the disease.
3. To learn strategies for managing doubtful clinical situations.

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

E³ - ECR Academies: Modern Imaging of the GI Tract

E³ 1322
Imaging the postoperative patient

Moderator:
A. Graser; Munich/DE

A-489 08:30
A. What the surgeon does: surgical procedures and normal postoperative anatomy
M.M. Maher; *Cork/IE (m.maher@ucc.ie)*

In most upper and lower gastrointestinal surgical units, imaging is frequently required in patients suspected of post-operative complications or in whom recovery would appear delayed. Interpretation of these studies can be challenging and requires an appreciation of expected imaging appearances of the post-operative abdomen as well as the anatomy of common surgical procedures. Imaging findings in the post-operative abdomen can vary significantly, depending on the surgical procedure performed and this can result in pitfalls for the radiologist.
Learning Objectives:
1. To understand common surgical procedures performed in the esophagus, stomach, small bowel and colon.
2. To appreciate the normal appearance of an enteric anastamosis on fluoroscopic and cross-sectional imaging.
3. To understand the normal appearances of haemostatic packing and other surgical devices on radiological investigations.

A-490 08:50
B. Do I need to re-operate? Postoperative imaging and immediate complications
D.J.M. Tolan; *Leeds/UK (damian.tolan@nhs.net)*

Imaging in the early postoperative period is complex. It is essential for radiologists to know the new anatomic arrangement after surgery and understand the range of normal postoperative appearances. This latter aspect can be particularly difficult, because the radiological findings are affected by the type of operation performed (open vs. laparoscopic) and the complexity of the surgery (such as the presence of adhesions or haemorrhage) as well as the underlying comorbidity of the patient. Patients may be considered in 4 broad categories: haemodynamically unstable patients who may be bleeding; patients with distension or unopened bowels who may have obstruction or ileus; patients with sepsis in whom to search for an intraabdominal collection or leak; and patients who do not follow an expected recovery for which the cause is unclear. CT is the primary imaging technique, with ultrasound reserved predominantly for liver and renal transplants or assessment of perihepatic collections, and fluoroscopy for routine postoperative assessment of upper and lower GI anastomoses. CT protocols should be optimised to detect particular complications with positive luminal contrast for assessment of anastomotic leaks (8%), triple-phase imaging for bleeding (without positive oral contrast) and delayed phase imaging to detect ureteric injury. Since each operation has a specific range of expected complications, these should be considered when deciding on the protocol and in light of the patient's clinical status. Excellent communication with the surgical team is required to make an accurate diagnosis and in particular where haemostatic compound or mesh for hernia repair was used.
Learning Objectives:
1. To understand the best imaging options for investigating suspected postoperative complications.
2. To appreciate the normal appearances of the abdomen and pelvis after surgery, in particular with regard to free fluid, haematoma and free gas, and when to suspect complications.
3. To become familiar with the radiological appearances of common and more unusual post-operative complications and their interventional radiological management.
Author Disclosure:
D.J.M. Tolan: Equipment Support Recipient; Vital Imaging. Speaker; Bracco.

A-491 09:10
C. It still hurts: follow-up imaging and long-term complications
L. Curvo-Semedo; *Coimbra/PT (curvosemedo@gmail.com)*

Radiologists should be aware of the newer surgical techniques and expected post-operative alterations, to yield a correct interpretation of a post-surgery imaging examination, thus being able to differentiate a normal post-operative finding from a potential complication. Many times, communication with the referring surgeon is strongly advised before performing a diagnostic study in such situations. It is crucial to perform a technically adequate imaging examination, so that post-operative anatomical and functional findings may be evaluated. Therefore, the aims of this lecture are to become acquainted with the long-term complications of surgery to the gastrointestinal tract and also to know the appropriate use of imaging in the assessment of long-term complications. It will include a mention of the technical issues that need to be considered to achieve better diagnostic accuracy, as well as a description and illustration of the main imaging findings of late post-operative complications. Those include disease-related (recurrence for malignancy or inflammatory disease) and procedure-related (anastomotic strictures, internal herniation, adhesions and intussusceptions, among others) complications. Focus will be placed on cross-sectional imaging techniques, particularly CT, which at present constitutes the workhorse for detecting and characterising late post-operative complications after GI tract surgery. In this way, knowledge of the most frequent complications after gastrointestinal surgery in the late post-operative period is of paramount importance for every radiologist, so that potentially life-threatening situations can be promptly diagnosed and adequate therapy can be planned.
Learning Objectives:
1. To become familiar with the long-term complications of surgery to the GI tract.
2. To appreciate the appropriate use of imaging in the assessment of long-term complications.
3. To learn about the radiological investigation of suspected postoperative adhesions.

A-492 09:30
D. Interactive case discussion
A. Graser; *Munich/DE*

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

Joint Session of the ESR and EORTC

Imaging in multicentre clinical oncological trials

Moderators:
L. Fournier; Paris/FR
Y. Liu; Brussels/BE

A-493 08:30
Imaging in clinical trials: the EORTC perspective
Y. Liu; *Brussels/BE (yan.liu@eortc.be)*

The use of imaging biomarkers in clinical trials has been increasingly appealing. Non-invasive imaging may serve multi-purposes in drug development, such as disease staging, patient stratification, risk assessment, pharmacokinetics/pharmacodynamics, drug safety and efficacy. As imaging biomarkers, apparent diffusion coefficient (ADC) from diffusion-weighted MRI may reflect tumour cellularity, k_{trans} from dynamic contrast-enhanced MRI/CT/ultrasound may detect early changes of micro-vascularisation in tumours, and uptake parameters of various labelled radioactive tracers may investigate key metabolic pathways up-regulated in cancer cells. Quantitative imaging biomarkers compared to mere visual evaluation allow for more objective evaluation of disease, and more accurate monitoring through time. Undoubtedly, the advanced MR techniques hold great promise, but qualifying these imaging biomarkers requires robust methodology. One needs proper study design following standardised procedures, correlation with pathology/outcome, reproducibility testing and optimal timing of observation, and sufficient statistical power. The EORTC has always focused on the quality of its clinical trials. The organisation has over 30 years' experience in quality assurance of and has launched pilot experiments on PET accreditation in collaboration with European association of nuclear medicine (EANM) and the standardisation of diffusion-weighted MRI in collaboration with quantitative imaging biomarkers alliance (QIBA). In this session, a road map for further collaborations between ESR and EORTC will emerge with the aim of establishing the standardisation for imaging biomarkers used in multicentre clinical trials.

Learning Objectives:
1. To become familiar with the importance of imaging in oncologic trials.
2. To learn about the role of the EORTC Imaging Group.
3. To appreciate how standardisation enhances the role of imaging in oncologic trials.

A-494 08:53

Standardisation and quality assessment of imaging as surrogate endpoints

N.M. deSouza; *Sutton/UK (nandita.desouza@icr.ac.uk)*

Imaging measurements used for decision-making in clinical trials need to be reliable and repeatable. The use of such imaging data appropriately for response assessment has potential to avoid administration of an ineffective, toxic treatment or to discontinue one that is potentially effective. Traditionally, response evaluation criteria in solid tumours (RECIST) have been used as they are simple and quick to perform. The use of newer targeted therapeutics, however, means that size changes occur late. Increasingly, therefore, imaging that derives information from other tumour features such as its cellular content, vascular or metabolic profile or characterises its molecular signature is preferred. These imaging measurements are subject to significant variation between sites and scanner platforms, not only because of different methods of data acquisition but also because of differences in data processing and interpretation. Achieving standardisation requires setup of equivalent protocols across scanner platforms, scanner calibration and maintenance of it through the trial (quality assurance) and a unified software platform for quality controlled data analysis. This process presents significant challenges at a local level as well as for centralised analysis. It requires significant primary engagement of radiology departments at institutions hosting such trials. The steps taken to address these issues through our iMi-funded project QuIC-ConCePT will be discussed.

Learning Objectives:
1. To become familiar with approaches to the standardisation of imaging methods.
2. To learn about the role of imaging biomarkers in oncologic trials.
3. To appreciate the interactions of quantitative imaging with the results from biobanks.

A-495 09:16

Optimised imaging for trials in brain tumours

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

Gliomas constitute a group of brain tumours with heterogeneous clinical behaviour, with many therapeutic agents under investigation for their effectiveness. Conventional MR imaging, including T2w/T2-FLAIR and contrast-enhanced T1w sequences, has only modest diagnostic value for the assessment of treatment effects. Numerous studies on perfusion MR imaging (pMRI) have indicated potential added prognostic and diagnostic value of this advanced MR neuroimaging technique for the work-up and follow-up of brain tumour patients. These studies are, however, limited by the fact that they were monocentric and commonly retrospective, and did not include a systematic histological or imaging review. To evaluate pMRI as its suggested potential as a neuro-oncological biomarker, the EORTC brain tumour group initiated a three-phase feasibility study on the implementation of pMRI in prospective, multicentre, multinational trials of gliomas. A standardised MR imaging protocol, including pMRI, was developed and subsequently implemented in 4 core sites. Available post-processing tools were assessed with respect to their applicability to multicentre data, and a protocol to standardise relative cerebral blood volume (rCBV) measurement was established. Datasets from all core sites were independently analysed by 3 experienced raters, assessing inter-rater variability for each of the post-processing tools. In this presentation, a brief overview of rCBV measurement and its potential value for brain tumour assessment is given. Furthermore, the EORTC brain tumour group's experience with and findings of the feasibility study will be presented, highlighting the difficulties of consistently measuring rCBV in general, as well as those specifically arising in multicentre trials.

Learning Objectives:
1. To consolidate knowledge about state-of-art quantitative MRI.
2. To learn about standardisation and validation.
3. To appreciate the value of quantitative MRI in grading and therapy response.

A-496 09:38

Multiparametric MRI in breast and prostate cancer

T.H. Helbich; *Vienna/AT (Thomas.Helbich@meduniwien.ac.at)*

MRI of the breast and prostate has evolved as a non-invasive imaging modality. Both applications require MRI parameters that offer high sensitivity and high specificity. Particular higher field strengths offer the possibility to introduce new imaging parameters, which can improve the differentiation and characterisation of breast/prostate lesion and well as treatment planning. These are MRI parameters which assess tumour angiogenesis with contrast-enhanced MRI, motions of molecules with diffusion-weighted imaging (DWI), and metabolic information with MR-spectroscopy. Multiparametric MRI using combinations of two or three parameters have been assessed for both organs. The results are promising and demonstrate that a combination of two or even three parameters lead to an increase in diagnostic accuracy in comparison to single-parameter studies. The numbers of parameters and their possible combinations necessary to significantly improve the diagnostic accuracy is still under debate. This talk will focus on the use and benefits of multiparametric MRI in breast and prostate cancer and allow insights in an encouraging algorithm enabling accurate characterisation and well as treatment planning.

Learning Objectives:
1. To consolidate knowledge about state-of-art techniques.
2. To become familiar with the reading schemes.
3. To appreciate the role of tissue characterisation and therapy response.

Author Disclosure:
T.H. Helbich: Research/Grant Support; Siemens, Hologic, Bracco.

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

Physics in Radiology

RC 1313

IT tools for dose tracking and workflow optimisation

Moderator:
A. Trianni; Udine/IT

A-497 08:30

A. Digital Imaging and Communication in Medicine (DICOM) and Integrating the Healthcare Enterprise (IHE) standards

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-498 09:00

B. Patient dose tracking: a must have?

D. Zamora; *Seattle, WA/US (dzamora@uw.edu)*

Various Radiation Exposure Monitoring Systems (REMS) have been commercially developed as a means of centralising the storage, analysis and user alerting of dose metrics from a variety of imaging modalities. Appropriate usage of the dose information provided by REMS is an emerging topic of interest. Dose information can be used to drive decisions in patient management and notification/education, and allows improved dose estimation for the individual patient. The REMS can also help informing the implementation processes for auxiliary active dose monitoring systems such as CT DoseCheck. Similarly, it can act as a conduit of data to national benchmarking databases such as the American College of Radiology (ACR) CT Dose Index Registry (DIR). However, there are signification challenges to implement REMS. Successful connection of various vendor's radiation producing equipment to a REMS is a challenge and integration into hospital or radiology information systems (HIS/RIS) introduces further layers of difficulty. Primary communication between sub-systems often includes Modality Performed Procedure Step (MPPS) messages, DICOM Radiation Dose Structure Reports (RDSR), optical character recognition (OCR) and health level 7 (HL7). This complex interplay demands coordination between the medical physicist, information technology (IT) team, clinical staff and vendors to oversee clinical equipment configuration, patient workflow, and IT issues. This presentation will provide examples of clinical REMS implementations, discuss interactions between various system elements, and provide sample dose calculations (with a focus on CT and fluoroscopy).

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.

A-499 09:30

C. Optimising technique using patient dose tracking software - tips and tricks

D. Murphy; *Dublin/IE (dara.murphy@olchc.ie)*

A project to introduce a national PACS - the National Integrated Medical Imaging System (NIMIS) - to the Irish Health system is currently nearing completion. The patient radiation dose tracking element of the project is sub-contracted by the PACS vendor to a third party (Bayer-Radimetrics). Their software is tracking and collating dose indices from over 90% of the CT scanners in Ireland. Consequently, it has been possible to compare technique among scanner manufacturers and hospitals for a variety of examinations. Although there are several limitations associated with the dose metrics currently available on CT platforms, we have used the ubiquitous indices, CTDIvol and DLP, present in the dose report, to identify poorly optimised CT scanners or poor technique. In particular, it has been possible to generate diagnostic reference levels, based on patient size for several common CT examinations, which we believe will allow hospitals assess the performance of their scanners automatic exposure control (AEC) system for non-standard size patients. We also highlight some of the challenges and limitations of using currently available DICOM data to draw conclusions in relation to CT technique and optimisation.

Learning Objectives:
1. To learn how to use the information in the DICOM header to improve technique and outcome for the patient.
2. To learn how to use the information in the DICOM header to improve performance of the AEC system.
3. To take advantage of dose tracking information in order to compare and contrast technique among several CT scanners.

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

E³ - European Diploma Prep Sessions

E³ 1323
Chest

A-500 08:30

Chairman's introduction

J. Vilar; *Valencia/ES (vilarsamper@gmail.com)*

The European diploma in radiology (EDiR) has become a necessity in a world where professional quality is a main issue. This is why many radiologists, especially young ones, are aiming to obtain a certification that will open for them new windows to their future. Yet there are still many doubts and questions that sometimes keep them away from the EDiR examination. This is why the participants in this session, all involved directly in the EDIR examination. The speakers, radiologists and members of the EDiR office, will explain all the details of the different steps that lead to obtain the European diploma in radiology, starting from the registration and preparation, followed by the examination and the future of this certification that aims to become, not only an official European certificate, but also a worldwide recognised diploma.

Session Objectives:
1. To describe the most important signs in chest imaging.
2. To differentiate the imaging features of benign and malignant lesions of the lung.
3. To differntiate the imaging appearance of common lesions of the mediastinum, pleara and chest wall.

A-501 08:33

A. Fundamentals of chest imaging

D. Tack; *Baudour/BE (denis.tack@skynet.be)*

The learning objectives will be met by demonstrating how they can be utilised in clinical practice, from the most evident to the most complex chest imaging cases. The major part of the presentation will be focused on signs in chest imaging, with side by side comparisons of radiographs and CT (or MR) images. A large database of misdiagnoses will be utilised to illustrate and emphasise the importance of a systematic analysis of the images and an in-depth knowledge of normal and basic signs in chest imaging.

Learning Objectives:
1. To understand the anatomy and normal variants of the respiratory system, heart and vessels, mediastinum and chest wall and to confidently identify these on radiographs, CT and MRI.
2. To understand the technical aspects, exposure doses and post-processing of radiographs and CT of the chest.
3. To have an in-depth understanding of the most common chest radiography signs (including silhouette sign, air bronchogram, air crescent sign, cervicothoracic sign, tapered margins, gloved finger sign, golden sign, deep sulcus sign).
4. To describe the appearance and correct position of monitoring and support devices (tubes and lines).

Author Disclosure:
D. Tack: Board Member; Radiology Editorial Board, Journal of Thoracic Imaging Editorial Board.

A-502 09:02

B. Inflammation and tumours of the lung

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

Inflammatory and neoplastic diseases of the lung are frequently encountered on chest CTs. As both inflammatory and neoplastic diseases, as well as some congenital disorders, present with an increase in lung density, the differential diagnosis is challenging. Increased lung densities may present as ground glass opacities or consolidations. Ground glass opacities are defined as an increase in lung density, with preservation of bronchial and vascular margins. Ground glass opacities may be caused by a thickening of the pulmonary interstitium or a partial filling of the airspaces with fluids or cells. Pulmonary opacities, in which the bronchial or vascular margins are obscured, are defined as consolidations. Consolidations are the result of a complete filling of the alveolar spaces with fluids or cells, or a thickening of the pulmonary interstitium with complete displacement of the air from the parenchyma. The diagnosis of diseases that present with an increase in lung density requires a systematic analysis of the predominant CT pattern and ancillary CT findings. Furthermore, clinical data, such as information on the immunological status of the patient as well as laboratory findings, have to be taken into account to narrow the differential diagnosis. If CT findings and clinical data are inconclusive, percutaneous or transbronchial biopsies is often required to confirm or rule out a presumptive diagnosis. Biopsies are particularly important in cases in which a presumed benign process does not respond to treatment or a malignant process is suspected.

Learning Objectives:
1. To understand the imaging features and differential diagnoses of diffuse infiltrative and alveolar lung disease and atelectasis.
2. To differentiate solitary and multiple pulmonary nodules, benign and malignant neoplasms, hyperlucencies and their potential aetiology and evaluation.
3. To differentiate thoracic diseases in immunocompetent, immunocompromised and posttransplant patients.
4. To describe the imaging features of congenital disorders of the lung.

Author Disclosure:
H. Prosch: Advisory Board; Boehringer, Novartis.

A-503 09:31

C. Mediastinum, pleura and chest wall

N. Howarth; *Chêne-Bougeries/CH (nigel.howarth@grangettes.ch)*

The presentation will cover the predefined learning objectives using side-by-side plain film and CT imaging to help understand the imaging features of common pathologies of the diaphragm, pleura and chest wall, concentrating on causes of mediastinal and hilar diseases, disorders of the pulmonary vascular system and great vessels and the postoperative chest. Although the clinical value of the chest x-ray remains undiminished, errors of interpretation of the chest x-ray remain one of the most frequent causes of malpractice issues. The skills required for accurate interpretation of imaging of the mediastinum, pleura and chest wall will be explored. The topics will be disease orientated. The objective is to help you improve your performance in plain film and CT imaging of the chest.

Learning Objectives:
1. To differentiate the imaging features of common pathologies of the diaphragm, pleura and chest wall on radiography, CT and MRI of the chest.
2. To analyse and explain the imaging features and causes of mediastinal and hilar diseases.
3. To describe the imaging features of disorders of the pulmonary vascular system and great vessels.
4. To differentiate imaging features of the postoperative chest.

08:30 - 10:00 **Studio 2015**

E³ - Rising Stars Programme

Basic 4: Musculoskeletal trauma

A-504 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 the 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-505 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-506 09:30

Ankle

J. Kramer; *Linz/AT (kramer@ctmri.at)*

The ankle joint is a hinge joint, whose function is central to locomotion. It is composed of three bones and several ligaments, which can be injured independently or in varying combinations. Tibia, fibula, and talus are held together by three principal 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). The knowledge of the complex nature of the mechanisms of injury together with the recognition of the importance of the ligaments has to be taken into account for making a reasonable final diagnosis. Plain films are still or should be still the first step in the imaging evaluation of the ankle joint. Degenerative changes as well as bony injuries can so confirmed or ruled out easily. 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, Haglunds heel, coalitions, etc). and tumors. High-resolution CT with the capability of two- or three-dimensional reconstructions may be of special help after trauma with multiple bony fragments. However, MR imaging is the examination of choice for the assessment of soft tissue injuries and lesions of the osteochondral region (different grades of ligament injuries, flake fractures, bone contusions, stress reactions).

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

Musculoskeletal

RC 1310

How I do it and report

Moderator:
K. Wörtler; Munich/DE

A-507 08:30

A. MRI of the hip

J. Teh; *Oxford/UK (jamesteh1@googlemail.com)*

The purpose of this lecture is to cover the clinical presentation, underlying pathological processes and essential MRI features of relatively common conditions affecting the hip. As the hip is afflicted by different conditions according to age, this is how the various pathological entities will be presented. A simple imaging algorithm is presented showing the role of MRI. The role of MR arthrography in the assessment of the dysplastic hip and femoro-acetabular impingement is covered. The presenter's approach to Hip MRI reporting is outlined.

Learning Objectives:

1. To learn about standardised imaging.
2. To understand the MRI-specific findings that aid diagnosis.
3. To learn a structured approach to reporting.

A-508 09:00

B. MRI of the spine and sacroiliac joints

C. Schueller-Weidekamm; *Vienna/AT*
(claudia.schueller-weidekamm@meduniwien.ac.at)

Overuse syndromes such as disc degeneration or herniation, osseous proliferations, trauma, tumour, infection or inflammation of the spine or sacroiliac joints (SIJ) are the most common causes for (lower) back pain. X-ray is the first method of choice, whereas in patients showing at least one of the so-called red flag syndromes, MRI is required. The MRI protocol should be adapted and standardised according to the clinical setting. MRI plays a major role in the early diagnosis of axial spondyloarthropathy because active inflammatory changes such as bone marrow oedema are detected in typical locations of the vertebral corners or in subchondral areas of the SIJs. The report should give information about activity and structural changes for further treatment decisions. The structure of the report should be systematic, clear and concise, and should allow interaction and broad communication with clinicians.

Learning Objectives:

1. To learn about standardised imaging.
2. To understand the MRI-specific findings that aid diagnosis.
3. To learn a structured approach to reporting.

A-509 09:30

C. MRI of the hand

M. Shahabpour, C. Boulet, M. De Maeseneer; *Brussels/BE*
(maryam.shahabpour@uzbrussel.be)

MRI of hand and wrist requires high spatial resolution and homogeneous fat suppression. The patient is placed in supine position with the hand along the body using a dedicated phased-array wrist coil or in prone position with the arm overhead. Imaging protocols for the wrist may vary but we recommend coronal (maximum 2-mm thick) PDFS and T1 (or better PD for articular lesions), sagittal PD and T2, axial PD and PDFS with 2- to 3-mm-thick slices (respectively for analysis of ligaments versus tendons). Coronal T1 FS and PDFS (or 3D PDFS) and 3D DESS sequences (0.5-mm-thick slices) followed by reconstructions are performed in MR arthrography (with double or triple injection) for detection of ulnar attachments TFC tears and lesions of extrinsic and intrinsic ligaments, especially in acute and subacute trauma to determine if the patient requires surgery. Indirect MR arthrography is obtained after addition of intravenous contrast prior to the examination to assess ligaments and cartilage in chronic phase. For avascular necrosis, intravenous contrast is often needed. In peripheral nerve compression, axial T1-w. images without fat saturation better delineate the nerves. In rheumatoid arthritis, static or dynamic T1 FS sequences are useful to assess tenosynovitis and synovitis. The most common injuries and inflammation of hand and wrist are presented. The clinical impact of the radiological report is discussed to strengthen the importance of proper terminology for the description of pathological findings. The structure of the report should be clear and concise and correlated with the clinical findings.

Learning Objectives:
1. To learn about standardised imaging.
2. To understand the MRI-specific findings that aid diagnosis.
3. To learn a structured approach to reporting.

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

Neuro

RC 1311
Reporting spine imaging studies

Moderator:
M.A. Papathanasiou; Athens/GR

A-510 08:30

A. Disc nomenclature and treatment strategy
M. Gallucci; *L'Aquila/IT (massimo.gallucci@cc.univaq.it)*

MRI is the gold standard for disc pathologies and its relationship to neural structures. However, multiple terminologies used to describe disc diseases and related nerve root compression have often been a source of confusion between. Review of the published literature shows that the most commonly used and studied classifications for lumbar disc herniation include the CTF, the Jensen, and the Pfirmann ones, whilst the most popular classification for nerve root compression is the one by Pfirrmann and van Rijn. After pooling the interobserver agreement of various systems, there is level 1 and 2 evidence to suggest that the CTF classification of lumbar disc disease and van Rijn criteria have significant interobserver agreement. The most used classification for concomitant vertebral end-plate changes results to be the Modic and the Nathan ones. As far as percutaneous interventions on disc are concerned, many different techniques are in common use, none of which seems to be dramatically affected by the classification category. Our personal experience suggests that free fragments or sequestered disc have about 100% of spontaneous resolution: in those cases symptomatic therapy (i.e. periradicular anaesthetic block) is enough to let the normal course of the disease occur. Independently from the percutaneous technique used, generic successful rate of 80-85 % is usually registered in cases of protrusion or extrusion. Bulges and disc pathologies associated with moderate degenerative bony changes (Nathan type 3) have a successful rate of about 50-60%, which is even lower in high grade of bony diseases (Nathan type 4).
Learning Objectives:
1. To become familiar with the different nomenclatures in degenerative disk disease.
2. To learn how to differentiate between degenerative disease and other pathologies.
3. To learn whether or not disc nomenclature influences treatment strategy.

A-511 09:00

B. 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 correlation and previous exam correlation.

A-512 09:30

C. Introduction to structured reporting in the spine
J. Van Goethem[1], L. van den Hauwe[1], F. De Belder[1], C. Venstermans[1], F. Ramon[2], P.M. Parizel[1]; [1]*Antwerp/BE*, [2]*Sint-Niklaas/BE*
(johan.vangoethem@ua.ac.be)

Radiology reports are a means to convey information from the radiologist to the referring physician. Currently, although most radiologists report in a free form text, reports already contain some basic structure like patient identification, clinical information, type of examination, the basic report and many times a separate conclusion. Introducing structured reporting goes further and introduces two extra key features. One is a common vocabulary and semantics, which are essential to clearly convey important patient information. Using a standard nomenclature and grading, which clearly exists and is well worked out for spine reporting, is very helpful.The other key feature is consistent organization, where there is a more or less fixed pathway followed describing the different anatomic areas and their appearance and/or pathology. This feature of structured reporting is sometimes called itemized reporting. In spine imaging studies, this might be organised by disc level, describing disc, facet, spinal cord/nerve root and other items for each level. Using structured reporting reduces the chance of ambiguous or imprecise communication between radiologists and referring physician. The information is also easier to interpret for software that itemizes and categorizes patient pathology in the EPR. Different systems are available to generate structured reports going from free text with headers, fill-in-the-blank, free text with auto-formatting, standard lexicon to point-and-click-trees. Some types of structured reporting however, can be distracting. If radiologists need to look away to fill in a template, it will take a while to refocus, both visually and cognitively, on the image, reducing accuracy and efficiency.
Learning Objectives:
1. To understand if it is always helpful to have a structured report.
2. To learn what a structured report is.
3. To learn whether or not we can escape through structured reporting.

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

E³ - ECR Master Classes (Oncologic Imaging)

E³ 1326
Imaging tumour phenotype: the future is now

Moderator:
D. Regge; Turin/IT

A-513 08:30

C. Will genomics change imaging? Renal cancer as a case study
P.L. Choyke; *Bethesda, MD/US (pchoyke@nih.gov)*

Radiogenomics for cancer: phentotypic and genomic heterogeneity. There is excitement about the role imaging will play in the genomic revolution. Disease will be characterized and subtyped by genomics. The complexity of the genomic information makes it seem unlikely that imaging, which is based on only a few features such as size, intensity, location, etc. will be able to predict genomics. However, new methods of analyzing images involving texture analysis among other methods extract information from images that hitherto was not apparent to the human reader, a process that has been termed "radiomics". Images can be characterised by numerous (> 30) non-overlapping computer-generated features. The hope is that this enriched data set will be able to predict genomic data and, therefore, guide patient management in the future. There are several major challenges to be overcome. Many studies simply extract features on imaging and compare these to genomic features without regard to where the sampling occurred. This results in "statistically significant" but weak associations. The challenge will be to spatially register imaging data and genomic data. Ironically, the best data may come from biopsies in which the needle position within the lesion is carefully recorded. Case studies will be shown. This will ensure that genetic heterogeneity is accounted for when performing imaging correlations. Imaging holds the best promise for in vivo, non-invasive "radiogenomic" testing as it reflects the "final common pathway" of multiple molecular pathways. Imagers will need to learn the language of genomics.
Learning Objectives:
1. To be familiar with the concept of radiogenomics.
2. To understand the potential role of radiogenomic studies in evaluating cancer.
3. To be familiar with the research objectives in this field.
Author Disclosure:
P.L. Choyke: Other; Non Financial Research Agreements with General Electric, Philips, Siemens, iCAD, inVivo, Aspyrian, Aura.

A-514 09:00

B. Imaging tumour heterogeneity and perfusion: predicting tumour behaviour
V.J. Goh; *London/UK (vicky.goh@kcl.ac.uk)*

Biological heterogeneity is the key to evolutionary diversity. In recent years, genomic and proteomic data have revealed that intra and inter-tumoral biological heterogeneity is highly prevalent. This heterogeneity is expressed phenotypically and thus may be linked to imaging appearances. There has been increasing interest in the possibilities of imaging evaluation of tumour heterogeneity. Molecular and functional imaging techniques including positron emission tomography (PET), magnetic resonance imaging (DW-MRI) and computed tomography (CT) provide an in vivo window into the heterogeneity of tumour physiology and biology. A multi-parametric approach allows different

physiological aspects of the tumour to be compared providing insight into physiological heterogeneity. Image pixel heterogeneity may also be assessed that appears to confer information of clinical outcome. This will be discussed with reference to tumour perfusion and angiogenesis.

Learning Objectives:

1. To be familiar with the techniques for measuring tumour heterogeneity on imaging.
2. To know the main findings of perfusion imaging in predicting tumour behaviour.
3. To be familiar with current research in this field.

Author Disclosure:

V.J. Goh: Advisory Board; EIBIR. Equipment Support Recipient; Siemens Healthcare, GE Healthcare. Research/Grant Support; Siemens Healthcare.

A-515 09:30

C. Molecular imaging: visualising the characteristics of cancer cells

G. Cook; *London/UK (Gary.Cook@kcl.ac.uk)*

Modern molecular and functional imaging methods provide enormous scope for detecting, measuring and monitoring a wide variety of biological processes in malignant tumours and normal tissues. This is leading to a much better ability to personalise management of cancer patients by characterising tumour phenotype as well as sensitively and specifically monitoring effects of targeted therapies. Whole body imaging also allows the measurement of heterogeneity between metastases (inter-tumoural heterogeneity). Measurement of intra-tumoural heterogeneity in medical imaging has also been shown to provide additional prognostic or predictive information in a number of cancers with different imaging modalities. PET, SPECT, WB MRI, as well as hybrid modalities (e.g. PET/CT, SPECT/CT, PET/MRI) are providing preclinical and clinical data allowing exploration of several aspects of tumour biology including cellular metabolism, membrane metabolism, proliferation, cellularity, blood flow, angiogenesis, hypoxia, apoptosis, receptor status and microenvironment status. Whilst many of these methods remain within the research arena, more are being clinically translated for use in clinical trials and routine imaging of cancer patients.

Learning Objectives:

1. To learn about important imaging targets in cancer cells.
2. To be familiar with specific radiotracers currently in early phase cancer imaging studies.
3. To be familiar with the potential role of new tracers in patient management.

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

Breast

RC 1302

Tailoring breast cancer screening to risk level

Moderator:
B. Brkljacic; Zagreb/HR

A-516 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-517 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 and individual risk due to previous breast cancer or borderline lesions (B3, ADH, LCIS, ALH). Breast density is the most important further independent risk factor. Whilst 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-518 09:30

C. High risk: MRI alone?

F. Sardanelli; *San Donato Milanese/IT (f.sardanelli@grupposandonato.it)*

A body of evidence exists for breast MRI as the best imaging 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 MRI specificity (6/8 studies ≥90%). Importantly, recent studies showed that the adjunct of mammography and/or ultrasound to MRI does not significantly increase the overall diagnostic performance, posing the rationale for screening these women using MRI alone. Moreover, observational, radiobiological, and risk modelling studies showed a higher sensitivity of BRCA mutation carriers to ionizing radiation, reinforcing a potential screening using MRI alone. The potential for an effect on patient outcome is shown by the following pooled data from 9 studies: 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. However, especially for BRCA1 mutation carriers, also MRI-including screening strategies should be evaluated versus strategy of risk reduction, 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 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: Equipment Support Recipient; IMS-Giotto, Bologna, Italy. Grant Recipient; Bracco, Milan, Italy, Bayer, Berlin, Germany. Investigator; Bracco, Milan, Italy, Bayer, Berlin, Germany. Speaker; Bracco, Milan, Italy, Bayer, Berlin, Germany.

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

Chest

RC 1304

Occupational lung diseases: the known and the less known

Moderator:
N. Karabulut; Denizli/TR

A-519 08:30

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-520 09:00

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 the 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 such as 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.
Author Disclosure:
S.J. Copley: Other; Organizer of Educational Course sponsored by Intermune and Boeringher Ingleheim.

A-521 09:30

C. Uncommon occupational lung diseases
L. Flors; *Valencia/ES (lcflors@gmail.com)*

Occupational lung diseases represent a frequently diagnosed work-related condition, and knowledge in this area has evolved substantially in the last decades. They comprise a broad variety of disorders caused by the inhalation of dust particles or other noxious chemicals. High-resolution computed tomography (HRCT) plays an important role in their radiologic evaluation, not only as an aid to diagnosis, but also for the quantification of disease severity, the prediction of prognosis and the identification of co-existing or alternative diseases as a cause of respiratory disability. The HRCT features of silicosis, asbestosis and coal worker's pneumoconiosis have been widely described. The aim of this lecture is to describe and illustrate the HRCT features of patients with uncommon occupational lung diseases such as siderosis, hard metal pneumoconiosis, talcosis, berylliosis, calcicosis, hypersensitivity pneumonitis due to uncommon agents -wheat flour (also known as miller's lung) and isocyanates- and Ardystil syndrome. The characteristic HRCT findings together with clinical features and related occupational history can improve the diagnostic accuracy of these uncommon occupational lung diseases.
Learning Objectives:
1. To illustrate the HRCT features of patients with uncommon occupational lung diseases.
2. To understand the importance of connecting the HRCT findings with clinical features and occupational history to improve the diagnostic accuracy of these diseases.

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

Radiographers

RC 1314

Radiography and evidence-based research: the way forward

A-522 08:30

Chairmen's introduction
I. Henderson[1], M.G.M. Hunink[2]; [1]*Aberdeen/UK*, [2]*Rotterdam/NL*

Welcome colleagues to this session on Radiography and Evidence Based Research. I am sure you all agree that the use of research to develop the evidence base in radiography is extremely important. The skill of radiographers in carrying out research and audit activities is therefore paramount to ensure that they are able to contribute to this. As a profession, we are still in the early days of developing a strong and credible research culture, but as you will see from the work presented at ECR this year, this situation is changing. In this session, we have eminent speakers whose experience of research and evidence-based practice should provide you with valuable knowledge and awareness that will assist you to understand or practice research in your own setting. I am sure therefore that the session will serve a valuable purpose in supporting and encouraging radiographers to engage in the promotion and development of evidence-based practice.
Session Objectives:
1. To outline the importance of a robust evidence base in supporting the development of professional practice.
2. To demonstrate how the evidence base can be used to develop services for the benefit of patients.
3. To provide guidance on how radiographers can contribute to the evidence base through research.

A-523 08:35

A. The fundamentals of evidence-based research
S. Mathers[1], G. Paulo[2]; [1]*Aberdeen/UK,* [2]*Coimbra/PT*

Current emphasis is placed on the importance of evidence-based practice (EBP) in medicine to inform change in practice. Radiography has traditionally followed a model of basic training plus experience of clinical practice with unsystematic clinical observations to inform good practice. As radiographers have moved to a graduate profession and have taken on tasks previously carried out by radiologists, there is a requirement for radiographers to increase their use of valid and relevant research evidence to inform their clinical practice and improve the quality of services for patients. This session will focus on the use of evidence-based research to inform EBP and stress the need for radiographers not only to be consumers of evidence-based research but also the researchers exploring and challenging practice. Strategies will be provided to search, retrieve and validate the sources of evidence to answer a clinical question, carry out a search of the literature of relevant research and describe tools to critically appraise what is found. In addition the practicalities of implementing research in to practice will be discussed. To illustrate the process examples using two United Kingdom research studies will be described. Both studies have clear implications and outcomes for practice and have led to changes in national policy, education and local practice. The necessity for clinical radiographers to collaborate with academic radiographers in research studies from the development of the research question and methodology, the carrying out and dissemination of the study and the translation of the results into practice will be discussed.
Learning Objectives:
1. To appreciate the importance and necessity of evidence-based practice.
2. To develop a strategy to search, retrieve and evaluate sources of evidence.
3. To understand how evidence-based practice can be translated into practice using examples with demonstrable impact.

A-524 08:58

B. Application of evidence-based research into practice

M. Gellert, M. Andersen; *Odense/DK (mago@ucl.dk)*

Learning by Developing is a model for cooperation between professionals and students in professional education through evidence-based studies. The model is of Finnish origin and developed for a nursing context (Raij K., Learning by Developing, Laurea University of Applied Sciences, Helsinki, 2007). Over the last three years, Department of Radiography at UCL has gained thorough experience on how to adapt the model to radiographic context, where problems typically have more of a technical focus. The model is based on the principle of learning by doing, in the sense that learning has the best conditions when the learner has the opportunity to take part in the activities to be learned. In undergraduate project, the students learn about professional development, and Learning by Developing is a model for how learning can take place in a collaboration on authentic professional development. Central to the model is that cooperation is based on a problem definition determined by the clinical practice, thus, increasing the common motivation for the project and the succes of the subsequent implementation of project results. Another key feature of the model is that research is conducted in a cooperation, where professionals, as well as students and teachers can contribute to the development of the profession, learning from and with each other. Participants in a Learning by Developing projects, e.g. students and radiographers are therefore equal partners in the cooperation. This interaction between students and professionals results in robust undergraduate projects of high professional quality and of great value for clinical practice.

Learning Objectives:

1. To learn how research outcomes can be used to enhance professional practice.
2. To be aware of the current gap between research and clinical practice and the importance of minimising it by developing proactive cooperation.
3. To appreciate "learning by development", a concept of including radiographers and radiography students into clinical practice research.

A-525 09:21

C. Improvement of patient outcomes by evidence-based research

K.G. Vikestad; *Oslo/NO (karivi@hioa.no)*

Focus on the benefits in evidence-based practice in the radiology department and an update on the status in Norway. How we organise our work to establish national procedures in the radiological field? In Norway, we have increased focus on quality and proven quality but have a challenge finding the form and the aim. It is a challenge to communicate the necessity of evidence-based practice and the form it should have. The culture in the radiological environment is pretty closed and radiographers have traditions of finding own ways to reach their aims.
The Norwegian Knowledge Centre for the Health Services have on commissioned by the Directorate for Health, developed 86 national evidence-based procedures and none of these are within the radiology field. At the clinical wards in hospitals in Norway, there is certain pressure to work evidence-based from the bachelor students from other disciplines and this creates an obligations to developing evidence-based procedures. Among the radiography bachelor students, there are no such pressure to work evidence-based and pressure to develop evidence-based procedures. The radiography bachelor program at The Oslo and Akershus University College has in 2015 an increased focus on the student's ability to think and work evidenced based and consciously have this as a recurrent theme throughout the program. We will start a project for students to cooperate with Oslo University Hospital about the evidence-based process for the whole lung cancer treatment in Norway. The preliminary results from this project will be presented.

Learning Objectives:

1. To learn how applying research outcomes can translate into measurable improvements in diagnosis or treatment.
2. To understand how changes and improvements of patient outcomes can be measured.
3. To identify opportunities to improve patient outcomes in the workplace.

09:44

Panel discussion: How to promote research as a tool for professional development?

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

Genitourinary

RC 1307

Female pelvic imaging: how I do it

Moderator:
K. Kinkel; Chêne-Bougeries/CH

A-526 08:30

A. Imaging female congenital anomalies

I. Thomassin-Naggara, N. Perrot, M.-F. Carette, M. Bazot; *Paris/FR (isabelle.thomassin@tnn.aphp.fr)*

To present the main embryologic features of female genital organs implicated in congenital abnormalities. To describe congenital abnormalities of the Uterus (The classification of the American fertility society). To present the new updated classification system established by the European Society of Human Reproduction and Embryology (ESHRE) and the European Society for Gynaecological Endoscopy (ESGE).

Learning Objectives:

1. To learn about the embryology of normal and abnormal female genital tract.
2. To understand the role of different available imaging techniques for female congenital anomalies: ISG, TV-US and MRI.
3. To learn about the examination technique and understand the imaging findings of MRI in the different classes of female congenital anomalies.

A-527 09:00

B. PET-CT in the female pelvis: how I do it

A.G. Rockall; *London/UK (a.rockall@imperial.ac.uk)*

This refresher course will focus on the radiologist's approach to using PET-CT within the context of the gynaecologic oncology multidisciplinary meeting. The current indications for using FDG-PET/CT will be discussed for cervix, endometrial and ovarian cancer as well as the potential use of FDG-PET/CT in rare gynaecologic cancers. The value of adding FDG-PET/CT into the patient management pathway will be presented alongside the potential pitfalls in interpretation. Future developments, including potential new tracers, will be mentioned.

Learning Objectives:

1. To understand the role of PET/CT in staging of various pelvic tumours and detection of tumour recurrence.
2. To learn about the advantages and limitations of PET/CT in imaging the female pelvis.
3. To appreciate the role of PET/CT with respect to other imaging techniques in the diagnostic algorithms of pelvic tumours.

A-528 09:30

C. How to image cystic tumours of the ovary

R. Forstner; *Salzburg/AT (r.forstner@salk.at)*

Cystic lesions account for the vast majority of ovarian masses and are detected incidentally in 5-18%. Their spectrum ranges from non-neoplastic cysts to benign tumours, e.g. cystadenomas and dermoids to the rare ovarian cancer. Diagnostic criteria in US, CT and MRI are based on the clinical background (age, menopausal status, medical history, and tumour markers) and the morphology of the ovarian mass. Typical of a benign cystic lesion is its pure cystic structure or thin septations, fatty or haemorrhagic contents, and mild enhancement of solid components in a complex solid and cystic ovarian mass. Thus, patients can be categorised into three different risk groups. Sonography has been established as the first-line imaging modality to assess the ovaries. Recently, management guidelines have been adopted for cystic ovarian lesions. In these guidelines, also cystic adnexal incidentalomas are included. MRI is most useful as a complementary technique in sonographically indeterminate masses. An algorithmic approach will render a specific diagnosis in the vast majority of cases. In complex cystic lesions, integration of DWI and dynamic contrast-MRI allows differentiation of rare benign complex tumours, e.g. cystadenofibroma from ovarian cancer. Pitfalls of cystic ovarian tumours include cystic fibroids, peritoneal cysts, and extraperitoneal cystic tumours. Compared to US, both CT and MRI are superior in assessing large cystic pelvic masses. Criteria to differentiate between intra- and extraperioneal origin include displacement patterns and identification of the vascular pedicle. Careful analysis of imaging and clinical findings usually allows differentiation of inflammatory tumours from ovarian cancer.

Learning Objectives:
1. To learn about specific imaging algorithms of ovarian cystic tumours.
2. To understand certain imaging features that can differentiate ovarian from non-ovarian cystic tumours in the pelvis.
3. To become familiar with the pitfalls in imaging of ovarian cystic tumours and the lessons to be learned from them.

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

E³ - ECR Academies: Hybrid Imaging (advanced)

E³ 1318

Advanced imaging with tracers beyond FDG

Moderator:
B. Tavitian; Paris/FR

A-529 08:30

A. Neuroendocrine tumours
S. Fanti; *Bologna/IT (stefano.fanti@aosp.bo.it)*

Neuroendocrine tumours (NET) originate from neuroendocrine (NE) cells that embriologically derive from the neural crest. Since NE cells are widely dispersed throughout the human body, NET may virtually arise in every organ although the most frequent sites include the gastro-entero-pancreatic tract followed by the lungs. NET are frequently well differentiated and slow growing, although aggressive variants exist. NET cells express a number of receptors, and those that have been most extensively studied are somatostatin receptors (SSTR). Five different SSTR subtypes have been identified in humans and the presence of receptors have been widely used for both diagnostic and therapeutic purposes. In the past two decades, the employment of somatostatin analogues labelled with 111Indium has been successfully used to image NET by means of SPECT (SRS). With the advent of PET, that presents a higher spatial resolution as compared to SRS, it is now possible to image NET with an even higher accuracy. In fact, PET imaging of NET is a rapidly evolving field closely connected to the development of novel positron radiopharmaceuticals. NET can be easily visualised on PET scans using an array of both metabolic and receptor-based tracers. 18 F-DOPA and 68Ga-DOTA-peptides (DOTA-TOC, DOTA-NOC, DOTA-TATE) are very promising to image NET and consistent data are reporting PET imaging to be superior to other modalities (CT, MR, SRS). On the contrary, the role of 18 F-FDG is limited in well-differentiated NET, due to their low glucose metabolism and growth rate, while it still can provide valuable information in less differentiated tumours.
Learning Objectives:
1. To become familiar with PET imaging of neuroendocrine tumours with PET.
2. To understand the biochemistry.
3. To learn about challenges in advanced imaging of neuroendocrine tumours.

A-530 09:00

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

Prostate cancer is the second most common cancer of men in the western world. The use of hybrid imaging techniques for detection and staging of prostate cancer has become increasingly important over the past years. The combination of anatomical and functional information provided by PET with CT or MRI offers great potential for detection of metastatic or recurrent disease. To facilitate the use of hybrid imaging, new innovative and more specific tracers beyond FDG are mandatory. In the past years, several more targeted tracers have been developed. For prostate cancer imaging, the most important tracer was 18 F- or 11C-choline based. Recently, other tracers are becoming more popular. These include bombesin-labelled molecules, ligands aiming for the prostate-specific antigen (PSMA), and androgen receptor-targeting agents such as anti-3-18 F-FACBC. For detection of prostate cancer, multimodal imaging concepts are currently state-of-the-art. Multiparametric MRI is growing as standard procedure for patients suspicious for prostate cancer, especially after negative transrectal ultrasound biopsy. PET/CT represents the modality of choice for imaging of metastatic and recurrent disease. In the future, PET/MRI has the potential to replace these techniques for detection and staging of prostate cancer because of the advantage of excellent morphological and functional multiparametric imaging in a one-stop-shop setting. Another advantage of PET/MRI compared with PET/CT is the lower radiation exposure of the patients, which is important for those patients being under active surveillance of prostate cancer.
Learning Objectives:
1. To learn about tracers for PET imaging of prostate cancer.
2. To learn about advanced MRI imaging of prostate cancer.
3. To consolidate knowledge in PET/MR imaging of prostate cancer.

A-531 09:30

C. Coronary atherosclerotic plaque
M.R. Dweck; *Edinburgh/UK (mdweck@staffmail.ed.ac.uk)*

Recent studies have demonstrated the utility of several different positron emission tomography (PET) tracers over and beyond 18 F-FDG for assessing the coronary arteries. This talk will review these tracers and in particular focus upon 18 F-fluoride. 18 F-fluoride has been used as a bone tracer for many years but also holds value in the vasculature as a marker of microcalcification. Indeed, in the coronary arteries it appears to identify culprit and high-risk lesions at risk of rupture and causing myocardial infarction.
Learning Objectives:
1. To learn about tracers for PET imaging of atherosclerosis.
2. To learn about advanced MRI imaging of atherosclerosis.
3. To consolidate knowledge in PET/MR imaging of atheroscperosis.

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

E³ - ECR Academies: Modern Imaging of the GI Tract

E³ 1422

Inflammatory bowel disease

Moderator:
S.A. Taylor; London/UK

A-532 10:30

A. Cross-sectional imaging protocols
M.A. Patak; *Zurich/CH (Michael.Patak@hirslanden.ch)*

The aim of this lecture is to give an overview of the techniques for imaging inflammatory bowel disease (IBD) of the small bowel and the colon with either ultrasound (US), multidetector-row computed tomography (MDCT) or with magnetic resonance imaging (MRI) and compare the different modalities for its strength and weakness. Optimal imaging of the bowel begins with the preparation phase. The small bowel has to be distended for a technically optimal examination. This is mainly done orally, which is named enterography. A solution of 2.5% mannitol seems to be the one preparation technique mostly used for small bowel distension. The comparative advantages and disadvantages of different preparation methods will be discussed. The proposed intraluminal contrast gives a neutral contrast in CT and a biphasic signal in MR. The colon can be prepared in a fashion similar to colonoscopy meaning total cleansing. Another possibility is the so-called faecal tagging whereas the stool will be contrasted with an additive to standardised food. Therefore, no cleansing is needed for preparation. Imaging parameters will be discussed for MR and CT. The aim of imaging for the bowel should be to establish the following: 1) presence, severity, and extent of disease; 2) activity of the disease and 3) extra-intestinal complications. US, MR and MDCT have proven to be a good tool to evaluate the extent, the activity of the disease and the presence of extraluminal complications. Pros and cons of when to use which technique will be discussed.
Learning Objectives:
1. To understand state-of-the-art MRI, CT and US protocols for imaging IBD.
2. To appreciate the comparative advantages and disadvantages of enterography and enteroclysis protocols.
3. To learn about protocol modifications when evaluating the colon.

A-533 10:50

B. Small bowel disease
J. Stoker; *Amsterdam/NL (j.stoker@amc.uva.nl)*

Classification of small bowel Crohn's disease is helpful for assessing disease activity and treatment monitoring. Similar to clinical-based classification also imaging-based classification systems have been developed of which some have been externally validated. Important imaging features for determining disease activity include bowel wall thickness and vascularity/enhancement; at MRI also wall oedema plays a role. Stenoses, fistulas and abscesses are important sequels. For assessment and monitoring of small bowel disease activity, ultrasound is readily available and gives detailed local information but is limited by the restricted field of view, communication of results to clinicians and comparison of examinations in time. Computed tomography (CT) is fast, readily available and gives a detailed, reproducible overview, but radiation exposure and contrast resolution are limitations. Magnetic resonance imaging combines a good, reproducible overview with high-contrast resolution, dynamic information and no radiation exposure and is, therefore, preferable in many situations, but the longer examination times than for CT, availability and costs are limiting factors. For the diagnosis of stenoses, fistulas and abscesses either technique can be used, although the unrestricted view of CT and MRI favour these techniques in many situations. In acute situations, US and CT are more accessible than MRI. In that setting US can be considered, but when the

examination is inconclusive or the patient has clear inflammatory signs, CT is preferable.
Learning Objectives:
1. To learn about the classifications of small bowel Crohn's disease.
2. To become familiar with cross-sectional imaging signs of disease activity and complications.
3. To understand a rational deployment of cross-sectional imaging techniques according to clinical indication, highlighting the main advantages and disadvantages of CT, MRI and US.
Author Disclosure:
J. Stoker: Consultant; Robarts Clinical Trials.

A-534 11:10

C. Colitis
J. Rimola; *Barcelona/ES (jrimola@clinic.ub.es)*

Endoscopy is currently considered the reference standard for the evaluation of colonic disease activity in patients with inflammatory bowel disease (IBD). However, it only allows evaluation of the mucosal surface and is not always complete. It cannot, therefore, help to estimate the depth of involvement of transmural inflammation and extraluminal complications, both characteristics of IBD. An evolving role of cross-sectional imaging for the evaluation of patients with IBD is increasingly recognised, especially in the setting of Crohn's disease (CD) since the cross-sectional imaging has demonstrated to have a high diagnostic accuracy not only for assessing the presence and extension of luminal disease but also for evaluating the CD-related acute or chronic complications. Available evidence suggests that ultrasound, computed tomography and magnetic resonance have similar and high diagnostic accuracy for the detection of disease activity, location, severity, and complications, particularly for penetrating and stricturing lesions which are characteristic of CD. Thus, the choice of the technique for assessing CD may be influenced by local availability or expertise. In case of ulcerative colitis, cross-sectional imaging, although less evaluated, may also be helpful in certain circumstances. There is evidence indicating that cross-sectional imaging is a problem-solving tool as alternative to endoscopy whenever tissue sampling is not required, that can provide a valuable guidance for performing medical and surgical treatment with maximised efficacy and safety. Overall, findings from cross-sectional imaging accurately reflect disease activity and provide reliable information for decision-making and patient care optimisation.
Learning Objectives:
1. To learn about the cross-sectional imaging features of colitis.
2. To become familiar with differentiating infectious, inflammatory and ischaemic conditions based on cross-sectional imaging criteria.
3. To appreciate an integrated approach to the use of cross-sectional imaging in colonic inflammatory bowel disease.

A-535 11:30

D. Interactive case discussion
S.A. Taylor; *London/UK*

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

ESR meets the Republic of Korea

EM 3
CT in lung cancer screening and COPD evaluation

Welcome by the ESR President:
L. Bonomo; Rome/IT
Presiding:
B. Hamm; Berlin/DE
T.-H. Lim; Seoul/KR

A-536 10:30

Introduction: Korean Society of Radiology - evolution and new challenges
T.-H. Lim; *Seoul/KR (d890079@naver.com)*

The Korean Society of Radiology which was established in 1945 is the official society representing all physicians of Korea in the field of Radiology. The Korean Society of Radiology (KSR) is the best society in Korea leading Asia-Pacific Radiology. Approximately 3700 members are registered, including over 3000 specialists and around 600 residents. The KSR is headed by a President (Tae-Hwan Lim), Board of Councillors and Board of Directors. The KSR committees are for planning, scientific, board examination, training, information & communication, international liaison, clinical practice guidelines, ethics, health policy and practice, health insurance, medicolegal affairs, public communication, accreditation, radiation safety and editor-in-chief (KJR). Subspecialty groups in the KSR include 10 subspecialty societies of all radiological fields. The key strategic mission of KSR is 'Active collaboration' through knowledge, service, responsibility, communication and justice. Strengthening communication, collaboration and coordination across international radiologic professional bodies will eventually lead to improved academic radiology and clinical care for patients. Since 2008, KSR has initiated numerous international outreach programs within Asia to promote collaboration and serve as venue for networking between Asian radiologic societies. This 'ESR meets' program provides opportunity for KSR to expand our international outreach further. For radiology in the future, we will go back to the basics, and open the era of "patient-centered, evidence-based radiology." In other words, we have to think deeply about the plain truth that all medical practice should start from a patient-centered mind and that all medical decision making should be based on evidence.
Session Objectives:
1. To learn about smoking-related pulmonary diseases.
2. To discuss the role of CT in lung cancer screening and COPD.
3. To learn about recent results of clinical trials in lung cancer screening and COPD.

A-537 10:35

Lung cancer screening in Korea
K.S. Lee; *Seoul/KR (smc7629@skku.edu)*

Lung cancer (LCA) screening was performed in 12427 symptomless Asian subjects using either LDCT (5771) or CXR (6656) in a non-trial setting. The number of patients with screening-detected LCAs and their survival were compared between LDCT and CXR screening with the stratification of risks for LCA. In non-high-risk group (< 30 pack years), significant difference was observed for the detection of LCA (0.94% vs. 0.24% in LDCT and CXR group; $P < 0.001$) and survival (hazard ratio of survival between two groups, 0.08; CI, 0.01 to 0.62; $P = 0.015$). No difference in detection or survival of LCA was noticed in high-risk group. LCAs in non-high-risk group were predominantly adenocarcinomas (96%) appearing as a part-solid or non-solid nodule compared with those in the high-risk group ($P = 0.023$). In female never-smoker group, LDCT screening allowed higher detection (2.09% vs. 0.26%; $P < 0.001$) and better survival (100.0% vs. 70.0%, $P = 0.003$) than CXR screening. In non-high-risk group of Asian population, LDCT screening detects more LCAs and offers better survival than CXR screening, with better detection of part-solid or non-solid lung adenocarcinomas in non-smoking women. In terms of public and nationwide measure for LDCT screening for lung cancer, we just started launching establishment committee for LDCT screening, and the committee recommended it as a category of recommendation grade B (recommend the LDCT as a screening test for LCA, but to perform the screening or not depends on national budget status and other fiscal conditions).
Learning Objectives:
1. To understand issues related to cancer screening.
2. To learn about the results of recent clinical trials of lung cancer screening.
3. To present the situation and results of lung cancer screening in Korea.

A-538 10:55

Interlude: Republic of Korea (South Korea): Korean people and culture
J. Hur; *Seoul/KR (khuhz@yuhs.ac)*

The Korean Peninsula is located in North-East Asia. It is bordered by the Amnok River (Yalu River) in the northwest, separating Korea from China, and the Duman River (Tumen River) in the northeast which separates Korea from both China and Russia. Because of its unique geographical location, Korea is a very valuable piece of land and an international hub of Asia. The Korean Peninsula is divided between north and south, making Korea one of the only divided countries in the world. The following information is about the Republic of Korea. The country's population reached 51.20 million in April 2014 (Ministry of Security and Public Administration), with a large proportion living in major metropolitan areas. Interest in Korea, triggered by the success of leading Korean dramas and popular music, continues to escalated to include a host of other aspects of Korean culture, such as hangeul (Korean alphabet), hansik (Korean food), hanbok (traditional Korean clothing), hanok (traditional Korean houses), hanji (traditional Korean paper), as well as Korean music. In Korea, the aforementioned six cultural symbols are collectively referred to as "Han Style". South Korea's historical tourist attractions include the ancient capitals of Seoul, Gyeonju and Buyea. Some natural landmarks include the peaks of the Baekdudaegan, particularly Seorak-san and Jiri-san, the caves of Danyang and Hwanseongul, and beaches such as Haeundae and Mallipo. Jeju island is the first natural property in Korea to be listed as a World Heritage site of the UNESCO World Heritage Committee.
Learning Objectives:
1. To briefly introduce Korean culture, food and people.
2. To introduce unique tourist attractions in Korea.

A-539 11:00

Computer-aided nodule detection and volumetry: role in lung cancer screening

J.M. Goo; *Seoul/KR (jmgoo@plaza.snu.ac.kr)*

Lung nodules are the major radiologic finding of primary and metastatic lung cancers. Recent lung cancer screening trials revealed that the lung cancer mortality can be reduced by applying low-dose CT in high-risk patients and many studies suggest that computer-aided detection (CAD) can help improve the diagnostic performance of radiologists in their image interpretations. Because a large proportion of the nodules detected on screening CT are smaller than 4 mm in diameter and most of them are benign, determining the malignancy of nodules by nodule characterisation is crucial. Computer-aided volumetry provides more accurate and reproducible measurement of nodules than manual measurements. As the measured difference in nodule volume between two time points includes both the true nodule change and variability due to measurement errors, the most essential question may be how we can identify the threshold for classifying the changes in volume as being medically meaningful. Many studies evaluated with a same-day repeat CT indicate that an increase in measured volume by 25% has a 95% likelihood of reflecting true nodule growth rather than measurement variability. From a technical point of view, CT scans should also be obtained with the same protocol that is used for the nodule volumetry, and experts should carefully review the segmentation results.

Learning Objectives:
1. To understand basic ideas of computer-aided nodule detection and volumetry.
2. To learn the results of computer-aided nodule detection and volumetry in nodule management.
3. To discuss the measurement variability and related issues in nodule volumetry.

A-540 11:20

Interlude: Introduction of the Korean Society of Thoracic Radiology (KSTR)

J. Hur; *Seoul/KR (khuhz@yuhs.ac)*

The Korean Society of Thoracic Radiology was established in 1988. The mission of the Society is to promote and develop the highest standards of thoracic radiology and related sciences through academic communication, research and education in Korea. The Society also seeks to foster closer fellowship among members. The society has grown rapidly during the recent 20 years. The number of members of the Society is 366. Members of the KSTR have actively participated in international meetings including RSNA, ECR, and ARRS. We also have participated in subspecialty meetings including STR, ESTI, Fleishner Society Meeting. Many distinguished members have participated in those meetings as presenters, lecturers and modulators. The society plays a leadership in establishing Asian Society of Thoracic Radiology. The Korean Society of Thoracic Radiology has launched the web-based remote learning program, named "Weekly Chest Cases", devoted to the education in thoracic radiolog (http://kstr.radiology.or.kr/weekly/index2.php). The editorial committee of the Korean Society of Thoracic Radiology selected several key images of submitted cases, which are posted with brief history every week. The readers are recommended to submit their opinions and diagnosis through e-mail. Two weeks after posting each case, the correct answer, along with brief discussion about the radiological findings, pathology, and differential diagnosis is presented. Since November 1997, the Society has posted over 600 quiz cases, encompassing most diseases in thoracic radiology. In 2008, 350 visitors from 38 countries responded to the quiz with an e-mail. The Society annually awarded a prize to the top-ranked answerers.

Learning Objectives:
1. To introduce the Korean Society of Thoracic Radiology (KSTR).
2. To introduce the "Weekly Chest Cases" website.

A-541 11:25

CT in COPD: now and future

J.B. Seo; *Seoul/KR (seojb@amc.seoul.kr)*

In recent studies on COPD, CT has been accepted as one of important research tools in evaluating disease severity and characteristics. The extent of low attenuation area and bronchial wall thickening at segmental and distal level on volumetric CT scan acquired at suspended inspiration state are commonly used as useful markers for evaluating the severity of emphysema and airway wall inflammation, respectively. The clinical values of these two imaging biomarkers are as follows: 1) many recent studies have proved that the extent of emphysema and bronchial wall thickening are independently related with the degree of airflow limitation. 2) The extent of emphysema is correlated with other clinical parameters such as osteoporosis, exercise capacity, respiratory symptoms and most importantly with BODE index, which is known to be one of the best predictors of mortality. 3) Both parameters may be useful in subgrouping/phenotyping of patients, prediction of treatment response, and prediction of disease progression. 4) Both parameters are related with frequency of exacerbation. However, volumetric CT, with its superior spatial resolution and superior contrast, has many additional evaluation potentials in assessment of COPD. They include (1) assessment of air trapping by direct anatomical matching of inspiration and expiration CT, (2) assessment of peripheral vascular changes in COPD, (3) assessment of diaphragmatic morphology, and (4) direct visualisation of ventilation and perfusion function with dual energy CT technique. In this talk, those new CT analysis methods will be introduced with their preliminary clinical research results.

Learning Objectives:
1. To know the current role of CT in clinical practice of COPD.
2. To know the early results of clinical researches in quantification of emphysema and airway wall inflammation with CT of COPD.
3. To know several new potential CT techniques in evaluating COPD, such as analysis of peripheral vascular changes, air trapping, diaphragmatic morphology and so on.

11:45

Panel discussion: Is CT an effective tool for management of lung cancer screening and COPD?

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

RTF - Radiology Trainees Forum

TF 1

Highlighted Lectures

Moderators:
M. Basta-Nikolic; Novi Sad/RS
C.A. Minoiu; Bucharest/RO

A-542 10:30

Ischemic cardiomyopathy - coronary arteries and myocardium: two sides of the same coin?

R. Marano; *Rome/IT (riccardo.marano@rm.unicatt.it)*

The coronary artery disease (CAD) is the disease with the greatest prevalence and incidence and the primary cause of death in the western countries, with a broad spectrum of clinical symptoms ranging from atypical chest pain or stable angina to sudden cardiac death. The key elements to approach patients with suspected or known coronary heart disease (CHD) include the coronary arteries from one side and the myocardium from the other. The former approach is focused on the detection or rule out of significant CAD and assessment of the so-called coronary plaque burden recognising in the multi-detector CT coronary angiography (MDCT-CA), the main non-invasive diagnostic tool. The latter approach is mainly focused on the haemodynamic and downstream effects of a coronary stenosis and recognises the cardiac MR as the standard of reference for the assessment of myocardial function, perfusion, stress, and viability. The lecture will focus on characteristics, appropriateness criteria, and clinical indication for both diagnostic tools, on the main differences in comparison with cardiological and nuclear tests underlying what a modern radiologist should know about ischaemic heart disease.

A-543 11:00

MRI appearances of incidental focal liver lesions: role of hepatocyte-specific contrast agents and DWI

S. Gourtsoyianni; *London/UK (sgty76@gmail.com)*

Most commonly encountered focal liver lesions in non-cirrhotic patients and their typical MRI characteristics will be reviewed. Different available MRI contrast mechanisms including hepatocyte specific contrast agents and DWI acquisition protocols (optimal b values, optimal sequences) will be discussed. Focus will be placed on how DWI and hepatocyte specific contrast agents can aid in characterisation of focal liver lesions and differentiation between benign and malignant lesions (mainly liver metastases).

Learning Objectives:
1. To learn about typical MRI imaging characteristics of the most commonly encountered focal liver lesions in non-cirrhotic patients.
2. To become familiar with different available MRI contrast mechanisms; including hepatocyte-specific contrast agents and DWI acquisition protocols.
3. To appreciate additional information that can be gained towards the detection and characterisation of focal liver lesions when using the aforementioned contrast mechanisms.

A-544 11:30

Radiology and sports injuries: more than reading the image!

M. Maas; *Amsterdam/NL (m.maas@amc.nl)*

Sports radiology is becoming an increasingly important subspecialty of MSK radiology. Yet no curriculum for sports radiology exists. In this session, a case-based approach is used to enhance our experience in multimodality, multidisciplinary teamwork in a centre of excellence, accredited by International Olympic Committee. Injured athletes are presenting with two types of injuries: acute or overuse related. This presentation will show both types of injuries. Special focus on stress fractures and muscle injuries will be presented interactively. The choice of imaging strategy or imaging protocol needs to be individualised to the specific needs of the case presented. The sports radiologist holds competencies in all domains of CanMeds. Besides multimodality expertise, a genuine interest in sports and athletes (people) is needed. Since biomechanics of trauma or trainings is crucial for expert care, anamneses is taken by radiologist. However, there always is a significant sense of urgency. This implies that the radiology team (secretary, technicians, radiology staff) needs to be flexible. No athletes are alike, so no injuries are alike, thus Tailor-made radiology.

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

E³ - European Diploma Prep Sessions

E³ 1423
Gastrointestinal and abdominal

A-545 10:30

Chairman's introduction

C. Stoupis; *Männedorf/CH (c.stoupis@spitalmaennedorf.ch)*

The role of radiologist in the diagnosis of abdominal diseases is crucial. Knowledge of the key imaging features of the different abdominal disorders including the benign and malignant lesions of the parenchymal organs and the GI-tract, based on the underlying anatomy, physiology and pathology is essential to approach the correct diagnosis. Awareness of strengths and limitations of the different imaging techniques will increase the diagnostic confidence of radiologist, providing important information about lesion detection and characterisation and will guide to the specific diagnosis and the decision making in patient management.

Session Objectives:

1. To describe typical imaging features of benign and malignant lesions of the heaptobiliary system.
2. To differentiate the imaging features of benign and malignant lesions of the pancreas and spleen.
3. To be familiar with the methodological basis and to differentiate typical features in imaging examinations of the gastrointestinal tract.

A-546 10:33

A. Hepatobiliary system

Y. Menu; *Paris/FR (yves.menu@sat.aphp.fr)*

The radiologist is a leading person in hepatobiliary imaging. He is involved in the vast majority of diseases, and is also instrumental in defining strategies. Three clinical situations are cornerstones in hepatobiliary imaging. 1) Focal liver lesions (FLL): ultrasound (US) is an excellent detector for FLL. Characterisation is excellent for fluid-filled lesions, and only fair for solid lesions. However, in many situations, such as incidental lesions, US may be sufficient to characterise typical haemangioma. In other cases, additional information is required. In most cases, MRI is the second step, because it characterises focal nodular hyperplasia and provides useful arguments for other solid tumours, either benign (adenoma) or malignant. Contrast enhanced US is an alternative when available. CT remains the workhorse for staging/follow-up of cancer, due to its whole body imaging capacity. The attendees will learn the main steps of decision-making in liver tumours. 2) Diffuse liver disease are increasingly considered as important to detect and treat. Morphological changes related to hepatitis/cirrhosis should be identified. Fat/iron content is routinely evaluated and graded with MRI. Elastography (US/MRI) is a promising method for fibrosis. The attendees will learn to drive these tools. 3) Biliary diseases: US is the preferred initial method. However, CT (especially in malignant diseases) and MRI (especially for stones and inflammation management) are complementary to US. Invasive methods are not any more necessary for detection or staging, and are now reserved for intervention. The attendees will learn about step by step imaging strategy.

Learning Objectives:

1. To differentiate the anatomy, normal variants and congenital disorders of the hepatobiliary system.
2. To describe the primary and secondary imaging features of acute and chronic diffuse liver diseases.
3. To differentiate the causes and imaging features of benign and malignant focal liver lesions, including cysts, hemangiomas, adenomas, focal nodular hyperplasia, hepatocellular carcinomas and metastases.
4. To differentiate the various causes and imaging features of benign and malignant diseases of the biliary tract and gallbladder.

A-547 11:02

B. Pancreas and spleen

W. Schima; *Vienna/AT (wolfgang.schima@khgh.at)*

In general, contrast-enhanced MDCT is the main pillar of pancreatic imaging, and MRCP is very valuable for assessment of the ductal system. There is a variety of anatomic variants and anomalies of the pancreas and the ductal system. Pancreas divisum and annular pancreas are the result of either failure of fusion or of rotation of the pancreas anlagen during the fetal period. Both anomalies may result in significant morbidity. Contrast-enhanced MRI is the technique of choice for visualisation of small tumors in patients with equivocal CT findings. Ductal adenocarcinoma is by far the most common malignant tumour of the pancreas, with approximately 80% of patients having non-resectable (advanced) disease at the time of diagnosis. For cystic lesions, a wide differential diagnosis exists: from benign pseudocysts to benign, borderline and invasive malignant neoplasms. Contrast-enhanced MRI is the technique of choice for characterisation of these lesions and to guide follow-up in these patients. Acute pancreatitis is classified as interstitial oedematous or necrotising pancreatitis according to the revised Atlanta classification, which has brought a consistent terminology for fluid collections and complications of pancreatitis. Imaging of splenic masses is one of the less estimated tasks in abdominal radiology. The reason for this is that the imaging appearances of many splenic lesions may overlap, which makes noninvasive characterisation quite challenging. However, imaging findings of the most important benign lesions such as haemangiomas, hamartomas, and abscesses should be familiar. If noninvasive characterisation of focal splenic lesions is not possible, US-guided biopsy may be of help.

Learning Objectives:

1. To describe the anatomy, normal variants and congenital disorders of the pancreas.
2. To differentiate the causes and imaging features of benign and malignant pancreatic tumours.
3. To understand the imaging features of acute and chronic pancreatitis and its potential complications.
4. To list the causes and imaging features of focal and diffuse splenic abnormalities.

A-548 11:31

C. Imaging of the gastrointestinal tract

R.G.H. Beets-Tan; *Maastricht/NL*

Fluoroscopy, US, CT and MRI are the cornerstones in GI tract imaging. Fluoroscopy has a role in congenital anomalies and functional disorders of GI tract. Transabdominal US is accurate to detect appendicitis and abdominal free fluid and fluid/abscess collections. Contrast-enhanced CT identifies post-traumatic complications such as lacerations, the causes of bowel obstruction and dilatation. CT shows postoperative complications such as leakage of surgical anostomosis, abscesses, internal herniation, bowel strangulations and bowel ischemia. Inflammation of the bowel, diverticulitis, epiploic appendagitis are well detected on CT. In recent years, MR enterography has gained field for the assessment of Crohn's disease activity and extent. Endoscopic US is the mainstay in staging oesophageal and gastric tumours, CT is the method of choice for local and distant staging of duodenal, small and large bowel tumours, while endorectal US and MRI have been widely adopted for staging of rectal tumours. This lecture will help the attendees to understand the various GI diseases and its imaging features.

Learning Objectives:

1. To differentiate the anatomy, normal variants and congenital disorders of the oesophagus, stomach, duodenum, small bowel, colon, rectum and anal canal.
2. To describe the imaging features of colonic diverticulosis, diverticulitis, tumour stenosis, ileocolic intussusception, colonic fistula, paracolic abscess, epiploic appendagitis, intra-peritoneal fluid collection, colonic pneumatosis and pneumoperitoneum.
3. To understand radiological manifestations of inflammatory bowel diseases, malabsorption syndromes, infection and bowel ischemia.
4. To be familiar with the the staging of tumours of the gastrointestinal tract, including features that indicate nonresectability.

10:30 - 12:00 **Studio 2015**

E³ - Rising Stars Programme

Basic 5: Thoracic emergencies

A-549 10:30

Vascular

T. Jargiello; *Lublin/PL (tojarg@interia.pl)*

Thoracic emergency cases caused by vascular pathologies can be divided into two groups: post-traumatic and non-traumatic. Post-traumatic vascular injuries are mainly aortic ruptures due to blunt chest trauma. The direct injuries of aorta or superior vena cave are not common. Non-traumatic vascular emergencies in the thorax are more complex. The most frequent pathology is pulmonary embolism (PE) and aortic dissection, also pulmonary bleeding and superior vena cava syndrome; they all may lead to sudden or immediate death. Like in other emergency situations, plain x-ray and CT are the imaging modalities of choice, because of being fast, accurate and available. The use of US is limited in chest, MR imaging lasts longer than CT, is less available and it needs special patient's conditions hardly obtained in trauma patients. Angiography is used when intervention in planned. Minimally invasive techniques of interventional radiology have much to offer as a treatment of vascular thoracic emergencies. Stent grafting of descending aortic aneurysms and acute dissections is stated as a gold standard. Vena cava filters may save life in PE patients and stent implantation in cases of SCV obstruction is an easy way to prevent life-threatening conditions. Finally, percutaneous embolisation of pulmonary bleeding is as effective as open surgery but definitely less invasive.

Learning Objectives:

1. To define and review pathologies causing thoracic vascular emergencies.
2. To review imaging techniques in diagnosing thoracic vascular disorders.
3. To show treatment possibilities by methods of interventional radiology.

A-550 11:00

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-551 11:30

Cardiac

V.E. Sinitsyn; *Moscow/RU (vsini@mail.ru)*

Today cardiac radiology plays an important role in management of patients presenting with syndrome of acute chest pain. Timely diagnosis of acute coronary syndrome (ACS) is one of the top priorities in clinical triage of such patients. It is related to high incidence of this syndrome (it includes unstable angina and acute myocardial infarction (AMI) and high mortality related to missed and untreated cases of ACS. Due to technical progress of cardiac CT angiography (CTA) this modality has already gained an established role in diagnostic approach to patients with probable ACS. Cardiac CTA can detect or exclude the presence of significant coronary lesions causing ACS. Acute MI in most cases could be detected with CTA. According to existing guidelines CTA is recommended in cases of suspected acute coronary pathology with low or intermediate probability of ACS or MI. In patients with verified AMI routine use of cardiac CTA is not justified. Radiologists should be aware of cases of acute chest pain, caused by cardiac non-coronary diseases such as acute myocarditis, pericarditis and some cardiomyopathies (Tako-Tsubo syndrome). CTA can be helpful in some of these patients but cardiac MRI is an established method of choice for these pathologies. Cardiac MRI, combining studies of myocardial perfusion and viability, also can be used for diagnosis of ACS. Several clinical studies have proven that appropriate use of cardiac CTA and MRI increase accuracy of diagnosis, provide time gain and save costs in patients with acute chest pain of cardiac origin.

10:30 - 12:00 **Room L 1**

ESR Patient Advisory Group for Medical Imaging (ESR-PAG)

ESR-PAG 1

The challenges of providing true patient-centred care: moving forward together

A-552 10:30

Chairmen's introduction

N. Bedlington[1], P. Cavanagh[2]; [1]*Vienna/AT*, [2]*Taunton/UK*

At the ECR 2013, the ESR patient advisory group for medical imaging was established. The group comprises of seven patient representatives and five ESR representatives. The group has identified six core aims, including the commitment to "ensure that a patient-centred, 'human' approach is embedded in the work of ESR." The patient advisory group thus has been collaborating closely with the ESR audit and standards subcommittee on the development of a 'driver diagram on patient-centred care'. The session will introduce the driver diagram, providing a framework on how to embed patient-centred care within radiology departments and should provide a platform to examine the ethics behind patient-centred care from the perspective of the patient and the radiologist.

Session Objectives:

1. To introduce a framework for delivering patient-centred care in radiology.
2. To understand the need for balance between professional responsibility and patient autonomy.
3. To understand the patient's needs and concerns.
4. To become familiar with methods and examples of good practice and how to improve the patient-doctor relationship.

A-553 10:40

Ethics in patient-centred radiology

C.D. Claussen[1], G. Marckmann[2]; [1]*Tübingen/DE*, [2]*Munich/DE (claus.claussen@med.uni-tuebingen.de)*

While in many medical disciplines ethical dilemmas, e.g. concerning life and death are quite frequent and often spectacular, the ethical issues in radiology are less visible. At the core, it is the challenge to provide high-technology services in a patient-centred manner, guided by professional competence and the best interest of the patient. Like any other physicians, radiologists can get ethical orientation in their practice by the widely established four principles of biomedical ethics: beneficence (maximise patient well-being), non-maleficence (avoid or at least minimise harm), respect for patient autonomy and justice. These four principles define physicians' ethical obligations towards individual patients and society and can guide radiologists in dealing with the more subtle ethical dimensions of their practice. How can individual patient preferences be respected if the radiologist has no (continuous) personal relationship to the patient? How shall radiologists deal with the increasing number of incidental findings due to improved imaging technologies, especially in clinical research? Teleradiology involves ethical (and practical) issues such as confidentiality, data security, competence, and interprofessional and professional-patient relationships. The presentation will discuss some of these ethical dimensions of radiological practice and provide perspectives on how radiologists can deal with them in an ethically sensitive and responsible way. The European society of radiology code of ethics will be presented as a way to more specifically define radiologists' ethical obligations.

Learning Objectives:

1. To learn about the basic ethical principles that guide patient-centred medical practice.
2. To understand some of the more specific ethical issues that arise in clinical radiology.
3. To develop perspectives of how to deal appropriately with these ethical issues in daily practice.

A-554 11:00

Lost in radiology: is there a doctor in the department?

E. Briers; *Hasselt/BE (erikbriers@europa-uomo.org)*

Medical imaging is becoming more and more important in the diagnosis of diseases. It is long since radiology and x-rays were only associated with broken bones and for the well informed with tuberculosis. Today imaging possibilities and techniques allow for precise diagnosis of diseases such as cancer, diseases to the brain, heart and circulatory system and much more. Together with laboratory medicine imaging is the cornerstone of modern diagnosis. In the radiology department the patient only sees assistants and very often refers to them as doctor. It is the assistant that is informing the patient on the position during the imaging, the length of the investigation

eventual contrast injections and waiting time. In this structure the patient will most often passively undergo the process. Very often the fact that the imaging session is prescribed by the clinician is seen as an informed consent. But, this can only be accepted as such if the patient is informed on the why, the how and the expected outcome. For the patient it is imperative to know that the imaging session will contribute to the quality of his care. The expected outcome (of imaging) should improve his treatment and make it more precise. Even, the overall outcome of his treatment should be better and more optimal with imaging than without it. For the patient who needs it, there should be a radiologist on call at all times ready to all questions on the radiological procedure that the patient may have.

Learning Objectives:

1. To understand the patient's needs and concerns.
2. To learn about the importance of informed consent (raise awareness and knowledge for medical imaging methods).
3. To become familiar with methods and examples of good practice and on how to improve the patient-doctor relationship.
4. To appreciate the contributions patients and their representatives can bring to realise true patient-centered care.

A-555 11:20

An ESR framework for delivering patient-centred care in radiology's services

P. Cavanagh; *Taunton/UK (petecavanagh@gmail.com)*

The patient journey through a diagnostic imaging service can be daunting regardless of the investigation or procedure to be undertaken. A key component of the quality of the service provided is that it should be centred on the patient's needs, not just those dictated by their medical presentation but also their psychosocial well-being. To be able to deliver such care requires a structured approach to understanding the patient journey by obtaining feedback at input from the patients and users of the service. In addition, there needs to be a strong focus on clear and open communication at all stages. This presentation introduces a framework developed by the ESR to help departments deliver such care.

Learning Objectives:

1. To comprehend existing good practice regarding patient-centred models in radiology.
2. To understand the concept of driver diagrams in quality improvement.
3. To introduce this approach in patient-centred care.

11:40

Panel discussion: on the 'driver diagram for patient-centred care in clinical radiology'

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

Plenary Session

HL 3

Nikola Tesla - Honorary Lecture

Presiding:
B. Hamm; Berlin/DE

A-556 12:15

Brain tumour update 2015: what's new and why you should care

A.G. Osborn; *Salt Lake City, UT/US (anne.osborn@hsc.utah.edu)*

The traditional classification of brain tumours is based primarily on histopathologic features. Every seven years since 1974, the world health organization (WHO) has convened a consensus panel of world-renowned neuropathologists to update its famed "blue book" classification of CNS neoplasms. New tumour entities are codified and existing entities clarified in this highly predictable septennial event. The eagerly awaited 5th edition should have been published in August, 2014, but was not. What happened? The cancer genome atlas (TCGA) project has revolutionised oncology and has resulted in rapid evolution of molecular profiling of neoplasms in all body parts, from the breast to the brain. In this lecture, we will review the implications of the evolving CNS tumor genomics for radiologists and ask the questions: what do we REALLY need to know in 2015 about the new molecular classifications of brain tumours? Are there imaging findings that can serve as preoperative surrogate markers for some common brain neoplasms?

Learning Objectives:

1. To understand the crucial importance of molecular profiles in the new integrated approach to the diagnosis of brain tumours.
2. To appreciate the importance of molecular profiling in stratifying patients for treatment decisions.
3. To be able to identify which imaging features may suggest the preoperative diagnosis of specific tumor molecular subtypes ("radiogenomics").

Author Disclosure:
A.G. Osborn: Author; Elsevier, Amirsys. Board Member; Amirsys Inc, LLC, Amirsys Publishing, LLC. CEO; Amirsys Publishing, LLC. Consultant; Elsevier.

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

E³ - The Beauty of Basic Knowledge: Breast Imaging

E³ 25D

Ductal carcinoma in situ (DCIS): small tumour but big problem

Moderator:
J. Camps Herrero; Alzira/ES

A-557 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: Skeletal Radiology

E³ 24D

Tumoural and pseudotumoural MSK lesions

Moderator:
V. Cassar-Pullicino; Oswestry/UK

A-558 12:30

Tumoural and pseudotumoural MSK lesions

K. Verstraete; *Ghent/BE (koenraad.verstraete@ugent.be)*

1. Bone (pseudo)-tumours: the majority of bone tumours can be detected on plain radiography. The age of the patient, location of tumour in a bone and history of a pre-existing bone abnormality should be included in determining the likely diagnosis. Careful analysis of the pattern of bone destruction, periosteal reaction and matrix mineralisation allow for characterisation of most tumours and differentiation from pseudotumours. CT may be useful for osteoid osteoma and fibrous dysplasia and MRI is the best technique for further diagnosis and staging by displaying tumour composition and extent of bone marrow involvement, including skip lesions, presence and extent of extraosseous soft tissue mass, and involvement of neurovascular bundle, muscle compartments and adjacent joint. This allows to find the best biopsy and surgical approach. To evaluate local control of disease and for detection of

local recurrence, MRI is usually the best imaging technique. 2. Soft tissue (pseudo)-tumours: the majority of soft tissue tumours can be detected on ultrasound. Except for cysts and subcutaneous lipoma, MR will be the next imaging technique for diagnosis, local staging, and eventually to find the best biopsy and surgical approach. The age of the patient, location of the tumour and careful analysis of the signal characteristics on MRI allow for characterisation of many soft tissue tumours and differentiation from pseudotumours. Plain radiography and CT may be useful for detection of calcifications and myositis ossificans. To evaluate local control of disease and for detection of local recurrence, ultrasound and MRI are the best imaging techniques.

Learning Objectives:

1. To become familiar with the common pathological features of bone and soft tissue tumoural lesions.
2. To appreciate the imaging hallmarks of pseudotumoural bone and soft tissue lesions.
3. To learn how best to use imaging modalities in differential diagnosis.

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

E³ - ECR Academies: Interactive Teaching Sessions

E³ 1521

Skull base lesions

A-559 14:00

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 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 learn the anatomy.
2. To learn the most common lesions and their differential diagnosis.

A-560 14:45

B. Imaging of the central skull base

A.D. Varoquaux[1], A. Reyre[1], N. Martin-Duverneuil[1], F. Benoudiba[2], F. Dubrulle[3], G. Moulin[1]; [1]*Marseille/FR*, [2]*Paris/FR*, [3]*Lille/FR (Arthur.VAROQUAUX@ap-hm.fr)*

Central skull base has a complex anatomy and can be involved in various pathologies. Both MRI and CT provides complementary information for non invasive lesion assessement. The radiologist needs to know normal anatomy and the pathologic spectrum of this region determine the nature and extent of pathologic conditions witch 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 play 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 learn the anatomy.
2. To learn the most common lesions and their differential diagnosis.

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

E³ - ECR Master Classes (Abdominal and Gastrointestinal)

E³ 1526

Advances in liver imaging

Moderator:
F. Caseiro Alves; Coimbra/PT

A-561 14:00

A. Molecular imaging: where do we go?

F.M.A. Kiessling; *Aachen/DE (fkiessling@ukaachen.de)*

Molecular imaging research has maturated and research directions have been identified that have potential to exceed the proof of principle stage. Among those is the assessment of macrophage activity by their ability to internalise nano-sized agents. Although SPIO are currently not available for clinics anymore, there is still intense research on the use of alternative materials such as ferumoxytol. In particular for the delineation of malignant lesions in liver and lymph nodes and for the assessment of local inflammation, this strategy works favourably. Since nano-sized contrast agents are predominantly accumulated via EPR (enhanced permeability and retention) and MPS (mononuclear phagocytic system) either larger or smaller compounds are recommended for target-specific imaging. For example, micrometer-sized probes remain in the intravascular compartment, which makes them highly suited for targeting angiogenesis. In this context, VEGFR2-targeted microbubbles have been developed which currently are clinically evaluated. Besides their suitability to characterise breast and prostate cancer, VEGFR2-targeted microbubbles showed promise for the detection of malignant conversion of liver dysplasia in experimental models. Another option is to make molecular imaging compounds very small to have a large distribution space and fast renal clearance. Since small compounds cannot carry large signaling molecules, highly sensitive imaging modalities such as PET, SPECT, hyperpolarised MRI and optical imaging are required. In this talk, it will be discussed what has been learned from diagnostic and therapeutic probe development over the last decade and what impact these findings will have on the development of molecular imaging strategies and image-guided therapy.

Learning Objectives:

1. To describe the basics of perfusion and diffusion in the liver imaging.
2. To give an overview in clinical application on focal or diffuse liver disease.
3. To emphasise and illustrate the importance of functional imaging in routine clinical practice and its potential applications over morphology imaging in the future.

A-562 14:30

B. Liver perfusion or diffusion?

M. Ronot; *Clichy/FR (maxime.ronot@bjn.aphp.fr)*

Diffusion imaging is based on the movement of water molecules, and is considered an accurate biomarker of cellularity and tissular architecture. Perfusion imaging analyses the temporal variation of the tissular concentration of a tracer to obtain haemodynamics parameters on a microvascular level. Its analysis uses various mathematical models. Usefulness of liver perfusion or diffusion relies on the assumption that pathological processes, whether focal or diffuse, result in significant modification of diffusion and perfusion parameters. While diffusion imaging is part of the routine protocol of liver MR imaging, perfusion imaging is not, and is mostly performed in experimental and clinical research. In the liver, the two main clinical applications are liver oncology, and the assessment of diffuse and chronic liver diseases. Diffusion imaging is mostly used for the detection and characterisation of focal liver lesions, and perfusion imaging shows encouraging results, pointing out its potential use in liver tumours and chronic liver diseases, mainly for the early evaluation of anti-tumoural treatments and the staging of fibrosis. In the future, functional imaging will complete and reinforce morphological imaging, by providing earlier, and more accurate information. However, especially for perfusion imaging, acquisition, mathematical algorithms and post-processing must be standardised to increase clinical use and reproducibility to be considered reliable biomarkers.

Learning Objectives:

1. To describe the basics of perfusion and diffusion in the liver imaging.
2. To give an overview in clinical application on focal or diffuse liver disease.
3. To emphasise and illustrate the importance of functional imaging in routine clinical practice and its potential applications over morphology imaging in the future.

A-563 15:00

C. MR/PET: blessing or curse?

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

PET/MR unifies the complementary capabilities of MRI and PET in one imaging modality providing excellent, anatomic and morphologic information. It combines the high soft tissue and contrast resolution of MRI with the best possible molecular, functional and physiological information of PET, which are complementary. PET/MR has potential to offer the most diagnostic information in a single imaging study. PET/MR is particularly promising in liver diseases where MR is the modality of choice due to its high sensitivity and specificity in characterising focal lesions. PET/MR combines the high sensitivity of liver MRI with the molecular imaging information of PET providing in a single examination the most complete multi-parametric information, plus the benefits of whole body staging. In this presentation we will discuss the clinical applications of liver PET/MR in primary liver tumors, metastases and liver infections and comparing it with other established modalities such as PET/CT and MRI. We will also present examples of liver PET/MRI pitfalls and lessons learned in daily practice leading to an efficient workflow. The future of using biomarkers other than 18 F-FDG will also be explored.

Learning Objectives:

1. To give a specific overview of this imaging modality, expressing the cellular and functional applications of MR/PET.
2. To describe advantages and disadvantages over the other known single or fused imaging modalities (PET/CT, MRI, PET, Dual CT etc).
3. To emphasise the role of MR/PET in molecular and oncologic imaging.

Author Disclosure:

P.R. Ros: Equipment Support Recipient; Philips Healthcare.

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

E³ - ECR Academies: Modern Imaging of the GI Tract

E³ 1522

Rectal cancer

Moderator:
L. Blomqvist; Stockholm/SE

A-564 14:00

A. Imaging protocols

S. Gourtsoyianni; *London/UK (sgty76@gmail.com)*

Standardised, baseline MRI protocol for locoregional rectal cancer staging will be described. Normal appearances as well as morphological MR signal changes encountered in pelvic structures/tissues involved by primary rectal cancer at baseline staging as well as at imaging taking place after completion of neoadjuvant treatment will be illustrated. Influence of imaging findings/ MRI reporting on patient stratification and tailored therapeutic approach will be discussed. Potential limitations and capabilities of different imaging techniques will be discussed.

Learning Objectives:

1. To become familiar with state-of-the-art MRI and US protocols for rectal cancer staging.
2. To understand the normal appearances of the rectum and perirectal tissues on cross-sectional imaging.
3. To understand the advantages and disadvantages of imaging techniques in evaluating the rectum.

A-565 14:20

B. Challenges in staging, treatment decisions and surgery for high rectal cancer

L. Curvo-Semedo; *Coimbra/PT (curvosemedo@gmail.com)*

Rectal adenocarcinoma is not in itself a single entity since there is a significant difference between tumours located highly in the rectum and more distal cancers. In fact, high rectal cancers possess a proper biological behaviour (resembling in many ways sigmoid cancer) and as such they not only place specific problems in terms of diagnosis and staging, but also regarding the choice of treatment and the surgical approach itself. The upper portion of the rectum is not peritonealised and cancers arising there may be quite challenging to stage. Therefore, it is fundamental to use an adequate imaging protocol that should include a correct positioning of the slices with regard to the tumour itself. This could be quite tricky due to the more variable anatomy of the upper third of the rectum in comparison with the two distal thirds. The most relevant information provided by imaging for high rectal cancers may be related to the invasion of the peritoneal reflection, which is well seen on MRI, and also of adjacent organs since in that region the anatomical barrier of the mesorectum, which contributes to 'contain' the neoplastic growth, is not present. Regarding treatment, high rectal cancers are generally approached surgically in the same way sigmoid cancers are. Ultimately, they share with the latter a more favourable outcome when compared to low rectal cancers, possessing lower rates of local recurrence alone, local and distant recurrence, and death as a result of cancer.

Learning Objectives:

1. To learn about the clinical relevance of tumour height in rectal cancer.
2. To become familiar with the treatment options in high rectal cancer and their pros and cons.
3. To appreciate the challenges in staging high rectal cancer and approaches to improving staging accuracy.

A-566 14:40

C. Assessment after neoadjuvant treatment

R.G.H. Beets-Tan; *Maastricht/NL*

The standard treatment for advanced rectal cancer is preoperative chemoradiotherapy (CRT) followed by standard resection of the rectum and mesorectum. Neoadjuvant CRT allows downsizing and downstaging of the tumour, resulting in improved resectability and local control. While the role of MRI in rectal cancer treatment is recognized and MRI is recommended as part of the standard staging workup, its role for restaging after preoperative treatment is more debatable. This lecture will provide an understanding of whether MRI can assess treatment response in rectal cancer and how it can influence treatment decision. The attendees will learn about the performance of MRI in restaging of rectal tumours after CRT and its difficulties in image interpretation.

Learning Objectives:

1. To understand the role of imaging in treatment response assessment of rectal cancer.
2. To learn about imaging features which identify viable disease after chemo-radiation.
3. To appreciate the role of imaging in the modern management of patients with rectal cancer.

A-567 15:00

D. Interactive case discussion

L. Blomqvist; *Stockholm/SE*

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

Joint Session of the ESR and ESTRO

ESR/ESTRO 1

Non-surgical approach to early lung cancer: perspectives of imaging and radiation-based disciplines

Moderators:
T. Franquet; Barcelona/ES
Y. Lievens; Ghent/BE

A-568 14:00

Imaging requirements to guide non-surgical treatment in early lung cancer

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

The emerging role of CT as imaging biomarker to document the stepwise progression of early pulmonary adenocarcinoma is based on knowledge gained from lung cancer screening studies and studies with radio-pathological correlation. Categorisation in nonsolid, partsolid and solid determines frequency and length of CT follow-up to document lesion growth as indicator of malignancy. While PET has a role for solid lesions or lesions with a substantial solid component, its role is limited for assessment of partsolid or nonsolid lesions. The presentation will allude to the various CT morphologies and methods how to assess lesion growth over time. Features to discriminate malignancy from benign differential diagnoses will be described, which are especially important for lesions, not accessible for histological proof based on location or comorbidity. Meaning and management of multiple lesions will be discussed.

Learning Objectives:

1. To be aware of the possible spectrum of early lung cancer appearance in imaging.
2. To understand what radiologists need to know and report in order to accurately guide non-surgical treatments.
3. To understand the current role of PET-CT for managing early lung cancer.

A-569 14:20

The most up-to-date evidence from the interventional oncology perspective

R. Lencioni; *Pisa/IT (riccardo.lencioni@med.unipi.it)*

Percutaneous image-guided radiofrequency ablation (RFA) is a minimally invasive technique used to treat solid tumours. Single-institution case series have suggested that RFA can be a valuable treatment option for patients with unresectable or medically inoperable lung malignancies. In a prospective, intention-to-treat, multicentre clinical trial (the RAPTURE study), 106 patients with 183 lung tumours that were 3.5 cm in diameter or smaller were enrolled. Diagnoses included non-small-cell lung cancer (NSCLC) in 33 patients, metastasis from colorectal carcinoma in 53 and metastasis from other primary malignancies in 20. Patients underwent RFA in accordance with standard rules and were then followed for up to 2 years. No procedure-related deaths occurred in any of the 137 ablation procedures. No significant worsening of pulmonary function was noted. A confirmed complete response of target tumours lasting at least 1 year was shown in 75 (88%) of 85 assessable patients. In patients with NSCLC, overall survival was 70% (95% CI 51-83%) at 1 year and 48% (30-65%) at 2 years, and cancer-specific survival was 92% (78-98%) at 1 year and 73% (54-86%) at 2 years. Patients with stage I NSCLC (n=13) had a 2-year overall survival of 75% (45-92%) and a 2-year cancer-specific survival of 92% (66-99%). This trial suggested that percutaneous RFA yields high proportions of sustained complete responses in properly selected patients with pulmonary malignancies and is associated with acceptable morbidity. Randomised controlled trials comparing RFA with standard non-surgical treatment options are warranted.

Learning Objectives:

1. To understand the basic principles of the various ablation techniques.
2. To understand the indications and contradictions for lung tumour ablation, as well as to know how to choose the right ablation technique for each lesion.
3. To know the main reported procedural complications and the basics for prevention and treatment of such complications.

A-570 14:40

The most up-to-date evidence from the radiation oncology perspective

S. Senan; *Amsterdam/NL (s.senan@vumc.nl)*

Guidelines of the European society of medical oncology (ESMO) recommend stereotactic ablative radiotherapy (SABR) as treatment of choice in patients with early-stage NSCLC, who are unfit to undergo surgery or who refuse an operation. SABR is defined by use of accurate radiotherapy delivery, use of high doses delivered in 8 or fewer fractions, and to a biological dose of at least 100 Gy. It is common practice to use so-called 'risk adapted' dose fractionation schedules, where a lower dose per fraction is applied when tumours are adjacent to critical normal organs such as the chest wall or large blood vessels. Serious toxicity after SABR is uncommon, with radiation pneumonitis, chest wall pain and rib fractures being reported in 10% or fewer of patients in most reports. Patients with pre-existing interstitial lung disease have a higher incidence of symptomatic and fatal radiation pneumonitis. While local recurrence rates after SABR are around 10-15%, post-SABR fibrosis is common radiological finding, which can pose a diagnostic challenge. A failure to recognise SABR-induced fibrosis can lead to inappropriate invasive and therapeutic interventions. Criteria have been proposed for identifying high-risk radiological features, but these remain to be validated in multi-institutional settings. Growing access to short-course outpatient SABR has reduced the rates of non-treatment in elderly patients with early-stage lung cancer, and improved survival in population studies. Three randomised trials comparing SABR and surgery in operable cases have closed prematurely, but data from many comparative effectiveness studies comparing both modalities suggest, that outcomes may be comparable.

Learning Objectives:

1. To learn about the most recent radiation therapy options to treat early lung cancer.
2. To know the strengths and weaknesses of the modern radiotherapy for treatment of the early lung cancer with respect to other treatment options.
3. To understand how to effectively determine the most appropriate and personalised treatment.

Author Disclosure:

S. Senan: Advisory Board; Varian Medical Systems. Grant Recipient; Varian Medical Systems.

A-571 15:00

Imaging follow-up of non-surgical treatments

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

Lung cancer not surgically treatable may be undergoing radiotherapy alone or combined with chemotherapy and ablation therapies. Non-surgical treatments induce early and late lung abnormalities in the site of treatment. Lung injury occurs in 13-37% of patients treated with radical radiation doses. The complex configuration of beams in 3D CRT (conformal radiotherapy) and SBRT (stereotactic body radiotherapy) determines radiologic patterns that differ from those of conventional RT, as regards morphology, extension, distribution and location. The early lung abnormalities usually manifest within 6 months from treatment completion, while the late injuries after 6 months, even though the latter can develop over years, particularly after SBRT. Lung abnormalities after ablation therapies usually occur within 30 minutes from treatment and consist of perilesional ground glass opacities. Within 3 months, cavitations, bullae, pleural effusion and increase in tumour size are the most common findings, and after 6 months the evidence of a stable lesion without enhancement or FDG-uptake represents the natural evolution of the tumour after treatment. Knowledge of radiologic appearance of lung abnormalities after non-surgical treatments is critical to accurately assess the overall effectiveness of this therapy and to differentiate normal appearances from incomplete treatments and/or local recurrences. Follow-up CT is helpful in interpreting these lung abnormalities and in suspecting recurrences. However PET-CT has the main advantage of an early identification of residual disease or recurrences in this context, even if PET-CT should never be performed before 3 months after treatment completion, due to possible false positives related to residual inflammatory activity.

Learning Objectives:

1. To learn about the morphologic changes in imaging induced by radiation and ablation therapies in early lung cancer and at the time of their appearance.
2. To know the radiological criteria necessary to differentiate between a therapeutic response and recurrence after non-surgical treatments.
3. To understand the actual role of PET-CT in the follow-up of early lung cancer treated with non-surgical treatments.

15:20
Discussion

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

Paediatric

RC 1512
Key issues in paediatric imaging

A-572 14:00

Chairman's introduction

R.A.J. Nievelstein; *Utrecht/NL (R.A.J.Nievelstein@umcutrecht.nl)*

The use of medical imaging in the paediatric population has increased exponentially over the past decades. The performance and interpretation of these imaging procedures are frequently done by general radiologists, whereas imaging needs and disease manifestations in children often differ markedly from adults. There are several important issues whereof a radiologist should be aware while imaging children. Performing a successful examination in children starts with effective (age and intellect adapted) communication by the radiologist and radiographer to the child and parents. This will help to reduce the anxiety of the child, positively increasing their mood and, consequently, increasing the success rate of the examination. Another important issue is the increased ionising radiation-related risks in children. Reducing the radiation dose starts with performing an examination only when properly indicated (justification). To achieve this goal, adequate communication between referring physician and radiologist and awareness of typical radiation doses of common paediatric imaging examinations is essential. Only with this information, the radiologist will be able to make a well-considered decision which imaging modality will be the best choice to answer the clinical question. And if the imaging modality of choice will involve ionising radiation, this information will help the radiologist to optimise the technique, with as primary goal to achieve clinically acceptable instead of optimal image quality. These "key issues" will be addressed during this refresher course, which will be concluded with a panel discussion on how to educate/increase the awareness among (paediatric) radiologists, radiographers, referring physicians and general public.

Session Objectives:

1. To learn about effective communication with paediatric patients, their parents or carers.
2. To understand the importance of dose reduction parameters.
3. To learn how to improve image quality in paediatric patients.

A-573 14:05

A. Communicating effectively with parents and carers

J. McNulty; *Dublin/IE (jonathan.mcnulty@ucd.ie)*

The growing international focus on the importance of communication within the radiology environment cannot be easily ignored. In paediatric radiology, this has largely focused on radiation protection, risk communication and consent. An ESR survey of the national societies found that under 50% of the countries

who responded included formal training on communication as part of their radiology training. This is despite the fact that effective communication is at the heart of patient satisfaction and safety. Debate around the communication triangle in radiology involving the patient, radiologist and clinician omits the valuable input of the radiographer. In addition, the parent or guardian forms a further point on the communication pentagon in the paediatric setting. With a large proportion of the general public unaware that a radiologist is in fact a medical doctor or what a radiographer is; it is imperative that all radiology professionals and professional societies to make efforts to enhance their public profile. Radiology professionals must: be aware of the milestones in child development, tailor their communication, build relationships with paediatric patients and their parents or guardians, consider frameworks for teaching and assessing communication, and, most importantly of all, be advocates for every child. A communication culture is at the heart of a modern radiology department which is both effective and efficient.

Learning Objectives:
1. To explore potential issues arising from ineffective communication by radiographers and radiologists in the medical imaging department.
2. To consider the value of improved public relations and the marketing of medical imaging professionals to paediatric patients, their parents or carers.
3. To review approaches to enhancing effective communication in the paediatric medical imaging environment.

A-574 14:28

B. Paediatric imaging: when less is more

J. Portelli; *Msida/MT (jonathan.portelli@um.edu.mt)*

Medical imaging plays an ever present and vital role in the management and care of millions of paediatric and adult patients worldwide and in many instances it may be lifesaving. Nonetheless, it must be acknowledged that most medical imaging examinations will involve the use of ionising radiation which has the potential to cause adverse biological effects. It is our legal responsibility, as medical imaging practitioners, to ensure that each medical exposure is justified so as to ensure that the benefits resulting from the medical imaging examination will outweigh the potential risks involved. It is also our responsibility to ensure that medical imaging examinations are optimised accordingly to the individual patients' age, size and/or clinical question being asked. This is particularly important when imaging paediatric patients, as they are relatively more susceptible to the adverse effects of radiation and will tend to receive a higher effective dose per unit of radiation when compared to adults undergoing the same medical imaging examination. This lecture will seek to raise awareness about typical radiation doses related to some common paediatric imaging examinations, as well as provide an insight into practical ways of how radiation dose can be reduced. Furthermore, this lecture aims to encourage reflection and discussion between professionals of the imaging team so as to emphasize appropriate justification and bring about optimisation of paediatric imaging examinations within their current practice.

Learning Objectives:
1. To become familiar with radiation dose associated with certain paediatric imaging examinations.
2. To learn about dose reduction parameters.
3. To understand practical aspects of imaging.

A-575 14:51

C. The importance of clinically acceptable image quality

E. Sorantin; *Graz/AT (erich.sorantin@medunigraz.at)*

Image quality refers to a highly subjective matter. In digital systems, like Computed/Direct Radiography, Fluroscopy and Computed Tomography (CT), several technical parameters exist (eg Signal/Noise Ratio-SNR), of which is known that their bad performance usually indicates bad image quality. Unfortunately, the opposite is not true-one can have a good SNR but the image may be blurred thus making it impossible to detect subtle fractures. In plain films & fluoroscopy phantom studies, eg based on Wellhöfer Phantom, allow evaluation of performance parameters like geometric & contrast resolution and SNR and their dose dependancy can be studied. Moreover, for the same purpose, a simple phantom can be constructed using nasogastric and endotrachel tubes as well as gauze. In addition, for several plain film investigations like chest films European Guidelines exist, which will be presented. In CT image, noise is a major determinants of image quality. There is an inverse relationship between noise and slice thickness if all other factors are kept constant. Therefore, reconstructing images with halve slice thickness will double noise and, in case that resulting images are still diagnostic, an unnecessary dose (in particular mAs setting) can be assumed. Reducing at the next examination mAs by 30% represents an easy-to-perform approach and the whole procedure can be repeated as long as the optimal dose at diagnostic image quality is found. A more challenging approach doing a full calibration of the used CT machine will be presented too. Appropriate examples for all steps will be presented.

Learning Objectives:
1. To become familiar with standards of acceptable image quality.
2. To learn about the image quality and patient dose.
3. To learn about the effect of poor-quality images.

15:14

Panel discussion: What are the essentials in education and training for paediatric imaging?

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

E³ - European Diploma Prep Sessions

E³ 1523
Musculoskeletal

A-576 14:00

Chairman's introduction

F.M.H.M. Vanhoenacker; *Antwerp/BE (filip.vanhoenacker@telenet.be)*

This E3 session will highlight the fundamentals of musculoskeletal imaging and will clarify the role of the different imaging modalities in the evaluation of traumatic, tumoral, degenerative and inflammatory diseases of the musculoskeletal system. Pathognomonic imaging signs, as well as atypical imaging features and pitfalls will be discussed. The session starts with a short entry test consisting of 3 sample questions, related to the musculoskeletal leg of EDiR examination. After this session, the target audience should be familiar with the basics of MSK imaging and be prepared to pass the musculoskeletal leg of EDiR examination.

Session Objectives:
1. To understand typical and atpyical imaging features of traumatic disorders of the musculoskeletal system.
2. To differentiate imaging features of benign and malignant bone tumours.
3. To describe the imaging appearance of degenerative and inflammatory disorders of the musculoskeletal system.

A-577 14:03

A. Traumatic disorders of the musculoskeletal system

M. Maas; *Amsterdam/NL (m.maas@amc.nl)*

Traumatic disorders of the musculoskeletal system are a challenge for radiologists. To be an adequate counterpart for the treating traumasurgeon, we as radiologists need to know which clinical questions we need to answer. In this presentation the focus will be on the normal anatomy and post-traumatic changes in the small yet complex joints. Knowledge of normal anatomic relation in wrist, ankle and foot are crucial for adequate analyses of conventional radiology in these frequently injured bones and joints. Awareness of complications of chronic trauma, such as stress fractures, is an important tool for clinical radiology. Making this diagnosis is a challenge, yet crucial for adequate patient management. Especially in injured athletes these injuries are common. Classical features of these injuries will be discussed. The important sports-related soft tissue pathologies are tendon overuse, ligament disruption and muscle injuries. Grading these injuries and the relation with clinical management and prognosis will be presented.

Learning Objectives:
1. To describe the anatomy and normal variants of the musculoskeletal system.
2. To understand common imaging presentations of acute and chronic trauma involving the skeleton and soft tissue.
3. To understand common pitfalls in trauma imaging of the musculoskeletal system.

A-578 14:32

B. Bone tumours

S.L.J. James; *Birmingham/UK (steven.james@nhs.net)*

Primary bone tumours are relatively infrequently encountered and consist of a group of benign and malignant lesions that can be characterised primarily by radiographs. In this presentation, the basic principles of bone tumour diagnosis will be discussed including tumour matrix, periosteal reaction, zone of transition and cortical response to the tumour. The role of other imaging modalities will also be covered explaining the role of MRI, CT and nuclear medicine studies. Once the basic principles of bone tumour diagnosis have been presented, the imaging characteristics of classic "don't touch" lesions will be discussed. Finally, the lecture will cover some of the common manifestations of haematological disorders and how they affect the axial and appendicular skeleton.

Learning Objectives:
1. To describe the typical imaging features of common bone tumours.
2. To differentiate the typical imaging features of "don´t touch" ("leave-me-alone") lesions.
3. To understand the imaging manifestations of heamatological disorders.
Author Disclosure:
S.L.J. James: Other; Royalties: Springer, Elsevier.

A-579 15:01

C. Degenerative and inflammatory disorders of the musculoskeletal system

K.-G.A. Hermann; *Berlin/DE (kghermann@gmail.com)*

Back pain is an important problem that affects two-thirds of adults at some time in their lives. One of the leading causes of functional incapacity is spinal degeneration, which is a common source of chronic disability in the working population. Disk degeneration has been linked to mechanical loading, which occurs most typically in the lower cervical and lower lumbar spinal regions. Degeneration of the intervertebral disc can result in annular tears and disc herniation, with compromise or compression of the nerve roots. Dehydration and disintegration of the disc tissue leads to increased segmental mobility. In some patients, instability with symptomatic osteochondrosis develops. Facet joint osteoarthritis can also be responsible for central spinal canal stenosis and stenosis of the recess or narrowing of the neuroforamen. Inflammatroy diseases affect the axial skeleton and must be differentiated from degeneration. While septic discitis and sacroiliitis are recognized by their rapid destruction and severe osteitis of the surrounding bone with involvement of soft tissues, rheumatic inflammation is usually less destructive in its early stage and features distinct imaging signs. Anterior spondylitis is the most frequent finding in spondyloarthritis but has overlap with spondylophytosis, while costovertebral arthritis occurs most specifically in patients with spondyloarthritis. Sacroiliitis is evident in 95% of spondyloarthritis cases but interpretation of findings is dependent of good knowledge of clinical complaints of the patients and possible differential diagnoses. This lecture will review important imaging signs in degenerative spinal disorders and inflammation of the axial skeleton.
Learning Objectives:
1. To understand the imaging presentation of degenerative disorders of the joints and to appreciate their clinical relevance.
2. To have an in-depth knowledge of the imaging features and clinical features of degenerative disease of the spine, disc and facet joints.
3. To understand the imaging manifestations of infection, inflammation and metabolic diseases of the musculoskeletal system.
Author Disclosure:
K.G. Hermann: Speaker; AbbVie, MSD, Pfizer, UCB.

14:00 - 15:30 **Room L 1**

EuroSafe Imaging Session

EuroSafe 3

Dose-tracking leads the way to dose-reduction

A-580 14:00

Chairman's introduction: dose-tracking leads to dose-reduction: why radiologists MUST get involved

P.M. Parizel, T. De Bondt, M. Geldof, F. Deferme; *Antwerp/BE (paul.parizel@ua.ac.be)*

In recent years, there has been a mounting awareness of the risks associated with ionising radiation in medical imaging procedures. With increasing attention from the general public, media, and government agencies, implementation of a dose-tracking system for radiological examinations has become a necessity rather than a luxury. Dose-tracking software monitors radiation exposure to individual patients, compares patient dose to baseline standards for each type of examination, and triggers an alarm whenever the dose threshold has been transgressed. In this way, it is possible to identify suboptimal parameter settings, and to perform diagnostic and interventional procedures with the lowest possible radiation exposure, while maintaining adequate image quality. Dose information can be incorporated in the in the radiology report. Unfortunately, to date, not nearly enough departments are implementing dose-tracking systems, mainly because of technical and financial challenges. Installation of a dose-tracking system requires an investment in terms of manpower and money; it takes time and effort to fully integrate it into the department's workflow. This notwithstanding, radiologists must show initiative and leadership in implementing dose-managing software and in bringing together different stakeholders, including technologists, physicists and also referring clinicians. Radiologists must speak up publicly and should be at the forefront of educating our colleagues, our patients and the general public. The ultimate goal of implementing a dose-tracking system is to reduce the radiation dose to our patients, while maintaining, and in some cases even improving, diagnostic information. And in this process we as radiologists should be leaders, not followers.
Session Objectives:
1. To understand how dose tracking contributes to dose-reduction without compromising quality of care.
2. To understand the role of radiologists in dose tracking.

A-581 14:05

The legislative environment in Europe: the new EU Directive and the goals of EuroSafe Imaging

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). The respective directive is related to the Euratom treaty. 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 17th January 2014, the revised Euratom BSS, the council directive 2013/59/Euratom, was published in the official Journal of the European Union. Member states have until the 6th February 2018 to complete the process of transposition into their national regulations. While the Euratom BSS 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 devices on the European market, was developed under the auspices of the EEC. The presentation will in particular address the provisions of the council directive 2013/59/Euratom with respect to medical applications of ionising radiation and hereby, will focus on the principles of justification and optimisation. In addition, other important issues will be discussed such as referral guidelines, information on patient exposure as part of the report of the medical radiological procedure, diagnostic reference levels, clinical audits as well as accidental and unintended exposures. Last, but not least, EuroSafe imaging's activities will be analysed in relation to the legal and regulatory environment.
Learning Objectives:
1. To learn more about the EU radiation protection legislation.
2. To learn more about the implementation of the EU basic safety standards directive.
3. To learn more about EuroSafe Imaging's activities in relation to the legal and regulatory environment.

A-582 14:20

Implementing a dose management solution in your department: where to start and what to expect?

D. Weishaupt; *Zurich/CH (dominik.weishaupt@triemli.zuerich.ch)*

Whoever decides to implement a dose management system has to understand two key concepts: first, the successful implementation of a dose management system calls for various competences such as: knowledge in radiation physics and dose, IT, legislation, image quality and workflow. This means that an introduction of such a system requires a dose team that includes radiologists, technicians, physicists as well as IT specialists. Second, the implementation of a dose management solution is more than just installing a technical solution for tracking and monitoring of patient dose applied by different radiological modalities. Implementation of this kind of tool needs a cultural process within your department because it affects workflow and structure. In our experience the initial step is to create a dose team and define the roles. The second step is to create a shared need, to shape a vision and to define achievable goals. The third step is to roll-out the project within the organisation. This step is crucial because each dose monitoring system requires a structured workflow in particular with regards to data input. During this phase resistance due to various reasons may occur. Therefore, mobilising commitment and making the project sustainable is of paramount importance. Successful installation of a dose management system provides you with various data which allow improving patient and business safety and also enables quality assurance not only in the radiology department.
Learning Objectives:
1. To understand the challenges of implementing dose management in radiology departments.
2. To learn from practical examples of dose management implementation.

A-583 14:35

Developing a multi-disciplinary team in dose management (CT example)

L. Martí-Bonmatí; *Valencia/ES (marti_lui@gva.es)*

On average, CT in European countries contributes to at least 60 percent of the radiation dose from all radiological procedures. The final objective in dose management is to reduce variability and uncertainty in dose exposure while keeping adequate image quality for diagnostic and therapeutic purposes.

Radiation exposure, data reconstruction, image quality, image processing, examination appropriateness and technical protocols are fundamental parts of a dose management approach. In this presentation, I will try to comment on our approach to construct a multidisciplinary team in CT dose management, defining the different disciplines that are involved in this multimodality team in our hospital. The different approaches to decrease examinations with low clinical meaningless, increase test appropriateness, improve equipment capabilities, adequate technical protocols, control and normalisation of radiation exposure, and balanced image quality/radiation dose will be discussed. Radiation monitoring will allow to decreased outliers and evaluate protocols with an increase mean dose. Disciplines involved in our multidisciplinary team are medical physicist (quality control, statistics, dosimetry to patients and organs), biologists (radiobiology, radiosensitivity, biological exposure history), medical physician (rationale, repeat procedures, interventionism), radiologist (appropriateness and technical protocols with ALARA principle), technician (reference dose, pregnancy, repetitions), engineers (alerts, deviations, dashboard, image quality), and hospital managers (providing modern equipment).

Learning Objectives:
1. To understand which disciplines are required on a CT dose management team.
2. To learn more about the advantages of multi-disciplinary collaboration.

A-584 14:50

PiDRL - European Commission Tender Project on diagnostic reference levels in paediatric imaging

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

There is a need to establish diagnostic reference levels (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 a new 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 as possible procedures. Consortium partners of the project are European society of radiology, ESR (coordinator), European society of paediatric radiology, ESPR, European federation of radiographer societies, EFRS, European federation of organisations for medical physics, EFOMP, Finnish radiation and nuclear safety authority, STUK, with public research centre Henri Tudor, CRP-HT, as subcontractor. A European workshop will be organised in Lisbon, Portugal, 15-17 October 2015 to discuss the results of the project and the needs for further action on DRLs and optimisation of radiation protection of paediatric patients. A web space for the project has been created within the EuroSafe imaging website (http://www.pidrl.eu, http://www.eurosafeimaging.org/pidrl) with the aim to disseminate project-related information to all stakeholders and to the general public.

Learning Objectives:
1. To understand the methodology for establishing and using DRLs for paediatric imaging.
2. To learn about the specific requirements for paediatric DRLs (in comparison to DRLs for adults).

A-585 15:05

Deploying a dose management strategy across multiple sites

K. Katsari; *Athens/GR (katia.katsari@euromedic.com)*

Results are presented of a Dose Management strategy that has been deployed in 36 CT departments in 28 cities of 6 European countries. The CT systems studied are 12 models from 3 different vendors. 27 out of 36 CT systems use iterative reconstruction algorithms for dose reduction. Dose Management teams have been assigned at a country and site level. All teams are coordinated by a Dose Management Project Leader. A CT Quality Assurance Program is followed on a monthly and yearly basis. To track, report and monitor dose all CT systems are connected to GE's DoseWatch software. Significant differences in dose for comparable CT examinations have been identified and the reasons analysed. Proposals have been made for standardising adult CT protocols and targets have been set for the optimisation of dose and image quality. The biggest challenge is to create protocols at clinical and technical levels that are acceptable by all radiologists. The CT radiographers and radiologists systematically follow continuing education courses to improve their knowledge of parameters affecting dose and image quality in CT examinations. Key goals of the strategy are to implement CT dose benchmarks, homogenise CT protocols across the countries for the same CT models and create new DRL's appropriate for the technology used.

Learning Objectives:
1. To understand the challenges of implementing a dose management strategy in different locations.
2. To learn more about practical examples of dose management strategies implemented across multiple sites.

15:20
Panel discussion

14:00 - 15:30 **Room E1**

Musculoskeletal

RC 1510

The hand and wrist

Moderator:
A. Plagou; Athens/GR

A-586 14:00

A. Patterns of injury

A. Navas Canete; *Leiden/NL (a.navas_canete@lumc.nl)*

Common injuries, particularly injuries of the wrist and hand, do not occur randomly but are the result of specific mechanisms causing specific patterns of injury. The purpose of this refresher course will be to present the most common mechanisms of injury of some of the most common fractures and soft tissue injuries of the hand and wrist. The preferred method of imaging of these injuries is conventional radiography with posteroanterior (PA) and lateral radiographs, but additional views may be necessary to appreciate subtle fractures. The aim of this presentation will be also to assess the clinical role of CT and MRI in the diagnosis and management of these kind of injuries.

Learning Objectives:
1. To learn more about the imaging appearances of soft tissue and osteoarticular injury.
2. To become familiar with the patterns of bone and soft tissue injury in the hand and wrist.

A-587 14:30

B. Inflammatory disorders

H. Guerini; *Paris/FR*

Rheumatoid arthritis (RA), psoriatic arthritis (PsA) and other inflammatory disease can be diagnosed and sometimes differentiated in the early stages of the disease on the basis of MRI and/or PDUS features of the hand and wrist. Rheumatoid arthritis (RA) activity is closely correlated with inflammation. The synovial membrane is the principal site of inflammation in which the inflammatory process enhances capillary perfusion and permeability. Doppler ultrasonography (DUS), using the amount of color pixels in the region of interest, and dynamic magnetic resonance imaging (DE-MRI), are both able to detect this inflammation in the wrist and hand. Although these techniques are both capable of monitoring synovium inflammation modifications after RA treatment, PDUS become an essential tool for RA joint monitoring in routine practice in view of its sensitivity in the detection of synovitis, feasibility in outpatient clinics, and low cost.

Learning Objectives:
1. To learn more about the imaging appearances of soft tissue and osteoarticular inflammation.
2. To become familiar with imaging findings of specific inflammatory conditions.

A-588 15:00

C. Tumours and tumour-like lesions

E. Llopis; *Valencia/ES (ellopis@hospital-ribera.com)*

We will review hand and wrist tumours and tumour like conditions. Diagnosis of a clinical suspicion of a tumour in the hand or wrist is made by a combination of the clinical scenario, the location (bone, soft tissue, synovial), unique or multiple together with the main radiological features. The most important radiological features when analysing a tumour is to rule out the presence of calcification, blood, fat or its enhancement. We will analyse the role of MR and US. The objective of this lecture is to be help to diagnose the most frequent causes of soft tumours around the hand and wrist.

Learning Objectives:
1. To learn more about the spectrum of intra and para-articular soft tissue tumours, and soft tissue tumour-like lesions.
2. To become familiar with US and MRI findings of specific soft tissue lesions.

14:00 - 15:30 **Room E2**

New Horizons Session

NH 15
Optical molecular imaging: a new dimension for radiology

A-589 14:00
Chairman's introduction
C.-C. Glüer; *Kiel/DE (glueer@rad.uni-kiel.de)*

Amongst the many modalities that can be used for molecular imaging, optical imaging is one of the most powerful and versatile ones. Optical imaging techniques suited for imaging in vivo are dominated by fluorescence and bioluminescence imaging, but techniques that combine optical and other techniques, such as optical signals generated by radioactive materials (Cerencov radiation) or sound waves generated by optical excitation (optoacoustics), expand the breadth of potential applications. A key advantage of optical imaging relates to the power of genetic engineering methods that can be exploited, e.g. by creating transgenic animals, thereby providing mechanisms for creating very sensitive and specific markers. Because of the limited penetration depth and high scatter, optical imaging is most powerful for studies in small animals. However, important applications for human studies have also been developed, including lymph node visualisation, intra-operative imaging or endoscopic techniques. This session will highlight some of the most exciting new techniques and achievements.
Session Objectives:
1. To appreciate the versatility and power of optical imaging methods.
2. To appreciate the difference in strengths and limitations of these methods.
3. To become familiar with state-of-the-art preclinical imaging concepts.

A-590 14:05
Reporter gene imaging
C.W.G.M. Löwik, E.L. Kaijzel, L. Mezzanotte; *Leiden/NL (c.w.g.m.lowik@lumc.nl)*

Whole body fluorescent imaging (FLI) and bioluminescent imaging (BLI) are now widely applied in small animals to study biological and molecular processes like gene expression, tumour progression and metastasis, apoptosis, inflammation, angiogenesis, proteolysis and to follow trafficking, differentiation and fate of cells (i.e. stem-, immune- and tumour cells). This has been done mainly using gene reporters expressing fluorescent proteins or luciferases. Recently new mutated redshifted fluorescent proteins and codon-optimised and mutated luciferases with different emission wavelengths have been developed making optical imaging more sensitive and offering the possibility to use multi-colour gene reporters. These optical imaging gene reporters can also be combined with gene reporters for MRI, PET or opto-acoustic (OA) imaging, allowing multimodality imaging. For BLI it is now also possible to use specific enzyme-cleavable pro-substrates for luciferase making bioluminescent imaging even more versatile. Apart from new "smart gene reporters" and pro-substrates for luciferase, there has also been a great development in injectable near-infrared fluorescent (NIRF) probes. These NIRF probes can either be targeted or enzyme-cleavable. In the current presentation, the focus will be on the methodology of creating reporter genes and examples will be shown on how they successfully can be applied in regenerative medicine and cancer research.
Learning Objectives:
1. To learn about the methodology of creating reporter genes.
2. To understand the differences between reporter gene imaging and other methods of labeling used in optical imaging.
3. To become familiar with successful examples of reporter gene imaging.

A-591 14:30
Cerenkov - faster than the speed of light
J. Grimm; *New York, NY/US (grimmj@mskcc.org)*

Cerenkov radiation is the blue light produced by electrons or positrons travelling faster than the speed of a light through a medium. Whilst this phenomenon has been described originally in the early 20th century, it was only recently recognised as a tool for optical imaging of radiotracers. Cerenkov luminescence imaging (CLI) is an emerging modality that merges nuclear and optical imaging. It requires highly sensitive optical equipment to detect the low amount of photons emitted compared to other optical imaging modalities. However, it offers several compelling advantages. CLI utilises clinically approved tracers, thus avoiding significant hurdles for approval of the imaging agent. It is able to image radionuclides that cannot be imaged otherwise such as the 90Y. By reverting to PET of the very same agent an internal standard is provided that allows for quantification as well as true multimodality imaging from the same imaging label. With CLI, several animals can be imaged in parallel within few minutes, allowing for a higher throughput. We and others have demonstrated CLI in various disease models. Fluorescent agents have been used to shift the light from blue to greater penetrating red. Using CLI, activatable imaging systems have been developed to sense enzymatic activity. Recently, first clinical images have been obtained and devices for intraoperative CLI are emerging. CLI provides a paradigm shift, transgressing conventional borders between imaging systems, and allowing for unique new imaging approaches and applications, which will be discussed.
Learning Objectives:
1. To understand the method of Cerenkov imaging.
2. To become familiar with representative applications of Cerenkov imaging.
3. To appreciate strength and limitations of this approach compared to other methods of molecular imaging.
Author Disclosure:
J. Grimm: Advisory Board; Lightpoint Medical. Grant Recipient; NIH - NIBIB. Research/Grant Support; NIH - NIBIB.

A-592 14:55
The kiss of light and sound - optoacoustics
V. Ntziachristos; *Munich/DE*

Optical imaging is unequivocally the most versatile and widely used visualisation modality in the life sciences. Yet, it is significantly limited by photon scattering, which complicates imaging beyond a few hundred microns. For the past few years, however, there has been an emergence of powerful new optical imaging methods that can offer high-resolution imaging beyond the penetration limits of microscopic methods. These methods can prove essential in cancer research. Of particular importance is the development of multi-spectral optoacoustic tomography (MSOT) that brings unprecedented optical imaging performance in visualising anatomical, physiological and molecular imaging biomarkers. Some of the attractive features of the method are the ability to offer 10-100 microns resolution through several millimetres to centimetres of tissue and real-time imaging. In parallel, we have now achieved the clinical translation of targeted fluorescent probes, which opens new ways in the interventional detection of cancer in surgical and endoscopy optical molecular imaging. This talk describes current progress with methods and applications for in vivo optical and optoacoustic imaging in cancer, and outlines how new optoacoustic and fluorescence imaging concepts are necessary for accurate and quantitative molecular investigations in tissues.
Learning Objectives:
1. To understand the method of optoacoustics.
2. To become familiar with representative applications of optoacoustic imaging.
3. To appreciate the strengths and limitations of this approach compared to other methods of molecular imaging.

15:20
Panel discussion: Potential of optical imaging for translation to human applications

14:00 - 15:30 **Room F1**

Special Focus Session

SF 15
Cardiac CT: cutting-edge techniques

A-593 14:00
Chairman's introduction: overview of the cutting-edge techniques
R. Salgado; *Antwerp/BE (rodrigo.salgado@uza.be)*

Cardiac-CT is now a widely available tool for non-invasive evaluation of the coronary arteries. However, emerging technologies allow additional evaluation of some clinical topics which until recently were not considered feasible with CT. These include coronary fractional flow reserve calculation, myocardial perfusion and viability and a more detailed analysis of coronary plaque morphology. In this session, the potential benefits and limitations of these technologies will be discussed.
Session Objectives:
1. To learn about new developing technologies in cardiac-CT.
2. To understand their potential benefits and limitations in clinical practice.
3. To learn about their current state of scientific evidence.

A-594 14:05

Estimation of coronary flow reserve by CT: a new arrival

G. Bastarrika; *Pamplona/ES (bastarrika@unav.es)*

Coronary CT angiography has become the non-invasive reference standard to assess coronary artery disease. A major limitation of this technique, however, is its limited ability to establish the haemodynamic significance of intermediate coronary artery stenosis. Recent advances in technology have led to estimation of fractional flow reserve computed from standard coronary CT angiography data (FFR-CT). This approach allows to determine functional significance of coronary artery lesions. Recent reports suggest that FFR-CT may improve diagnostic accuracy of coronary CT angiography to establish lesion-specific ischaemia by combining anatomic aspects of the test with physiological assessment of stenosis significance. Further, latest investigations support that estimation of FFR-CT may result in improved patient outcome and reduced healthcare costs by avoiding additional testing to evaluate for ischaemia. In this lecture, the principles and clinical significance of fractional flow reserve (FFR) and the technical background of FFR-CT will be reviewed. Advantages and limitations of this new technology and influence of coronary CT angiography protocols in diagnostic performance of FFR-CT will be described. Further, the results of most recent trials will be discussed.

Learning Objectives:

1. To understand the principles and clinical significance of fractional flow reserve (FFR).
2. To describe the rationale of CT-derived FFR (CT-FFR).
3. To provide insights into the usefulness of CT-FFR to assess ischemia-causing coronary lesions.

A-595 14:30

Myocardial perfusion imaging in clinical routine: ready for prime time?

K. Kitagawa; *Mie/JP (kakuya@clin.medic.mie-u.ac.jp)*

CT perfusion (CTP) has recently emerged as a novel technology for assessing the functional significance of coronary stenosis. There are two approaches to stress CTP: static (acquisition of images during a predefined single time point) and dynamic (acquisition of images over a predetermined period of time to characterize the wash-in and wash-out of contrast medium in the myocardium), however, given the rapid progress in hardware and software for dose reduction, dynamic stress CTP is becoming a viable choice for clinical routine. With dynamic CTP, full-quantification of myocardial blood flow (MBF) in ml/min/g allows generation of voxel-wise parametric map that can be colour-coded and fused with coronary CTA. Furthermore, absolute MBF can be an objective index to determine the extent and severity of myocardial ischaemia. In a comprehensive cardiac CT protocol, assessment of myocardial delayed enhancement (CTDE), which characterises extent of fibrosis caused by myocardial infarction and other cardiomyopathies, is possible by employing contrast medium previously injected for CTP and CTA. CTDE is rarely used in routine practice, but could change interpretation of stress CTP and patient management. This presentation covers state-of-the art techniques for stress CTP and highlights how to acquire good CTDE images. Then, advantages and current limitations of comprehensive cardiac CT protocol consisted of dynamic stress CTP, coronary CTA and CTDE will be discussed.

Learning Objectives:

1. To learn about state-of-the-art imaging techniques for myocardial perfusion and viability.
2. To appreciate clinical usefulness of comprehensive cardiac CT protocol.
3. To get informed about current limitations of myocardial perfusion imaging by CT.

Author Disclosure:

K. Kitagawa: Research/Grant Support; Siemens Japan KK.

A-596 14:55

Plaque imaging with cardiac CT: coming of age?

J. Hoe; *Singapore/SG (johnwmhoe@gmail.com)*

Coronary CTA (CCTA) is now well-validated as best non-invasive imaging method of detecting coronary plaque. Plaque quantification and plaque characterisation is also possbile, even though there are some difficulties related to overlap of plaque density overlap and semi-quantitaitve methods of plaque quantification are probabaly more clinically useful than manual or automated methods. Coronary calcium correlates with plaque burden and calcium scoring has been long established as better predictor of cardiac events compared to traditional risk factors as well as other imaging techniques. Detection of vulnerable plaques by CCTA is now possible and recognition of features such as large plaque volume or burden, positive remodeling, low-density plaques, spotty calcifications as well as newly reported features such as napkin ring sign are important as this helps clinician to better risk stratify the patient and has an impact on patient treatment and follow-up. Reduction in major cardiac events and death is aim of identifying vulnerable plaques by CCTA and being aware of outcomes and hazard ratios for events is important for the imaging physician. Although currently CCTA is not recommended for screening asymptomatic patients, studies have already shown that it is better predictor of cardiac events compared to calcium scoring. Future work for assessment of effects of medical therapy on plaque volumes and outcomes and clinical value or outcome studies in asymptomatic patients, whose treatment is changed by CCTA results, are awaited.

Learning Objectives:

1. To understand pathophysiology of coronary plaque and clinical effect of plaque rupture.
2. To learn how CT can be used to detect, quantify and characterise coronary plaque.
3. To become informed about clinical value and outcomes of plaque detected by CT.

Author Disclosure:

J. Hoe: Research/Grant Support; Toshiba Medical Systems. Speaker; Toshiba Medical Systems, Infinitt Healthcare.

15:20

Panel discussion: Which technique will change clinical practice?

14:00 - 15:30 **Room F2**

Breast

RC 1502

Update on BI-RADS

Moderator:

L.J. Pina Insausti; Pamplona/ES

A-597 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 such as 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-598 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: Other; Supersonic imagine, BARD, Siemens.

A-599 15:00

C. MRI

P.A.T. Baltzer; *Vienna/AT*

This talk will provide an update on the recent updates of the Breast Imaging Reporting And Data System (BI-RADS) lexicon. An overview about the systematic of reporting including diagnostic criteria will be given. Furthermore,

a review of clinical cases is provided to demonstrate and discuss the potential pitfalls and limitations in reporting according to BI-RADS.
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
Pulmonary arterial hypertension

Moderator:
R. Cesar; Golnik/SI

A-600 14:00
A. An overview of pulmonary artery hypertension
N.J. Screaton; *Cambridge/UK (Nicholas.Screaton@papworth.nhs.uk)*

Coronary hypertension is defined by increased mean pulmonary arterial pressure > 25 mmHg at rest. PH causes significant mortality and morbidity, but commonly presents with non-specific clinical signs and symptoms resulting in significant delay in accurate diagnosis and specific treatment. Untreated PH is progressive with increased pulmonary vascular resistance leading to right ventricular failure and ultimately death. The current classification of pulmonary hypertension is clinical-based. It groups diseases with similar pathophysiological mechanisms and therapeutic approaches. Groupings include conditions characterised by diffuse small vessel narrowing (Group 1 and Group 1'), PH secondary to left-sided cardiac disease (Group 2), chronic hypoxic pleuro-parenchymal disease (Group 3), chronic thrombo-embolic pulmonary hypertension CTEPH (Group 4), and a miscellaneous group of diseases with either unclear or multi-factorial aetiologies (Group 5). In the clinical classification, small vessel diseases are subdivided into Group 1 which primarily affect the pulmonary arterioles and Group 1' affecting the capillary/venous pulmonary circulation (pulmonary capillary haemangiomatosis and pulmonary veno-occlusive disease). The differentiation of Group 1 from Group 1' diseases is important since in group 1', arteriolar dilatation treatments can cause life-threatening pulmonary oedema. Group 4 is synonymous with CTEPH with other causes of large vessel obstruction (vasculitis and pulmonary artery tumour) being considered as Group 5 disorders. Recent advances include an increased understanding of molecular mechanisms underpinning PAH, facilitating targeted therapy development, a rapidly expanding role of surgical pulmonary endarterectomy in proximal CTEPH, and recognition of imaging as a potential therapeutic end point.
Learning Objectives:
1. To learn about the epidemiology of pulmonary artery hypertension.
2. To become familiar with the clinical symptoms, signs and causes of pulmonary artery hypertension.
3. To appreciate the importance and difficulties of treating pulmonary artery hypertension.

A-601 14:30
B. CT in pulmonary artery hypertension
M.-P. Revel; *Paris/FR (marie-pierre.revel@htd.aphp.fr)*

CT allows depicting pulmonary hypertension (PH) and helps identifying its cause, therefore CT plays a crucial role in the diagnostic work-up of PH. CT features of pulmonary arterial hypertension include dilatation of the main pulmonary artery, with a diameter greater than or equal to 29 mm, a ratio to the aortic diameter greater than 1:1 and a segmental artery-to-bronchus ratio greater than 1:1 in at least three pulmonary lobes. On ECG-gated CT, right pulmonary artery distensibility shows the best diagnostic value with 86% sensitivity and 96% specificity for a cut-off value of 16.5%. Signs of chronic thromboembolic pulmonary hypertension (CTEPH) must be recognized to distinguish CTEPH from idiopathic pulmonary artery hypertension. These signs include wall-adherent thrombi, bands, webs or chronic arterial occlusion, mosaic perfusion and systemic collateral supply. Signs of pulmonary edema, such as thickening of the interlobular septa, centrilobular ground glass opacities, mediastinal lymph node enlargement and pleural effusion are seen in PH caused by pulmonary veno-occlusive disease, left heart diseases or mediastinal fibrosis. Signs of lung parenchyma diseases may be identified on CT; PH is a late complication in patients with pulmonary fibrosis, sarcoidosis or chronic obstructive lung disease, but may affect systemic sclerosis patients with limited lung parenchyma involvement. Congenital cardiac abnormalities with untreated right-to-left shunting resulting in Eisenmenger syndrome, such as ventricular or atrial septal defect and patent ductus arteriosus are easily recognised on CT. Conversely, signs of peripheral pulmonary arteriovenous shunting in portopulmonary hypertension and PH caused by hepatopulmonary syndrome are more difficult to assess.
Learning Objectives:
1. To learn about the CT diagnosis of pulmonary artery hypertension.
2. To become familiar with the causes of pulmonary artery hypertension on CT.

A-602 15:00
C. MRI in pulmonary artery hypertension
J. Biederer; *Groß-Gerau/DE (biederer@radiologie-darmstadt.de)*

For the assessment of pulmonary arterial hypertension (PAH), the dedicated 30-min MRI protocol would comprise a free breathing and non contrast-enhanced examination, short T2-w. sequences, dynamic contrast-enhanced perfusion imaging, a high-resolution angiogram, a 3D breath-hold acquisition, dynamic steady-state-free precession or gradient echo sequences of the heart and a study of myocardial late enhancement. The morphologic sequences show typical features of PAH: right atrial/ventricular dilatation, enlargement of the pulmonary trunk/main pulmonary arteries and peripherally attenuated pulmonary vessels. Incidental infiltrates, nodules or masses of the lung, mediastinum and chest wall would be covered. The first pass contrast enhanced perfusion imaging demonstrates an increased mean transit time/decreased pulmonary blood flow but a relatively homogeneous lung perfusion (important to differentiate from CTEPH, where multiple segmental perfusion defects would be expected). The cardiac part shows right ventricular mass, wall thickness and functional changes correlating with elevation of pulmonary arterial pressure: Distortion of the interventricular septum, area change of the pulmonary trunk, right ventricular volume/stroke volume as well as pathologic right/left ventricular end-diastolic volume indexes. Late enhancement of the right ventricular wall would correlate with myocardial fibrosis. Furthermore, optional experimental velocity-encoded sequences (ideally for multidirectional flow visualization, "4D flow") show a decreased pulmonary artery blood flow velocity, increased retrograde flow and inhomogeneous velocity profiles. In conclusion for the near future, given the availability of scanner time and appropriate experience of the team, thoracic MRI is a candidate for the most comprehensive and effective single examination for the diagnosis and follow-up of PAH.
Learning Objectives:
1. To learn about the MRI diagnosis of pulmonary artery hypertension.
2. To appreciate the role of MRI in the assessment of pulmonary artery hypertension.
3. To become familiar with MRI techniques in the assessment of pulmonary artery hypertension.

14:00 - 15:30 **Room D2**

Radiographers

RC 1514
CT from A to Z

A-603 14:00
Chairmen's introduction
E. Agadakos[1], M. Prokop[2]; [1]*Athens/GR*, [2]*Nijmegen/NL*

Radiation dose and contrast media administration management in CT remain challenging for radiologists, radiographers, medical physicists and vendors. Although continuous advances in CT technology incorporate novel dose reduction and enhanced image quality tools, they are not effectively utilised in daily practice. The expanded CT applications offered with state-of-art hardware and innovative software demand for modifications in protocol design and further training in patient preparation and rapport. The aim of this refresher course is to outline the importance of continuous professional development (CPD) for the radiographer who often acts as an "interface" between patients and technology. This will be achieved through a panel discussion involving two moderators, the participants and three CT experts who will illustrate the capabilities and limitations of both, CT equipment and radiographers, during their presentations: A. Exploring and exploiting CT technology: back to the future, B. Patient safety in CT: radiation dose and CM Administration, C. Tips and tricks for CT optimisation. These enduring challenges seem to be independent of the CT technology on hand. However, with the introduction of modern CT systems and automatic CM injectors, radiographers are presented with new sophisticated tools which make it less complex to manage radiation dose and contrast media administration effectively and efficiently without compromise in diagnostic quality. Therefore, radiographers must demonstrate the capacity to immediately recognize and systematically control demanding situations in daily CT practice. In conclusion, this superior level of radiography competency required to optimise CT examinations can only be realised with continuous professional development.

Session Objectives:
1. To learn about the new developments in CT technology.
2. To understand how to maximise the use of new CT technology.
3. To appreciate the importance of developing radiographers' competencies in CT.

A-604 14:05

A. Exploring and exploiting CT technology: back to the future
D. Pekarovic, U. Zdešar; *Ljubljana/SI (dean.pekarovic@kclj.si)*

Computed tomography (CT) technology and its medical applications are rapidly developing. Showing cross sections of human body has many advantages comparing to projection techniques. But technique itself has also some disadvantages. It is relatively slow and causes higher dose. Development in past years has tackled both. Faster system rotation, multi-slice technology and ECG gating enable today faster CT imaging even of the heart. With hardware and software developments, CT Today gives many options not only in static but even in dynamic imagining. Dose issue is also being solved in different ways: automatic exposure control not generally available in CTs 10 years ago is now standard, newer reconstruction algorithms are also becoming one. Image processing and manipulation techniques are also developing. CT gives many possibilities to be more accurate in diagnostics. But we still should not forget the basics. Image formation is separated into two steps: data capture and image reconstruction. Understanding parameters driving both phases is of crucial importance in order CT examination to be optimised. Parameters chosen in both steps should strongly depend on information required by radiologist - referral. Scanning parameters affects patient dose, determine the amount of data collected and also influence reconstruction possibilities. Reconstruction step on the other hand affect image quality and processing time. To be able to properly use all of the possibilities offered by such sophisticated technology understanding of its operation and especially its limitations is mandatory. Comprehensive training is needed at all professional levels: radiographers, radiologist and medical physicist.
Learning Objectives:
1. To learn about the basics of state-of-the-art CT technology.
2. To become familiar with the newly available CT features.
3. To understand how to optimise protocols by maximising technology.

A-605 14:28

B. Patient safety in CT: radiation dose and CM administration
F. Zarb; *Msida/MT (francis.zarb@um.edu.mt)*

Computed tomography (CT) is well-documented as a main contributor to the radiation dose in medical imaging and constitutes the largest provider of radiation exposure to the population from medical imaging examinations. Radiation risks from justified and optimised CT examinations should be considered in the proper perspective. Radiation exposure should be limited without compromising diagnostic efficacy so that the benefits of the use of CT overall outweigh the radiation risks. Other risks linked with CT examinations are associated with the administration of contrast media (CM). Potential risks from CM are associated with either the type of CM or its route of administration. The purpose of this presentation is to appreciate and provide awareness of the risks involved during CT examinations and to be familiar with ways of optimising the examinations maximising patient safety.
Learning Objectives:
1. To appreciate risks associated with radiation doses used with current CT scanning techniques.
2. To learn about practical methods for optimising patient radiation dose and maximising patient safety.
3. To be aware of the general risks associated with contrast media administration during CT examinations.
4. To become familiar with best practice guidelines concerning the safe use of contrast media.

A-606 14:51

C. Tips and tricks for CT optimisation
R. Booij; *Rotterdam/NL (r.booij@erasmusmc.nl)*

Currently, CT scanners are highly advanced with almost limitless possibilities. The number and complexity of CT scans are increasing. For faster examination at optimal dose and high-quality, protocols should be robust, easy to perform and dose optimized. Although current CT systems are already provided with intuitive and intelligent scan software, the need of special-trained and educated technicians is of the utmost importance. Knowledge about all innovative technology provide possibilities to take the full advantage of the available dose reduction techniques and their pitfalls. Personnel should be well-trained and regularly educated to use all of these technologies, effectively adjust scan parameters, recognise CT artifacts and to prevent unnecessary loss of image quality. This will lead to highly optimised CT protocols and increased patient throughput with the least possible chance of errors.

Learning Objectives:
1. To learn how to effectively use scan parameters and innovative technologies to optimise CT protocols.
2. To appreciate the need for well-educated and -trained radiographers for optimal use of CT innovations.
3. To learn about iterative reconstruction processes and their quality impact.
4. To recognise CT artefacts and learn how to deal with them.

15:14
Panel discussion: How should a radiographer develop the interface between patient and technology?

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

Neuro

RC 1511
White spots in the brain

Moderator:
E.T. Tali; Ankara/TR

A-607 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 are 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: Advisory Board; Biogen Idec; Genzyme. Author; No. Board Member; No. CEO; No. Consultant; No. Employee; No. Equipment Support Recipient; No. Founder; No. Grant Recipient; Novartis, Biogen, GSK, BHF, MS Society of Great Britain and Northern Ireland, MRC, Wellcome Trust. Investigator; No. Owner; No. Patent Holder; No. Research/Grant Support; BRC. Shareholder; No. Speaker; ESOR. Other; No.

A-608 14:30

B. How can I improve my reporting of T2-hyperintense lesions?
A. Rovira-Cañellas; *Barcelona/ES (alex.rovira@idi-cat.org)*

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-ischemic 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 etiological 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, infarcts, etc). Knowledge of these features, will assist the diagnostic work-up 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 all 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-609 15:00

C. Is there a need for quantitative reporting of white matter lesions?

F. Barkhof; *Amsterdam/NL (f.barkhof@vumc.nl)*

WM lesions are a coming aging 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.

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

E³ - ECR Academies: Hybrid Imaging (advanced)

E³ 1518

Advanced hybrid imaging of brain

Moderator:
G. Morana; Genoa/IT

A-610 14:00

A. Memory decline

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

Decline in episodic long-term memory and also some other forms of cognition is one of several biomarkers in an Alzheimer's disease pathological cascade model. However, episodic memory decline is a characteristic feature of normal ageing and cannot by itself be used as a sign of impending dementia. Longitudinal studies converge on the onset of average memory decline in non-demented individuals after the age of 60, but there is marked inter-individual variability in age of onset as well as rate of decline. Older individuals with relatively preserved memory and cognition tend to have minimal age-related brain pathology, as measured by MRI of regional brain volumes and PET imaging of amyloid burden. However, some individuals with apparently intact cognition show substantial brain pathophysiology, which may reflect compensation in the form of a high "cognitive reserve". Decline in functioning has most strongly been linked to hippocampus atrophy, as measured with structural MRI, whereas accumulation of amyloid beta as measured with PET does not account for memory decline in older people. In the absence of longitudinal data, absolute hippocampus volume is not a strong predictor of decline due to inter-individual variability in volume also in younger individuals.

Learning Objectives:

1. To learn about PET imaging in cognition.
2. To learn about advanced MRI in cognition.
3. To understand PET/MRI in cognition.

A-611 14:30

B. Minimal cognitive impairment and dementia

J.O. Rinne; *Turku/FI (juha.rinne@tyks.fi)*

Multimodality imaging in mild memory impairment and dementia offer various advantages both in scientific research and in clinical practice. First, it allows the combination of good chemical sensitivity and specificity with good anatomical resolution (especially in the case of PET/MRI). Second, obtaining anatomical information in addition to functional measurements helps to correct for atrophy and partial volume effect which might lead to overestimation (in case of fluorodeoxyglucose as a marker of neuronal and synaptic function) or underestimation (amyloid imaging) of the functional changes caused by the disease process. In addition, it is possible to get better anatomical localisation of the PET signal and to identify possible co-existing pathologies (e.g. vascular changes). In clinical practice multimodality imaging can improve diagnostic accuracy as compared to single imaging methods. It can help in the early diagnosis and in predicting the risk and expected time to conversion from mild memory impairment for instance to Alzheimer´s disease. It also has value in follow-up studies and in monitoring the effects of therapies giving more accurate estimates of disease progression or effects of therapy by correcting for atrophy. From practical point of view, multimodality imaging protocol requires a single visit and increases patient conform and reduces costs. Multimodality imaging of the brain still has some technical and practical challenges. Disadvantages include possible contraindications for MRI and MRI is also sensitive to movement artefacts. PET/CT adds radiation dose and image quality for structural evaluation in low-dose CT is limited.

Learning Objectives:

1. To learn about PET tracers in minimal cognitive impairment (MCI) and dementia.
2. To learn about MRI in MCI and dementia.
3. To understand the role of advanced hybrid imaging in MCI and dementia.

Author Disclosure:

J.O. Rinne: Advisory Board; Teva Finland Ltd. Consultant; Clinical Research Services Turku (CRST) Ltd.

A-612 15:00

C. Brain tumours

P. Bartenstein, N. Jansen;
Munich/DE (peter.bartenstein@med.uni-muenchen.de)

Brain tumour evaluation by conventional imaging techniques is challenging, especially after therapeutic intervention. Unspecific post-therapeutic changes on MRI (e.g. after radio (chemo-)therapy) can mimic tumour progression by enlargement of a contrast-enhancing lesion (so-called pseudoprogression), and a reduction of contrast enhancement after antiangiogenic therapy with bevacizumab might mimic treatment response (pseudoresponse). Advanced MRI such as perfusion MRI and MR spectroscopy might be helpful for a better tumour evaluation, but are still under investigation, not yet standardised and not implemented in the clinical routine. In this context, molecular imaging using radiolabelled amino acids or their analogues (e.g. C11-methionine, F18-fluoroethyltyrosine or F18-DOPA), which overcome these limitations, are increasingly used for brain tumour imaging. Multiple studies have reported the utility of amino acid PET not only for the evaluation of treatment response, but also in the primary setting for tumour grading, prognostic evaluation and consequent treatment planning. While F-DOPA-PET has certain limitations due to high uptake in basal ganglia, dynamic F18-fluoroethyltyrosine-PET has gained increasing interest due to the high informative value of characteristic time-activity curves in low- and high-grade glioma. However, the underlying pathophysiologic mechanisms are still not fully understood. The implementation of hybrid PET/MRI enables an accurate and simultaneous correlation of dynamic PET with advanced MRI findings and might help to better understand the pathophysiologic changes in brain tumours. Furthermore, first studies report complementary information provided by PET and MRI so that the combination of both imaging modalities might ameliorate tumour assessment in future and consecutively prolong survival of brain tumour patients.

Learning Objectives:

1. To learn about PET tracers in brain tumours.
2. To learn about advanced MRI in brain tumours.
3. To understand the use of advanced hybrid imaging in brain tumours.

Author Disclosure:

P. Bartenstein: Grant Recipient; Siemens. Investigator; Siemens, General Electrics, Piramal, Bayer. Speaker; General Electrics, Piramal.

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

E³ - ECR Academies: Interactive Teaching Sessions

E³ 1621
Cardiac imaging

A-613 16:00
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 ischemic and non-ischemic myocardial damage is relatively easy. However, DE is not specific for ischemic 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 Pharma, Philips Healthcare, GE Healthcare.

A-614 16:45
B. Cardiomyopathies: from diagnosis to prognosis
A. Jacquier; *Marseille/FR (alexis.jacquier@ap-hm.fr)*

Cardiomyopathies are a major cause of morbidity and mortality worldwide. Dilated cardiomyopathy (DCM) is a frequent cause of heart failure worldwide with an incidence of 7/100 000 per year. DCM presents highly variable clinical outcomes, ranging from stable disease to sudden cardiac death or rapid heart failure. During this lecture we will review important points for diagnosis, etiology and prognosis of DCM. We will review the definition of DCM as well as the magnetic resonance (MR) method to quantify left ventricular volumes and mass. Ischemic heart disease is the first cause of LV dilatation and dysfunction and that dysfunction is potentially reversible after revascularisation, coronary CT scan represent robust tool to assess coronary anatomy in that population. MR is an interesting tool for assessing specific etiology such as non-compaction or heart involvement during inflammatory systemic disorder. MR has the ability to detect scar tissue after gadolinium injection, the presence of a scar in the lateral wall predict the failure of resynchronisation therapy. Prognosis of DCM could be assessed using MR with late gadolinium sequence; T1 mapping and extracellular matrix quantification might be an interesting tool for prognosis of such disease.
Learning Objectives:
1. To understand the diagnostic work-up of cardiomyopathies.
2. To review the association between diagnostic findings and clinical outcome.

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

GI Tract

RC 1601
From my workstation: difficult cases on review

A-615 16:00
Chairman's introduction
A. Maier; *Vienna/AT (andrea.maier@meduniwien.ac.at)*

Although there is an advance in imaging techniques, several pitfalls in the assessment of diseases of the pancreas, small bowel and rectum remain.The differentiation and the correct characterisation of tumours and inflammatory disease in some cases may be difficult. As well atypical presentation of common tumours or uncommon tumours persist a challenge. A problematic situation constantly represent intestinal bleeding and unexpected finding. In this session, we would have to point out the procedure of best imaging modality and protocols of challenging cases.

A-616 16:05
A. Pancreas
C. Triantopoulou; *Athens/GR (ctriantopoulou@gmail.com)*

Difficult cases in pancreatic imaging could be related to many factors. A radiologist should be familiar with all variants that may be the reason of imaging pitfalls. Different types of pancreas divisum or ectopic spleen in the pancreas could be misinterpreted as focal enlargement or even a focal mass. Many difficulties also rise in the differential diagnosis between pancreatic cancer and mass forming chronic pancreatitis and the two specific forms, autoimmune and groove pancreatitis. A dedicated pancreatic protocol should be applied in all modalities and careful evaluation of the ductal changes is the clue for the diagnosis. Pancreatic adenocarcinoma may sometimes appear as an isoatenuating mass, an exophytic mass, multifocal lesions or as a diffuse pancreatic infiltration. In cases of atypical presentation other multifocal or diffuse diseases should be excluded as metastases or lymphoma. Excluding pancreatic cancer should be the first issue and every attempt should be made taking also into consideration the clinical signs and laboratory results. When it is definitely needed, EUS-guided FNA should be applied. Challenging cases could also be related to the heterogenous group of cystic lesions. Differentiation between a neoplastic and a non-neoplastic cyst is not always easy as there are many overlapping appearances. Worrisome imaging features should be recognised and specific care should be taken for a proper follow-up in atypical cases. Large non-functioning neuroendocrine tumours may also appear as cystic lesions. Other rare tumours that cannot be easily characterised are lymphoepithelial cysts, endometrial cysts, solid pseudopapillary tumour, pancreatic sarcoma or schwannoma.
Learning Objectives:
1. To appreciate the challenging variants in pancreatic anatomy.
2. To learn about the most important pitfalls in pancreatic imaging.
3. To understand the management of these challenging cases.

A-617 16:28
B. Small bowel
E. Biscaldi; *Genoa/IT (ennio.biscaldi@gmail.com)*

The small bowel is far from natural orifices, but its position allows radiologists and endoscopists to perform diagnoses. Endoscopy is the gold standard, while Multidetector CT is a diffused technique in small bowel imaging. We have to be aware, throughout investigations, that morphologic anomalies or embryonic development defects may exist, complicating diagnosis, causing misunderstandings. CT enteroclysis/enterography are well-known tools in small bowel evaluation: frequently used in cases of 'first diagnosis' of an unknown pathology. In different patterns of intestinal wall thickening, there are many possible diagnostic pitfalls. The increasing diffusion of PET-CT examinations requires awareness of physiological patterns of small bowel loops (hot spots, artefacts from peristalsis): PET imaging does not target the small intestine. MDCT is the first tool in emergency diagnosis, where many pitfalls are possible. Unknown diseases may be revealed (such as tumours): for example a complicated GIST was found in a patient affected by intestinal bleeding of an obscure origin. CT enteroclysis may find unknown or unsuspected diseases but correct technical parameters have to be respected. Artefacts may derive from an improper acquisition technique such as a limited distension or an incorrect use of pharmacological hypotonisation. Unexpected findings may be detected in rare pathologies: we found nodules of intestinal endometriosis with an ambiguous clinical presentation; in patients with autoimmune pathologies (pyoderma gangrenosum, lupus erythematosus) unknown inflammatory

intestinal diseases were discovered. Comparisons with endoscopy are possible, particularly with the challenging pillcam technique; the knowledge of its limits is important. In emergency, when radiological diagnosis is unclear, the surgeon determines the patient's management. In case of a defective study technique, a proper examination may be repeated. Endoscopy or pillcam may help to detected mucosal lesions invisible by CT.
Learning Objectives:
1. To learn about the normal anatomy and normal variants.
2. To learn about the most important pitfalls in imaging assessment of small bowel lesions.
3. To understand the management of these challenging cases.

A-618 16:51

C. Rectum
D.M.J. Lambregts; *Maastricht/NL (d.lambregts@mumc.nl)*

Rectal cancer is the most common and well-known pathology of the anorectum. There are, however, other less common pathologies, both benign and malignant, that can involve the anorectum and may mimic rectal cancer. Moreover, rectal cancer may have various atypical presentations that can lead to difficulties in image interpretation. In this session, the most important interpretation challenges in the assessment of rectal cancer will be discussed. Furthermore, some atypical presentations of rectal cancer (mucinous, signet ring) will be shown and a variety of other pathologies of the anorectum which may mimic rectal cancer such as lymphoma, GIST, lipoma and neuro-endocrine tumours.
Learning Objectives:
1. To learn about normal rectal anatomy and normal variants.
2. To learn about the most important pitfalls in imaging assessment of rectal cancer or rare tumours of the rectum.
3. To understand the management of these challenging cases.

17:14
Panel discussion: What can we learn from challenging cases?

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

E³ - ECR Academies: Modern Imaging of the GI Tract

E³ 1622
Oesophageal and gastric cancer

Moderator:
W. Schima; Vienna/AT

A-619 16:00

A. Modern imaging: an update
A. Ba-Ssalamah; *Vienna/AT (ahmed.ba-ssalamah@meduniwien.ac.at)*

Multi-detector computed tomography (CT) offers new opportunities in the imaging of the gastrointestinal tract. Its ability to cover a large volume in a very short scan time, and in a single breath-hold with thin collimation and isotropic voxels, allows the imaging of the entire oesophagus, stomach, and the whole chest and abdomen with high-quality multiplanar reformation and three-dimensional reconstruction. Preparation of the patients by fasting from solid food approximately six hours prior to the examination is important. Proper distention of the oesophagus and stomach by oral administration of effervescent granules and water, and optimally timed administration of intravenous contrast material, are required to detect and characterise disease. Preoperative staging of oesophageal and gastric carcinoma appears to be the main indication for MDCT and may replace endoluminal ultrasound (EUS) in the staging of advanced cancers. The use of various reconstruction techniques, including virtual gastroscopy (VG) using a volume-rendering (VR) technique, are promising techniques for the detection of early gastric cancer. The application of the texture analysis technique to distinguish between the different types of gastric and oesophageal tumours is still evolving. Finally, the introduction of FDG PET, in combination with MDCT, has resulted in further optimisation of the diagnostic workup of oesophageal cancer, as well as specific types of cases of gastric cancer. By providing morphologic and functional information in the same setting, this technique has come to be the modality of choice, when it is available.
Learning Objectives:
1. To learn about the appropriate use of modern imaging techniques in the staging of oesophageal and gastric cancer.
2. To become familiar with optimised imaging acquisition protocols, including patient preparation.
3. To appreciate the use of emerging visualisation techniques, including virtual gastroscopy.

A-620 16:20

B. How to provide the perfect staging report
R.M. Mendelson; *Perth/AU (themendelsons@iinet.net.au)*

Oesophageal and gastric cancer staging is a matter for diagnostic imaging and is a major determinant of disease management. This ideally should be discussed within a multidisciplinary team (MDT) meeting at which the radiologist plays a crucial part. Accurate staging, based on the TNM staging criteria, is essential and the radiologist's report should reflect this pivotal role. The TNM staging of oesophageal cancer and gastric cancer will be discussed in detail. The phases in staging are a process of algorithmic filtering which seeks to initially exclude distant metastasis and/or advanced local disease, first by optimally protocolled CT scanning. If CT shows advanced disease, treatment is palliative, but imaging will help determine the method of palliation. If CT demonstrates localised disease, PET scanning for oesophageal cancer and for selected cases of gastric cancer is indicated. If this shows no nodal or distant metastasis, accurate T staging with EUS will help determine whether the patient proceeds directly to surgery or pre-operative neo-adjuvant chemo/radiotherapy, or in the case of oesophageal cancer may be suitable for EMR. However, recent studies showing an increased role for neo-adjuvant chemo-radiotherapy, in this author's opinion, have had a subsequent effect in reducing the occasions when accurate nodal staging is crucial. The role of staging laparoscopy in gastric cancer will also be discussed. In summary, imaging specialists are crucial in determining treatment. Their reports are the lynch-pins in the MDT discussion of patient management. It is, therefore, essential that the imaging report should optimally inform this discussion.
Learning Objectives:
1. To learn about the latest TMN staging in oesophageal and gastric cancer.
2. To appreciate the imaging criteria for local, nodal and metastatic disease, and understand the accuracy of imaging staging.
3. To become familiar with the structure of a perfect imaging report.

A-621 16:40

C. Assessment after treatment
A.M. Riddell; *Sutton, Surrey/UK (Angela.Riddell@rmh.nhs.uk)*

It is now established that for the majority of patients with oesophageal & advanced gastric cancer there is a survival benefit to the use of neoadjuvant therapy. Therefore, there is a requirement for imaging to accurately restage the tumour & to assess response to neoadjuvant therapy, to provide prognostic information and to direct future management. Re-staging following therapy is challenging as differentiating treatment-related fibrosis/oedema from viable tumour is problematic for both CT and endoscopic ultrasound. The T&N staging accuracy for both modalities falls following neoadjuvant therapy. Inconsistencies in measurements due to alterations in the degree of gastric/oesophageal distension can also limit the accuracy of RECIST criteria to determine response. Functional imaging techniques such as PET-CT offer an improved method for assessing response. Alterations in the standardised uptake value (SUV) occur much earlier than changes in size; therefore, a metabolic response can be detected sooner, allowing for more rapid alterations in treatment strategies. Acute complications following oesophagogastrectomy generally occur within the thorax and are either related to a leak at the anastomosis/mediastinitis or respiratory complications such as pneumonia or a pleural effusion. Intra-abdominal collections may develop following oesophagogastrectomy & gastrectomy. Late complications following both procedures are often due to tumour recurrence, either locoregional: lymph node recurrence or at the anastomosis; or metastatic spread: haematogenous spread or via the peritoneum or pleura. Currently there is no consensus on the most appropriate timing or frequency of postoperative imaging.
Learning Objectives:
1. To understand the role of imaging in treatment response assessment.
2. To appreciate the imaging signs of viable or recurrent tumour after therapy.
3. To learn about the common surgical procedures and potential pitfalls in interpreting postoperative imaging.

A-622 17:00

D. Interactive case discussion
W. Schima; *Vienna/AT*

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

Joint Session of the ESR and ESTRO

ESR/ESTRO 2

Radiology and radiation oncology: new chances for a partnership

Moderators:
P.M.P. Poortmans; Nijmegen/NL
L. Bonomo; Rome/IT

A-623 16:00

Introduction
L. Bonomo; *Rome/IT (lbonomo@rm.unicatt.it)*

Since the discovery of X-ray, Radiology and Radiation Oncology have been considered sister disciplines. Moreover, for many years Radiology and Radiation Oncology lived in the same department, as it is still today in many European countries. The development of both disciplines increased the points of contact between Imaging and Radiation Oncology, so that they can work together to develop the best treatment plan and improve patient care. The opportunities for both disciplines should be dealt with within the collaborative relationship existing between ESR and ESTRO. This joint session aims at targeting the issue of new technological developments in imaging relevant to Radiation Oncology and issues relevant to the above partnership. Working together, Interventional Radiology and Radiation Oncology would cover a very large proportion of oncological patients, to the advantage of both disciplines. The greatest advantage for Interventional Radiology is that this partnership would offer access to the infrastructure currently available to Radiation Oncology, enabling Interventional Radiology to practice its clinicians. The most strategic goal for Interventional Radiology is to gain access to the infrastructure they need to look after their own patients.

Session Objectives:
1. To understand how collaboration between radiology and radiation oncology presents great opportunities to both the disciplines.
2. To learn how interventional radiology can achieve excellent clinical results in oncologic patients.
3. To understand how the partnership between radiology and radiation oncology offers the best treatment to patients.

A-624 16:05

Imaging in oncology: achievements and limitations
V.J. Goh; *London/UK (vicky.goh@kcl.ac.uk)*

Accurate evaluation of the anatomical tumour extent is important for therapeutic triage for which imaging plays an important role. For cancer patients with locoregional disease curative treatment is the intent. Imaging plays an important role in planning definitive treatment, in modifying its treatment, and in response assessment. Accurate depiction of all involved sites of disease is important to optimise radiotherapy delivery and to minimise the likelihood of local recurrence. In the last decade, there has been a paradigm shift towards more physiologically based imaging approaches in recognition of some of the limitations of morphology-based imaging and the requirements of more sophisticated radiotherapy techniques including intensity-modulated radiotherapy and sterotactic radiotherapy. A number of molecular and functional imaging techniques that are available in clinical practice including positron emission tomography (PET), diffusion-weighted magnetic resonance imaging (DW-MRI) and dynamic contrast-enhanced (DCE) MRI show promise in tumour staging, tumour phenotyping, treatment planning and response assessment. These imaging techniques will be discussed in the context of patients treated with radiotherapy.

Learning Objectives:
1. To learn about the actual capabilities of imaging for the management of oncologic patients.
2. To become familiar with functional techniques applied to oncologic patients.
3. To understand how imaging can help radiation oncologists.

Author Disclosure:
V.J. Goh: Advisory Board; EIBIR. Equipment Support Recipient; Siemens Healthcare. Research/Grant Support; Siemens Heathcare.

A-625 16:25

Interventional radiology in oncology: achievements and limitations
J.I. Bilbao; *Pamplona/ES (jibilbao@unav.es)*

Interventional radiology (IR) is a radiological transversal specialty that covers a wide range of diseases including the rising field of interventional oncology (IO). At this moment, IR represents a basic and differentiated pillar in the care of patients with cancer because IO, as part of the image-guide therapy processes, is fundamental in the clinical care as well as in the research for the understanding and application of the most advanced ways to treat patients with malignancies. In collaboration with morphological and functional image methods for the evaluation of diseases, sampling by needle biopsy of the most representative tumoral sites, give unvaluable information about biomarkers for selection and monitorisation of the assigned treatment. The clinical application of percutaneous methods for the direct treatment of tumours is a landmark of oncological therapies. Its application, alone or in combination with surgery, are included as curative procedures in a wide variety of oncological guidelines (although not as many as they should be). Investigation about the different techniques for the guidance of an anticancer agent through endovascular methods represents a most appealing way to approach a disease. It seems obvious that by shortening the distance between delivery and target several shortcomings of the selected therapy can be overcome. Similarly, if the interaction between the antitumoral agent and the tumoral cells can be prolonged, its effect should be higher. Also, the tumoral cells and their surroundings can be modified with the aim of allowing the application of other curative methods such as radiotherapy among others.

Learning Objectives:
1. To learn about the best indications for interventional radiology in oncology.
2. To learn about the results of interventional procedures in comparison to other treatment options in the most common tumours.
3. To understand how interventional radiologists and radiation oncologists can work together.

Author Disclosure:
J.I. Bilbao: Speaker; Sirtex Medical Europe, Terumo.

A-626 16:50

Interventional radiology and radiation oncology: working together
D. Verellen, J. de Mey, F. Vandenbroucke, N. Buls, M. De Ridder; *Brussels/BE (dirk.verellen@uzbrussel.be)*

When it became clear in the 70/80s of the previous century that therapeutic and diagnostic radiologists were developing different needs (with the introduction of a separate discipline radiation oncology and creation of ESTRO) the synergy between developments in both disciplines never dwindled, on the contrary. The introduction of CT in 3D treatment planning, and developments of image-guided and biological conformal radiotherapy can be considered as major milestones in the evolution of radiotherapy and indeed emphasise this close collaboration. The interaction between interventional radiology and radiotherapy is a case in point. With the introduction of respiratory synchronised irradiation techniques (gating and real-time tumour tracking) for stereotactic body radiotherapy of primary tumours and oligometastases in lung and liver, the implantation of radio-opaque fiducials prompted close collaboration. In addition, optimisation of 4D respiratory correlated CT using both phase and amplitude-based image binning was needed for internal motion prediction models to drive the treatment machines for motion management. Another example is the use of digital subtracted angiography for stereotactic radiosurgery of arteriovenous malformations, which is evolving from a frame-based approach (for registration of 2D-DSA images with 3D MRI/CT data) towards frameless, image-guided SRS using image registration tools to incorporate the angiography data into the volumetric data set for treatment planning. Finally, some comments will be made on the apparent competition between radio-frequency ablation and SBRT, where outcome can be optimised by combining both approaches ("the square of the sum being larger than the sum of squares").

Learning Objectives:
1. To understand the radiation oncologist's perspective regarding interventional radiology in oncology.
2. To learn about the image-guided radiotherapy technologies in comparison with other treatment.
3. To learn how radiation oncologists and interventional radiologists can work together.

17:10
Panel discussion: The future partnership between radiology and radiation oncology

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

Physics in Radiology

RC 1613
MR: artefacts and devices

Moderator:
D. Bor; Ankara/TR

A-627 16:00

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 artifacts, 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 nonlinearity, 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 artifacts, 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.
Author Disclosure:
D.J. Lurie: Board Member; Member of Physics in Radiology Committee of ECR.

A-628 16:30

B. Imaging around metal implants: artefact reduction in MRI
C. McGrath; *Belfast/UK (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 arteacts 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 re-familiarise the listener with the origin of signal in MRI.
2. To understand the concept of magnetic susceptibility and how differences between magnetic susceptibilities determine metal artefacts in MRI.
3. To understand the MRI physics of artefact reduction around metal implants.
4. To understand the parameters used in an optimised imaging protocol.
Author Disclosure:
C. McGrath: Speaker; The author has presented a similar presentation at two MRI Symposia organised by GE Healthcare.

A-629 17:00

C. Artefacts in perfusion and diffusion MRI
I. Tsougos; *Larissa/GR (tsougos@med.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 characterization over conventional MRI alone. Particularly, Diffusion Weighted Imaging, Diffusion Tensor Imaging and Dynamic Susceptibility Contrast Imaging provide, non-invasively, significant structural and functional information in a microscopic level, revealing aspects of the underlying patho-physiology. Although over the last 10 to 20 years, diffusion and perfusion MRI has become established techniques with a great impact on differential diagnosis, like any other MRI technique they remain subject to artifacts and pitfalls. Hence it is evident that obtaining reliable data and drawing meaningful and robust inferences is of outmost importance. The process of quantifying diffusion and perfusion indices and/or correlating them with other parameters starts at the acquisition of the raw data, followed by a long pipeline of image processing steps. Each one of these steps is susceptible to sources of bias, which may not only limit the accuracy and precision, but can lead to substantial errors. Therefore in addition to common MRI artifacts, there are specific problems that one may encounter when using MRI scanner gradient hardware for diffusion and perfusion MRI, especially in terms of eddy currents and sensitivity to motion.
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.

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

E³ - European Diploma Prep Sessions

E³ 1623
Breast

A-630 16:00

Chairman's introduction
F. Pediconi; *Rome/IT (federica.pediconi@uniroma1.it)*

Radiology is a medical specialty that involves all aspects of medical imaging. It provides information about the anatomy, physiology, and function of organs and systems of the human body in normal and abnormal status, allowing for imaging-based diagnosis, tissue sampling, and therapy. This is even more applicable to the breast radiology subspecialty where only appropriately trained physicians should carry out this duty. The fundamentals of undertaking and interpreting a wide range of imaging techniques and disease manifestations remain essential for breast radiologists. Mammography is the main investigation for breast cancer. It is used primarily to detect and diagnose breast cancer and to evaluate palpable masses and non-palpable breast lesions. So starting from the anatomical and pathological knowledge of the breast disease, the first step is to understand the principles of the mammography and how to apply them. This will be followed by all the other imaging modalities currently available to gain an appropriate diagnosis (US, MR, biopsy, etc). What it is desirable for all the radiologist embracing the breast subspecialty is to interpret and report mammograms, breast ultrasound and breast MRI examinations using a standardised diagnostic categorisation system such as the ACR breast imaging reporting and data system (BI-RADS®) and put the patient into a correct diagnostic pathway. It is important to have the appropriate breast imaging knowledge to choose the best-suited method for evaluating the breast disorder in each patient. Finding breast cancers early greatly improves women's chance for successful treatment and it really affects their prognosis.
Session Objectives:
1. To understand the methodological principles of mammography.
2. To know the mammographic appearance of benign and malignant lesions of the breast.
3. To become familiar with the imaging appearance if benign and malignant breast lesions.

A-631 16:03

A. Fundamentals of mammography
S. Barter; *Cambridge/UK (suebarter@btinternet.com)*

In this lecture, anatomy, normal variants and common abnormalities of the female breast will be discussed, with particular emphasis on breast cancer detection. Basic mammographic interpretation "how to read a mammogram" with particular reference to characteristics of primary and secondary signs of malignancy will be illustrated. The importance of technical aspects of diagnostic mammography especially with regard to positioning, dose and image quality will be discussed. Quality can be lost at different points in the mammography process, positioning of the patient, the x-ray beam and dose, the detector and display. Viewing conditions must be optimised to ensure accurate detection of abnormalities. There is good evidence from 2 population-based screening programmes that poor image quality can reduce cancer detection on screening mammograms from 15% to 24%. Finally the principles of current practice and risk/benefit analysis in breast cancer screening will be

explained. Screening is the practice of mammograms performed regularly in asymptomatic women. The goal of screening is to ensure detection of breast cancer in the examined population at the earliest possible stage to reduce breast cancer mortality, and minimise potential side effects and unnecessary interventions in the screened population. Fundamental to a successful program is strict quality assurance.

Learning Objectives:

1. To understand the anatomy, normal variants and abnormalities of the female breast.
2. To describe the technical aspects diagnostic mammography, especially in regard to dose and image quality.
3. To explain principles of current practice and risk/benefit analysis in breast cancer screening.

A-632 16:32

B. Breast cancer diagnosis and interventions

M. Müller-Schimpfle; *Frankfurt a. Main/DE (mms@dr-mms.de)*

Mammography, ultrasound and MRI are the imaging modalities of choice for diagnosing breast diseases. The ability to detect lesions depends on density, glandular heterogeneity or background enhancement. The typical types of findings that can be differentiated are masses, non-mass lesions, architectural distortions, asymmetries or additional findings. Masses can be characterised by shape and margin, non-mass lesions by morphology and distribution, suggesting a category of suspicion for malignancy. Further elements such as density, echogenicity, contrast kinetics, pre-test probability, change over time or individual risk can modify a category of suspicion. Whenever a lesion shows a probability of malignancy > 2%, a needle biopsy should be considered. The modality of choice as well as the needle used depend on the detection method and lesion type. The same is true for pre-surgical localisations. Most masses will show a correlating finding in ultrasound which subsequently can guide a fine needle, a 14G needle biopsy or a wire, clip / coil marker online. Non-mass lesions such as microcalcifications or lesions in breast MRI will typically be biopsied by vacuum-assisted techniques to diminish sampling error.

Learning Objectives:

1. To recognise the different presentation of normal breast patterns and the appearance of common benign diseases and of breast cancer at mammography, ultrasound, and MRI.
2. To understand principles and basic application of a standardised diagnostic categorization systems such as the ACR breast imaging reporting and data system (BI-RADS®).
3. To describe indications, contraindications and technical aspects of image-guided interventional breast procedures (fine needle aspiration, core needle biopsy, vacuum-assisted biopsy, presurgical localisation).

A-633 17:01

C. Advanced imaging of the female breast

R.M. Mann; *Nijmegen/NL (ritse.mann@radboudumc.nl)*

While the basis of radiological evaluation of the breast is the so called triple diagnosis, i.e. mammography supplemented with ultrasound and if needed biopsy, additional techniques are sometimes indicated. It should be stressed that additional techniques do seldom rule out the need for biopsy, and should thus not be used as a replacement for histology, although this may change in the near future. Rather additional techniques may be helpful in situations where biopsy is not possible, but conventional imaging remains inconclusive. First, among the current alternatives for breast imaging is MRI, which has a very high sensitivity for breast cancer and consequently a very high negative predictive value in a setting where the a priori chance of detecting breast cancer is already low. It is also used for screening in settings where the chance of breast cancer detection is already relatively high, and the performance of mammography is poor, such as in women at increased risk for the development of breast cancer or (supplementary to staging the primary tumor) in women with already known unilateral breast cancer. In the neoadjuvant setting, MRI with advanced techniques such as DWI and MRS may be used to predict the likelihood of eventual response and thus the usefulness of the therapy. Similar indications may be used for the employment of contrast-enhanced mammography, PEM or scintimammography, although their role is much less well defined.

Learning Objectives:

1. To describe imaging techniques of the breast other than mammography and to put these into a correct diagnostic pathway.
2. To recognise the different presentations of normal breast patterns and the appearance of common benign diseases and of breast cancer at ultrasound and MRI.
3. To understand the various post-therapeutic imaging patterns of the treated breast.
4. To be familiar with the staging of breast cancer.

Author Disclosure:

R.M. Mann: Speaker; SIEMENS Healthcare, Bayer.

16:00 - 17:30 **Studio 2015**

Multidisciplinary Session

MS 16

Solving the crossword puzzle in diffuse interstitial lung disease (DILD)

A-634 16:00

Chairman's introduction

H.-U. Kauczor; *Heidelberg/DE (Hans-Ulrich.Kauczor@med.uni-heidelberg.de)*

Diagnosis and therapy of diffuse interstitial lung disease (DILD) remains a major challenge in the era of personalised medicine. The joint consensus statement from multiple international medical societies on the diagnosis and management of DILD published in 2011 introduced two important changes. 1) The CT pattern of DILD has been recognised as a pivotal cornerstone in their diagnosis. One advantage of CT with regard to biopsy and histology lies in the volumetric data set with evaluation of the whole lung instead of a small specimen of pulmonary tissue from a single location. In typical cases the CT diagnosis even prevails histology. 2) Best results for determination of diagnosis and decision of appropriate personalised therapy are obtained from multidisciplinary boards consisting of radiologist, pulmologist and pathologist. The implementation of these recommendations into clinical practice comes with opportunities and requirements. 1) Radiology (CT) is indispensable for the (differential) diagnosis of DILD. 2) Radiologists have to be well trained in CT patterns and terminology of DILD to substantially contribute to the multidisciplinary DILD board.

Session Objectives:

1. To become familiar with the multidisciplinary diagnosis.
2. To understand the roles of the radiologist, pulmonologist and pathologist.
3. To consolidate knowledge on the radiological patterns.

Author Disclosure:

H.-U. Kauczor: Equipment Support Recipient; Siemens, Philips. Speaker; Siemens, Bracco, Bayer, Boehringer, Novartis.

A-635 16:05

Pulmologist's approach: the clinical aspects

F.J.F. Herth; *Heidelberg/DE (Felix.Herth@med.uni-heidelberg.de)*

Interstitial lung diseases are a collective name for various diseases, when different triggers, injuries or genetic disorders lead to an abnormal healing response of the lung. Over the past year, specialists have witnessed considerable progress in the clinical evaluation/management of DILD and in the elucidation of pathobiological mechanisms. A joint consensus statement from multiple international medical societies on the diagnosis and management of IPF was published in 2011. The major criteria established in the 2000 consensus statement have been eliminated; in the appropriate clinical context, a pattern of usual interstitial pneumonia (UIP) on high- resolution computed tomography scan is sufficient to make a diagnosis of IPF. Surgical lung biopsies may be required in uncertain cases, and a multidisciplinary discussion among experienced clinicians, radiologists, and pathologists improves diagnostic accuracy. In the presentation the different aetiologies, epidemiology and prognosis will be discussed based on the actual knowledge. The audience will learn the clinical criteria for diagnosing DILD and to understand the clinical course including the diagnostic algorithms and evidence-based treatment options.

Learning Objectives:

1. To learn about the different aetiologies, epidemiology and prognosis.
2. To know the clinical criteria for diagnosing DILD.
3. To understand the clinical course: natural history, exacerbations, treatment options.
4. To become aware of current non-invasive diagnostic procedures.

A-636 16:25

Pathologist's approach and diagnosis

A. Gschwendtner; *Amberg/DE (agpathopalm@gmail.com)*

The main task for the pathologist in the diagnosis of fibrosing alveolitis of the lung is to separate the pattern of usual interstitial pneumonia (UIP) from the other patterns of diffuse interstitial lung diseases (NSIP, RB-ILD, COP and EAA). Although high-resolution CT scans are highly advanced and often can already fix the diagnosis in a later stage of UIP with high accuracy, there still lies valuable additional information in the microscopical analysis of lung tissue which is not accessible by today's radiology. Cystic patterns in radiology may be emphysematous bullae, histiocytosis X, bronchiectasis or well-established honeycombing of UIP in histology. Areas of ground glass opacity may alter the pattern of fibrosis and can only be differentiated by histological analysis

indicating if they are compatible with UIP or not. In addition granulomatous disease as well as exposure to mineral dusts and asbestos fibers can only be proven by histological examination of lung tissue. Honeycombing at least may lack fibroblastic foci and, therefore, being indicative for an end-stage disease other than UIP, although seeming specific for UIP in radiology. The difference can only be recognised by histology which is important because of a different clinical course of the disease. Samples are shown to demonstrate how histology can contribute to diagnostic decision making. Limits are clearly demonstrated and so making it understandable why the diagnostic procedure has to be complemented by an interdisciplinary board of clinicians and pathologist to solve the puzzle of DILD.

Learning Objectives:
1. To appreciate the potential of histopathology.
2. To appreciate the limitations of histopathology.
3. To learn about the role of novel molecular markers.

A-637 16:40

Radiologist's approach, patterns and diagnosis

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

There is a confusing list of abbreviations describing the diffuse interstitial lung diseases. Some of them are patterns only, while others are diseases as well and there are transitions from one into the other. There are frequently typical patterns or constellations which can lead an interdisciplinary conference consisting from pulmonologist, radiologist, pathologist clearly to the correct diagnosis. In certain constellations, clinical information together with radiology is as specific that pathology is nowadays not obtained anymore (typical UIP). This interdisciplinary approach is crucial today, since more and more specific therapies are introduced which require adequate indication due to adverse events and costs. Furthermore, drug toxicity as a possible trigger of ILD plays an increasing role, which requires detailed knowledge of the different types of ILD and adequate matching with patients' history.

Learning Objectives:
1. To know about the appropriate protocols for CT and MRI.
2. To consolidate knowledge about the typical radiological patterns.
3. To understand the atypical radiological patterns.

Author Disclosure:

C.P. Heussel: Consultant; Schering-Plough, Pfizer, Basilea, Boehringer Ingelheim, Novartis, Roche, Astellas, Gilead, MSD, Lilly, Intermune, Fresenius. 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; AstraZeneca, Lilly, Roche, MSD, Pfizer, Bracco, MEDA Pharma, Intermune, Chiesi, Siemens, Covidien, Pierre Fabre, Boehringer Ingelheim, Grifols, Novartis, Gilead, Essex, Schering-Plough.

16:55

DILD-board: Multidisciplinary case presentation and discussion

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

EuroSafe Imaging Session

EuroSafe 4

How can clinical audit enhance patient safety?

A-638 16:00

Chairman's introduction

E.J. Adam; *London/UK (drjaneadam@gmail.com)*

How can we know that we are doing our best for patients and providing a good and safe service if we do not make any checks? Clinical audit is a structured way to sample performance against pre-set targets. If we fail to meet a target, then a careful analysis of what we are doing and making appropriate changes will allow us to improve performance and reassure patients and others that we are providing a satisfactory and safe service.

Session Objectives:
1. To understand the regulatory framework underpinning patient safety.
2. To gain insight into how clinical audit can be carried out, and its scope.
3. To learn how clinical audit is used in different countries and clinical settings.

A-639 16:05

A new approach to clinical audit and safety by the ESR

P. Cavanagh; *Taunton/UK (petecavanagh@gmail.com)*

Clinical audit is a tool designed to improve the quality of patient care, experience and outcome through formal review of systems, pathways and outcome against defined standards and the implementation of change based on the results. The ESR recognises that clinical audit represents good practice and should be a routine activity within radiology departments with which individual radiologists should engage. To this end the ESR audit and standards committee is developing a web-based tool that will provide a resource for radiologists and departments to help them understand the role of audit and more importantly how to perform good quality clinical audit. It also provides templates for a wider range of situations and processes where audit should be focused. This presentation will explore this tool in more detail with specific reference to patient safety and radiation protection.

Learning Objectives:
1. To learn about the ESR's proposed clinical audit tool.
2. To understand the role of the ESR's Audit and Standards Subcommittee.

A-640 16:20

Models of external audit in the Netherlands

S. Geers-van Gemeren; *Utrecht/NL (s.geers@nvmbr.nl)*

In the Netherlands clinical audit is since 2010 obligatory for healthcare professions, regulated by law, to be able to practice. Clinical audit is a tool designed to improve the quality of patient care, experience and outcome through formal review of systems, pathways and outcome of care against defined standards, and the implementation of change based on the results. The quality of the provision of care by professionals is assessed by peers. In the fields of radiology, nuclear medicine and radiotherapy different models of clinical audit are used. For radiotherapy a multidisciplinary audit is used since 2003. For nuclear medicine a multidisciplinary audit has been implemented since 2013. For radiology the clinical audit for radiologists and for radiographers are separate. Implementation of the multidisciplinary audits needs requirements and adjustments of the audit system. This process is complex and needs approval of the members of all involved societies. To support the clinical audit a web-based tool ADAS (general digital audit system) is used. The development of professional standards is a prerequisite to start clinical audit. The use of ADAS in multidisciplinary audits is a requirement to be able to audit different professions and focus on the content and the quality of their contribution to patient care. Clinical audit is a good tool to improve the quality of patient care. Important are the professional standards, the culture of learning and willing to improve by the professionals. "Every defect is a treasure".

Learning Objectives:
1. To learn about practical examples of external audit.
2. To understand the advantages and disadvantages of external audits.

A-641 16:40

Clinical audit in cardiac CT: the UK experience

S. Harden[1], I. Castellano[2]; [1]*Southampton/UK*, [2]*London/UK (stephen.harden@uhs.nhs.uk)*

There is a great deal of interest in lowering the radiation dose in modern cardiac CT practice. Originally a high radiation dose examination can now be performed at a low dose provided the supervising clinician pays great attention to technical detail. The dose delivered may now be useful as a quality marker of practice in cardiac CT. A variation in radiation dose exists across the UK, so we sought to compare the median cardiac CT radiation dose at each cardiac CT centre together with BMI, acquisition heart rate and choice of gating technique. All BSCI members and other cardiac CT centres were invited to submit radiation dose data on all cardiac CT scans performed during the month of March 2014. 49 centres responded and submitted data on a total of 1289 scans. The median DLP for the whole cohort was 200 mGycm, although the median dose for each centre varied from less than 100 to greater than 1300 mGycm. The lowest radiation dose was associated with prospective gating, while padding techniques doubled the dose. Reducing acquisition heart rate provides a means of reducing the radiation dose of the examination. The results have been sent to the participating centres in an anonymised format and will serve as a means of departmental benchmarking against other UK cardiac CT centres for quality control. It will also allow a national dose reference level for cardiac CT to be determined.

Learning Objectives:
1. To understand issues specific to clinical audit in cardiac CT.
2. To learn from practical experiences in the UK.

A-642 17:00

The European Radiation Protection Regulators' perspective on audit

S. Ebdon-Jackson; *Didcot/UK (steve.ebdon-jackson@phe.gov.uk)*

Council directive 97/43/Euratom provides the basis for current national legislation across Europe for the health protection of individuals against the dangers of ionising radiation in relation to medical exposure. It includes a requirement that clinical audits shall be carried out in accordance with national procedures. The latest basic safety standards directive 2013/59/Euratom has a similar requirement. Clinical audit varies throughout Europe and includes internal, internal with external direction and external audit systems. These all differ from regulatory radiation protection inspection in their bases, outcomes, organisation and conducting body and potential overlap should be recognised and minimised. Nevertheless, while the process of audit and inspection are separate and the scope of audit will include aspects other than radiation protection, each may inform the other and a common requirement for independence is essential if the full benefits of audit are to be realised.

Learning Objectives:

1. To understand the legal and regulatory environment for clinical audits.
2. To learn more about the role and expectations of radiation protection regulatory authorities in clinical audit.

17:15
Panel Discussion

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

E³ - ECR Master Classes (Head and Neck)

E³ 1626a

Cone-beam vs multi-detector CT in head and neck imaging

Moderator:
A. Trojanowska; Lublin/PL

A-643 16:00

A. Understanding image quality and radiation dose in MDCT and CBCT

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

Diagnostic or clinical CT, today also called multi-slice CT (MSCT) or multi-detector CT (MDCT), and flat detector CT, misleadingly assumed to be synonymous to cone-beam CT (CBCT), are modalities that mainly differ in detector technology and form factor. The detector technology (pixel size, thickness, absorption, cross-talk, intrinsic noise, dynamic range, …) is the determinant for image quality and radiation dose, while the form factor (fixed gantry, C-arm, robotic arm, …) determines the potential use cases of the systems. The clinical CT detectors are made of structured pixels of about 1 mm size. Each pixel's photo diode comprises of its own readout electronics that is spatially located close to the photo diode. The pixel's scintillator thickness is optimised for high-dose efficiency (about 90%). The level of intrinsic detector noise (electronic noise) is low and the dynamic range is high (about 1:10000000). The flat detector CTs use TFT- or CMOS-type detectors that are manufactured in a single piece (or several tiles) comprising an unstructured scintillator. The photodiodes behind the scintillator define the pixels of about 0.2 mm size. To minimise cross-talk the scintillator needs to be thin. Thus, dose efficiency is small (about 50%). Most of the signal encoding takes place far away from the detector pixel: the electronic noise is high, the dynamic range is low (about 1:1000). This presentation discusses the differences of MDCT and CBCT in image quality and dose. It discusses strategies for dose optimisation, such as prefiltration, shaped filtration, tube voltage selection, tube current modulation, iterative reconstruction.

Learning Objectives:

1. To review the working of multi-detector computed tomography (MDCT).
2. To understand the basic principles of cone-beam CT (CBCT).
3. To become familiar with strategies for dose optimisation in CT.

A-644 16:35

B. My finest cone-beam CT cases

J. Casselman[1], B. De Foer[2]; [1]*Bruges/BE*, [2]*Antwerp/BE*
(jan.casselman@azsintjan.be)

The very high spatial resolution (HSR) (125 µm), lower radiation dose and better image quality in the presence of metal provided by CBCT make CBCT a very tough competitor for MDCT in the head and neck region. Exact visualisation of the inferior alveolar canal in implantology and impacted wisdom teeth is crucial and HSR provided by CBCT is needed here. This HSR also made CBCT competitive in endodontics and periodontology. Detection of subtle tooth fractures and visualisation of a fourth root canal are only two examples. Also 3D cephalometric analysis became possible at a low dose allowing better treatment planning and repetitive follow-up in often young patients. HSR in all planes at a lower dose made CBCT also the method of choice in the screening, pre-operative evaluation and post-operative follow-up of sinusitis, today the number 1 CBCT indication. For the same reasons CBCT also excels in imaging of osseous TMJ lesions, maxillofacial and nose fractures, and can be used to evaluate the bone involvement/calcifications in skull base tumours. The temporal bone is probably the most challenging CBCT application and here the resolution is pushed to its limits and the radiation dose can be substantially reduced in comparison with MDCT. Visualisation of ossicular malformations and lysis, evaluation of the footplate, correct evaluation of a dehiscent facial nerve canal or superior semicircular canal, etc. became routinely possible on HSR CBCT and often correct MDCT. The above CBCT applications and advantages of CBCT over MDCT will be discussed and illustrated in this presentation.

Learning Objectives:

1. To describe the application of CBCT in head and neck imaging.
2. To present examples of the value of CBCT in head and neck pathology.

Author Disclosure:
J. Casselman: Equipment Support Recipient; NewTom. Speaker; General Electric Healtcare.

A-645 16:55

C. What can be missed on cone-beam CT: pitfalls and challenges

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

High-resolution CBCT has been recently applied outside the dental area to study the temporal bone and paranasal sinuses. As a limited contrast resolution is the main limitation of this technique, its use in the temporal bone lesions is focused on the demonstration of bone structures' abnormalities. For the same reason, CBCT is not indicated to study neither the complications of acute rhinosinutis nor the extra-sinusal spread of sinonasal neoplasms into adjacent non-osseous structures (brain, orbit, masticatory space). Though CBCT has the ability to demonstrate high-density structures inside soft tissues, as the "iron-like" appearance of some fungus balls, a precise densitometric analysis is much more complex than with MDCT. When compared to MDCT, other two relevant limitations are related to the longer acquisition time required, in the range of more than 20 seconds, and by the constraint of the reduce power of x-ray tubes in the range of a maximum of 90 kV. The long acquisition time requires that the patient really cooperates to achieve the information required without the blurring related to movement artifacts. The maximum voltage may be insufficient in large heads with thick bone, resulting in a less detailed demonstration of the anatomy. While the flat-panel geometry results in a more precise representation of thin structures, like the cribriform plate, running parallel to scanning plane of MDCT; others, as the spiral lamina and modiolus, are less precisely depicted by present CBCT technology.

Learning Objectives:

1. To discuss exclusion criteria for CBCT scanning.
2. To learn about pitfalls in CBCT imaging.

A-646 17:15

Panel discussion: Cone-beam vs multi-detector CT: pros and cons

A. Trojanowska; *Lublin/PL*

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

Special Focus Session

SF 16

Imaging biomarkers in degenerative joint disease

A-647 16:00

Chairman's introduction

S. Trattnig; *Vienna/AT (siegfried.trattnig@meduniwien.ac.at)*

MR imaging of cartilage and cartilage repair tissue has significantly improved in recent years due to the development of well-equipped high-field MR systems operating at 3 Tesla. In addition to evaluation of gross cartilage morphology by MRI, there is growing interest in the visualisation and quantification of ultra structural components of cartilage by MR in two fields: 1) Osteoarthritis is manifested by significant changes in biochemical composition of articular cartilage. Loss of glycosaminoglycans (GAG) and increased water content represent the earliest stage of cartilage degeneration and quantification may allow the evaluation of new disease modifying drugs. 2) since GAG are responsible for the biomechanical properties of cartilage repair tissue their detection may allow to monitor cell-based cartilage repair surgery techniques, such as autologous chondrocyte implantation (ACI) and matrix-based ACI for

the maturation of these grafts and the efficacy of the technique. Therefore, several MR techniques were developed, which allow detection and quantification of biochemical changes that precede the morphological degeneration in cartilage. To date, the most promising techniques for visualising the loss of GAG in osteoarthritis or the increase in cartilage implants are the delayed gadolinium-enhanced MRI of cartilage (dGEMRIC) and GAG specific Chemical Exchange Saturation Transfer (gagCEST). For the second component of articular cartilage but also for other structures in the joint, the collagen fiber network T2 and T2* mapping techniques have been developed. The pros and cons of these techniques and their clinical usefulness will be presented.

Session Objectives:

1. To provide an overview of possible quantitative imaging biomarkers in the musculoskeletal system.
2. To discuss the requirements of imaging biomarkers in degenerative diseases of the musculoskeletal system.
3. To present the clinical impact of imaging biomarkers in degenerative diseases of the musculoskeletal system.

A-648 16:05

Proteoglycan-specific quantitative imaging in osteoarthritis and cartilage repair - part 1

E.H.G. Oei; *Rotterdam/NL (e.oei@erasmusmc.nl)*

Delayed gadolinium enhanced MRI of cartilage (dGEMRIC) exploits a repulsive force between an intravenously administered negatively charged contrast agent and negative charges on proteoglycans (PGs) in cartilage, resulting in an accumulation of the contrast agent inversely proportional to PG content. MRI acquisition in dGEMRIC commonly involves using pulse sequences with variable flip angles or inversion times and is aimed at calculating T1 relaxation times (sometimes expressed as dGEMRIC index) that can be used a quantitative indicator of cartilage PG content. Good correlations between dGEMRIC outcomes and PG content, as well as good reproducibility of dGEMRIC have been found in in-vitro and in-vivo studies. dGEMRIC has been applied as outcome measure in various clinical research studies, e.g. on development of early osteoarthritis in patients with anterior cruciate ligament rupture, femoro-acetabular impingement and developmental dysplasia of the hip. It has also been used to study effects of pharmacotherapy, lifestyle interventions, and surgical procedures for osteoarthritis, and to follow-up cartilage repair procedures. Although dGEMRIC is regarded as one of the best available imaging tools for indirect PG measurement in-vivo, there are several disadvantages of dGEMRIC mainly related to the contrast agent that increases costs and precludes imaging of patients with renal failure. Total examination time is extremely long due to the required 90 minutes delay between contrast administration and image acquisition. Finally, rate and degree of contrast accumulation in cartilage may be influenced by factors other than PG content, such as collagen content and orientation, pharmacokinetics, and type and duration of the exercise.

Learning Objectives:

1. To learn about the basic principles of delayed gadolinium-enhanced MRI of cartilage (dGEMRIC).
2. To learn about imaging protocol issues and analysis methods for dGEMRIC.
3. To understand the advantages and disadvantages of dGEMRIC for clinical research and patient care.
4. To appreciate the additional value of dGEMRIC for the follow-up of cartilage repair procedures.

Author Disclosure:

E.H.G. Oei: Research/Grant Support; GE Healthcare.

A-649 16:28

Proteoglycan-specific quantitative imaging in osteoarthritis and cartilage repair - part 2

M.-A. Weber, C. Rehnitz;
Heidelberg/DE (MarcAndre.Weber@med.uni-heidelberg.de)

The loss of glycosaminoglycans (GAG) is a key event in early osteoarthritis and cartilage damage. CEST (chemical exchange saturation transfer) is a new promising MRI technique to non-invasively measure the GAG content (also named gagCEST). The gagCEST technique relies on the chemical exchange of mainly the OH-groups of GAG, which are specifically saturated during CEST-experiments, and bulk water. The decrease in GAG is expressed as decrease in CEST asymmetry value or percentage. Clinically, gagCEST has been used to evaluate the knee's cartilage at 7 Tesla where decreased CEST values were found in areas of cartilage repair when compared with adjacent normal cartilage. Also, a high correlation of CEST and ^{23}Na, which directly measures GAG, was observed. Current efforts concentrate on the transfer of CEST to clinically more widely used 1.5 and 3 Tesla systems because the amount of the CEST effect also depends on the field strength. Recent reports demonstrate the feasibility of gagCEST at 3 Tesla for evaluating the knee's cartilage. CEST could measure normal cartilage, indicated early GAG-loss in cartilage of the elderly, and detected cartilage damages with non-inferiority when compared with dGEMRIC and T2 mapping. When compared with dGEMRIC at the knee, CEST does not need intravenous contrast agent and is more time sparing (imaging time, 13 minutes). Future developments include improvements in sequence design, correction algorithms, post-processing, clinical validation in correlation with arthroscopy, and the transfer to other joints. Then, gagCEST has the potential to play a central role in comprehensive cartilage assessment.

Learning Objectives:

1. To understand basic principles of chemical exchange saturation transfer (CEST) in cartilage imaging.
2. To become familiar with possible clinical applications of gagCEST.
3. To learn about the advantages and disadvantages of gagCEST compared to other compositional methods.
4. To appreciate current challenges and future perspectives of CEST in comprehensive cartilage assessment.

A-650 16:51

Degenerative joint disease: collagen-specific quantitative imaging of menisci and tendons

K.M. Friedrich, V. Juras, P. Szomolanyi, S. Trattnig; *Vienna/AT*

Menisci and tendons consist of collagen fibers, proteoglycans, glycoproteins, water, and cells; both do have T2 relaxation times below 1 ms, give little to no signal using conventional MR sequences and appear therefore black on conventional morphological sequences. With ultrashort time echo (UTE) sequences or variable echo time (VTE) sequences it is possible to acquire signal from those structures and to quantify it using T2* mapping. T2* provides information about collagen fibers content and orientation as well as water content of tissue. It has been successfully used to quantify the regional variability of the Achilles tendon in a healthy population as well as in pathologic conditions in-vivo and is therefore thought to be a promising marker for tendinopathy. For this purpose, bi-exponential T2* calculation was found to be superior to mono-exponential T2* calculation and the short T2* component also strongly correlated with a clinical score. T2* mapping was also successfully used for the detection of sub-clinical meniscus degeneration and for outcome assessment after anterior cruciate ligament reconstruction to quantify associated meniscal damage. In conclusion, preliminary results for using T2* mapping as a quantitative marker in meniscal and tendon disease are promising, but further studies will be necessary to clarify its role in clinical practice.

Learning Objectives:

1. To understand the basic principles of T2* mapping and ultra-short TE methods in MSK imaging.
2. To become familiar with T2* mapping and ultra-short TE methods in meniscal and tendon disease.
3. To understand the benefits of these quantitative MRI techniques compared to morphological MRI.
4. To learn about the limitations and future applications of these quantitative MRI techniques in MSK imaging.

17:14

Panel discussion: What are the new imaging biomarkers in degenerative MSK disease?

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

State of the Art Symposium

SA 16

Controversies in comprehensive imaging of coronary artery disease

A-651 16:00

Chairman's introduction: what is the evidence?

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

This introduction by the moderator Prof. Dewey will give you an overview of the future of computed tomography, magnetic resonance imaging and hybrid nuclear imaging for the diagnosis of coronary artery disease. The moderator will also introduce the open research questions for coronary disease imaging and introduce the three speakers to the audience.

Session Objectives:

1. To appreciate the different modalities used for coronary disease imaging.
2. To understand the open research questions for coronary disease imaging.
3. To learn what coronary disease imaging could look like in the future.

Author Disclosure:
M. Dewey: Author; "Coronary CT Angiography", Springer, 2009, "Cardiac CT", Springer 2011 and 2014. Consultant; Guerbet. Research/Grant Support; DFG, BMBF, European Commission, European Regional Development Fund, German Heart Foundation/German Foundation of Heart Research, GE Healthcare, Bracco, Guerbet, and Toshiba Medical Systems. Speaker; Toshiba Medical Systems, Guerbet, Cardiac MR Academy Berlin, and Bayer. Other; Institutional master research agreements exist with Siemens Medical Solutions, Philips Medical Systems, and Toshiba Medical Systems. The terms of these arrangements are managed by the legal department.

A-652 16:05

Computed tomography is all you need
H. Alkadhi; *Zurich/CH*

The role of cardiac CT for cardiovascular imaging is becoming increasingly important. Cardiac CT today represents a reliable means for the detection and for the exclusion of coronary artery disease. Cardiac CT also provides information regarding coronary artery plaque burden, morphology and function of the ventricles, valves, and accurate imaging of the aortic root. In addition, cardiac CT shows relevant prognostic value for patients also in the longterm. Cardiac CT, however, also has some shortcomings, such as the only moderate positive predictive value and specificity, particularly in the presence of severe coronary calcifications. Furthermore, the method has an inherent limitation, the associated ionising radiation. This lecture aims at a comprehensive review of the strength and weaknesses of cardiac CT, hereby focussing on those patients in whom cardiac CT is the only thing you need.
Learning Objectives:
1. To understand the high diagnostic accuracy of coronary CT angiography.
2. To learn about the great clinical potential of CT to rule out significant coronary stenosis.
3. To appreciate in which patients CT may become the single test needed for coronary disease imaging.

A-653 16:28

Magnetic resonance will take the lead
M. Francone; *Rome/IT (marco.francone@uniroma1.it)*

Cardiac Magnetic Resonance (CMR) has the ability to potentially cover the whole spectrum of events characterising the ischaemic cascade, from the early reversible, metabolic and functional changes representing the initial sign of imbalance between oxygen demand and supply and progressing towards the various phases of ischaemia which finally lead to myocardial necrosis and its series of complications. This can obtained using a unique combination of dedicated sequences which allow to comprehensively image the various aspects of coronary artery disease, including regional and global biventricular function, myocardial perfusion and tissue characterisation with T2-weighted "oedema-sensitive" and late-gadolinium enhancement (LGE) sequences which were more recently implemented with mapping techniques. Beyond simple detection of myocardial stenosis which can be obtained with CTA, CMR allows to identify the presence of possible underlying myocardial ischaemia which is critical for improving patient care with direct impact on prognosis, therapy and outcome of revascularisation.
In the setting of necrosis and viability imaging, CMR allows to directly visualise myocardial scar, characterising extent, location and transmurality of a lesion, with possible relevant prognostic implications for patients. Finally, CMR represents the most reliable diagnostic tool for depiction of infarct complications such as pericarditis, aneurysm formation, thrombus formation, wall rupture, and ischaemic mitral valve regurgitation. Present lecture will aim to demonstrate how much the definition of one-stop-shop perfectly fits to CMR in the clinical setting of ischaemic heart disease and will focus on which patients will specifically benefit from the exam.
Learning Objectives:
1. To understand the unique comprehensive potential of MRI for coronary disease.
2. To learn about the high accuracy of MRI to assess myocardial ischaemia.
3. To appreciate in which patients MRI may become the single test needed for coronary disease imaging.
Author Disclosure:
M. Francone: Speaker; Bracco Medical Imaging.

A-654 16:51

Hybrid nuclear imaging shows no defeat
S. Kajander; *Turku/FI (sami.kajander@gmail.com)*

Computed tomography coronary angiography (CTCA) and myocardial perfusion imaging techniques (single photon emission computed tomography, SPECT, and positron emission tomography, PET) are well-established modalities for the non-invasive diagnosis of coronary artery disease, CAD. However, both methods have their unique strengths and weaknesses: nuclear imaging, though being the golden standard in assessing the myocardial flow and perfusion, fails to visualise the epicardial arteries themselves. CT, on the other hand, is able to show epicardial plaques and stenoses-but is generally unable to provide information about blood flow at the myocardial level. The integration of either PET or SPECT with CT provides means to overcome these shortcomings and a way to establish connection between epicardial lesions and myocardial flow. Normal or near normal CTCA effectively rules out significant CAD with excellent negative predictive value. In addition, it shows early plaques that may still be non-flow limiting but already in the remodelling stage of coronary wall disease. Furthermore, CT gives information about the calcium burden of the coronary tree, thus being valuable in risk stratification and patient management. In patients with epicardial stenoses, PET or SPECT is able to assess the functional significance of a given lesion. Even in patients without significant epicardial disease, nuclear imaging, particularly PET, may show universally diminished perfusion, a possible sign of small-vessel disease. Thus, in a non-invasive single session exam, PET/CT or SPECT/CT yields information about both sides of the coin, function and anatomy.
Learning Objectives:
1. To understand the high accuracy and prognostic power of nuclear imaging.
2. To learn about how hybrid imaging can guide therapy.
3. To appreciate in which patients hybrid imaging may become the single test needed for coronary disease imaging.

17:14
Panel discussion: Imaging of coronary artery disease in 2020

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

E³ - ECR Master Classes (Breast)

E³ 1626b

Breast imaging: improving the information to women

A-655 16:00

Chairman's introduction
F. Sardanelli; *San Donato Milanese/IT (f.sardanelli@grupposandonato.it)*

Delivering correct information to women is a duty no longer negligible by radiologists. This is true in particular for breast imaging considering the current hot discussion on screening mammography and the current cycle of technological innovation where MRI and tomosynthesis offer great opportunities but also challenges in terms of evidence and appropriateness. Information we deliver to women is crucial and we should acknowledge that this was not always sufficiently addressed in both screening and clinical work. This gap must be filled starting from highly controversial topics as are those we discuss in this session. Overdiagnosis (and its relation with whatever screening programme) is a counterintuitive non-friendly concept for lay persons and its estimate implies the use of complex statistics. However, we must be able to explain overdiagnosis with simple words showing how it is counterbalanced by the number of saved lives. Breast density is a double-face issue, questionable as a relevant risk factor but surely relevant as a masking factor reducing sensitivity of mammography. Interval cancers cannot be avoided, but education of screening radiologists and technological innovation (tomosynthesis) could reduce underdiagnosis. At any rate, we should stress that mammography (also with tomosynthesis) is not a perfect test: women must be clearly informed not to underrate any breast symptom after a negative screening test. Finally, we should learn to present preoperative breast MRI as more sensitive test which implies the possibility of a more appropriate therapy but also the risk of unnecessary wider conservative surgery or mastectomy.
Session Objectives:
1. To understand the relevance of delivering correct information to women about breast imaging.
2. To define the most important controversial topics.
3. To learn to present balanced views allowing women to make an informed choice.
Author Disclosure:
F. Sardanelli: Equipment Support Recipient; IMS-Giotto, Bologna, Italy. Investigator; Bracco, Milan, Italy, Bayer, Berlin, Germany. Research/Grant Support; Bracco, Milan, Italy, Bayer, Berlin, Germany. Speaker; Bracco, MIlan, Italy, Bayer, Berlin, Germany.

A-656 16:05

A. Overdiagnosis in breast cancer screening
N. Houssami; *Sydney/AU (nehmath@med.usyd.edu.au)*

Overdiagnosis (or overdetection) is a controversial and increasingly important topic in cancer screening in general including population breast screening. Given that screening mammography confers benefit (mortality reduction) by detecting cancer at an early stage (including screen-detected lesions such as

in situ disease) it is inevitable that some of the early-detected malignancies revealed through screening may never have caused any adverse consequences to the woman. Hence, overdiagnosis is essentially the flip side of the coin of early detection of cancer. Traditionally, it has been defined as diagnosis of a breast cancer that would not have presented clinically nor caused the woman any problem. Both epidemiological and biological lines of evidence indicate that overdiagnosis occurs in breast screening, so the persisting controversy mostly relates to the extent that this occurs. Extremely divergent estimates of overdiagnosis from mammography screening (ranging from 0 to > 50%) reflect variability of methodological and analytic approaches, and also the applied definitions, in estimating overdiagnosis, and may also reflect true differences in its frequency. The harms from overdiagnosis are inherent in both the consequences of living with the diagnosis and those from overtreatment. In an era of transparency and consumer/patient participation surrounding healthcare decisions, it is appropriate that women are informed of this adverse outcome of breast screening just as they are informed of its benefits. However, this is a challenging task, given both the complexity of the issue and the uncertainties surrounding quantifying overdiagnosis. Evidence on informing women about this issue will be highlighted.

Learning Objectives:
1. To understand what overdiagnosis is and what its relation is with early diagnosis.
2. To understand why the estimates of overdiagnosis can be greatly different.
3. To learn how to inform women about overdiagnosis.

A-657 16:25

B. Breast density, interval cancers, and underdiagnosis

R.M. Pijnappel; *Utrecht/NL (r.m.pijnappel@umcutrecht.nl)*

Breast density is an important issue regarding mammographic screening. There are two factors involved. One is the suggested higher breast cancer risk as independent risk factor of breast density; the other is the often-delayed detection on mammography due to masking of the tumour by the dens breast tissue itself. Breast density as independent risk factor is often overestimated in relation to the average breast density of the female population. Some author's even doubt the scientific evidence of the higher risk of developing breast cancer. The detection of breast cancer is hampered if the breast tissue is extremely dens due to masking. A lot of additional imaging methods are used to improve the detection in very dens breasts and achieve the same breast cancer detection rate compared to lucent mammograms. So far there is not a proven good cost-effective method in adjunct to mammography that reaches the same detection rate compared to woman with fatty non-dens breasts. The consequence of the initial lower cancer detection rate in screening very dens breast is a higher interval cancer rate in these cases. So it is important to realise that under diagnosis and, therefore, a delayed diagnosis of breast cancer forms a potential problem for woman with very dens breast tissue. Despite the higher incidence of delayed diagnosis, high density itself is not related to a higher mortality. When informing woman about their breast density it is essential to have knowledge about these issues.

Learning Objectives:
1. To learn how to inform women about the role of breast density as a masking factor.
2. To learn how to inform women about the role of breast density as a risk factor.
3. To learn how to inform women about interval cancers and underdiagnosis.

Author Disclosure:
R.M. Pijnappel: Advisory Board; Hologic.

A-658 16:45

C. Preoperative breast MRI

K. Pinker-Domenig; *Vienna/AT (katja.pinker@meduniwien.ac.at)*

Magnetic resonance imaging (MRI) of the breast is an established non-invasive imaging technique with several indications including preoperative staging of breast cancer. In breast cancer patients MRI of the breast may be performed to assess lesion extent, detect satellite lesions as well as other cancers in the ipsi- or contralateral breast. Although MRI allows a more accurate estimate of tumour size and extent than mammography or ultrasound and thus presumably allows an improved therapy planning, it has been demonstrated that the detection of additional lesions can lead to more extensive surgery. Additionally randomised studies that evaluated the surgical outcome of preoperative MRI reported conflicting results about the actual benefits of preoperative MRI in breast cancer patients and, therefore, there is an on-going debate in the scientific community about the indications and which patients to refer for preoperative MRI of the breast. This presentation aims to provide a comprehensive overview on the possible indications of preoperative MRI, to discuss the potential advantages and disadvantages of preoperative MRI and to highlight the importance of thorough pre-examination information about MRI of the breast to be provided to cancer patients.

Learning Objectives:
1. To become familiar with the debate about preoperative breast MRI.
2. To learn how to inform women about potential advantages of preoperative breast MRI.
3. To learn how to inform women about potential disadvantages of preoperative breast MRI.

17:05
Panel discussion: How to deliver information to women on difficult and complex issues?

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

Radiographers

RC 1614
MRI from the cradle to the future

A-659 16:00

Chairmen's introduction

B. Hafslund[1], M. Maas[2]; [1]*Nesttun/NO*, [2]*Amsterdam/NL*

Magnetic Resonance Imaging (MRI) is a useful tool for a number of clinical indications. Recognising the importance of an evidence-based approach to the development of protocols will influence the further integration of this technique into everyday clinical practice. The aim of this session is to highlight the MRI basic principles and give an overview of the continuous development of MRI as a key modality to the evolution of medical imaging. This should be leading to evidence of its safety, efficacy, cost and cost-effectiveness and legal implications, both in absolute terms and in comparison with other competing technologies. This session will discuss current and emerging functional and molecular imaging techniques using MRI. Functional and molecular imaging techniques with MRI (fMRI) will increasingly be used in radiology in conjunction with anatomical imaging methods to improve diagnosis and prognosis, target biopsies, as well as predict and detect response to treatment. Medical imaging professionals have to be aware of hazards and dangers associated with MRI environment, safety guidelines and how we communicate any risks associated with MRI / fMRI examinations. Procedures are rapidly expanding. To maintain safe and efficient practice, we should focus upon organisational, functional and technological appropriateness of practice.

Session Objectives:
1. To learn about MRI basic principles and state-of-the-art technology.
2. To understand the role of fMRI in clinical settings.
3. To appreciate the importance of safety procedures in MRI settings.

A-660 16:05

A. MRI sequences made easy

S. Brandão; *Porto/PT (sofia.brand@gmail.com)*

To obtain the relevant clinical information in each exam, radiographers need to know how to accurately setup the several pulse sequences available, and with the increasing number of high-field strength scanners this knowledge requires constant update. Therefore, it is important to consolidate in-depth knowledge of the basic principles of the Magnetic Resonance Imaging (MRI) pulse sequences, to understand the main types of pulse sequences currently in use and to recognise their main applications, advantages and limitations. This includes describing the spin echo and gradient echo-based pulse sequences, their sequence diagrams and the main parameters involved. Secondly, the main applications, advantages, disadvantages and limitations of the pulse sequences have to be considered. Different features should be compared, such as the k-space filling strategies, acquisition time and the resulting tissue contrast. Also, the sensitivity to different kinds of artifacts such as magnetic susceptibility or inhomogeneities of the main magnetic field have to be emphasised, since choosing the most appropriate acquisitions has to take into account practical considerations, such as time constrains or patient motion or lack of cooperation. Finally, the need to adjust the sequence type, their parameters and some technical aspects depending on the application and field strength available are important, so that the radiographers may maintain the image quality.

Learning Objectives:
1. To consolidate in-depth knowledge of the basic principles of MRI sequences.
2. To recognise main applications, advantages and disadvantages of different MRI sequences.
3. To understand the main types of pulse sequences currently in use.

A-661 16:28

B. Functional MRI: new clinical applications

C. Malamateniou; *London/UK (christina.malamateniou@kcl.ac.uk)*

The last two decades witnessed the transition of functional MRI (fmri) from a purely research tool reserved for only a few scientists with very specialised knowledge and a few institutions with state of the art hardware and software to a clinically applicable modality, capable to advance the understanding of normal brain development as well as the pathophysiology of many neurodegenerative diseases. Fmri teaching is nowadays integral to the curriculum of many scientific and medical degrees. The aim of this presentation will be to help the audience understand the basic principles of fmri (signal production and detection of activation techniques), become familiar with current and emerging clinical applications of fmri and their projected clinical benefits to patients and to highlight future developments and research priorities in this field. It will also attempt to explain why certain research applications haven't yet been translated into clinical practice yet and which steps are required to move forward.

Learning Objectives:

1. To understand the basic principles of fMRI.
2. To become familiar with clinical applications of fMRI.
3. To be aware of future developments and research priorities in fMRI.

A-662 16:51

C. Safety in MRI: all you have to know

C. Vandulek; *Kaposvár/HU (cvandulek@gmail.com)*

The growth of MRI has led to a dramatic increase of the number of MRI scanners available. Furthermore, it has resulted in an increasing number of 3 T and higher field strength scanners being used in clinical practice. The rise in scanner numbers and field strength demand an increased awareness of MRI safety issues and measures by radiographers and radiologists. The purpose of the lecture is to discuss MRI safety issues associated with low-field and high-filed MRI scanners. It will review the differences between working in low-field and high-field, furthermore, it will provide an insight on the key differences of MRI safety when going from 1.5 T to 3 T scanner. Knowledge of current MRI safety guidelines and recommendations has an important role in the development of dedicated site/scanner safety protocols. The role of MR Safety Officers (MRSO) in ensuring the MR safety in and around MR scanners, suites, and environments will be presented. MRSOs ensure that all required policies and procedures are understood by MRI staff and are implemented in daily practice. They also regularly carry out risk assessment and support MRI safety-related quality assurance procedures. Preventive measures will be reviewed to refresh standards of best practice in MRI safety. Radiographers and radiologists are responsible for the well-being and safety of the patients and staff, working at an MRI suite. Raising the MRI Safety awareness of professionals who work in an MR environment contributes to the prevention of safety-related incidents.

Learning Objectives:

1. To describe common hazards and dangers associated with MRI environment.
2. To understand procedures for screening patients prior to performing MRI exams.
3. To learn about guidelines and safety recommendations to prevent accidents and injuries.
4. To become familiar with MRI safety and preventive measures.

17:14

Panel discussion: What to expect from MRI in the future of medical imaging?

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

E³ - ECR Master Classes (Neuro)

E³ 1626c

Epilepsy

Moderator:
T. Stosic-Opincal; Belgrade/RS

A-663 16:00

A. How to image epilepsy in children and adults

K. Koprivsek; *Sremska Kamenica/RS (katarina.koprivsek@gmail.com)*

Epilepsy is a chronic neurological disorder characterised by spontaneous recurrent seizures and is commonly classified into generalised and partial (focal). Magnetic resonance imaging (MRI) is fundamental for high-resolution structural imaging in focal seizures, due to its ability to detect anatomic substrates that underlie regional brain epileptogenesis (aka. epileptogenic zone). High MRI efficiency in detecting and assessing epileptogenic zone could be achieved using "personally tailored" MRI protocols. In such protocols for focal epilepsies, the MR sequences, diagnostic planes and slice thickness are carefully selected according to patient age, EEG findings, ictal semiology and additional neurological findings. We are going to present a selection of "personally tailored" MRI protocols and MRI diagnostic strategies in paediatric and adult population used in our Institution during last 20 years, for detection of hippocampal abnormalities, cortical developmental malformations, epileptogenic intracortical tumours, vascular malformations, gliosis and variety of encephaloclastic lesions. Main characteristics of used MR protocols, for all previously listed epileptogenic lesions, will be thoroughly discussed. The remainder of this lecture will address strategies and further developments (coils, higher magnetic fields, specific sequences and different approaches), which may hopefully improve MRI efficiency in patients with MR imaging-negative focal epilepsy.

Learning Objectives:

1. To explain how to study patients affected by epileptic seizures.
2. To explain the difference between sequences and when to perform contrast media injection.
3. To show different diagnostic strategies in paediatric and adult populations.

A-664 16:30

B. How to report MRI in patients with epilepsy

D. Zlatareva; *Sofia/BG (dorazlat@yahoo.com)*

Magnetic resonance imaging plays an important role in the diagnosis, therapeutic planning and follow-up of patients with epilepsy. However, since most of the examinations are performed in different hospitals and different imaging protocols are applied, there is possibility of communication errors especially regarding imaging findings and their clinical relevance. Nowadays in the era of filmless departments when communication between clinician and radiologist is decreased, the role of report is even more important. The new advances in information technologies allow to create computer-generated itemised reporting also known as structured reporting. Structured report minimises possibility of miscommunication between radiologist and clinicians but also between different imaging centers. Systematic approach when reading MRI of epilepsy patient and use of standard terminology is advisable as well as similar organisation of the report. Physician-to-physician communication errors are one of the top five indications for medical malpractice in radiology. Radiology report is a medico-legal document regarding formal communication with referring physician. When radiologist follows a structured report the risks of medico-legal problems will be decreased. In some of the conditions causing seizures initial MRI could be normal and follow-up could reveal underlying structural changes. Using a structured report is very useful at follow-up of the patients with epilepsy who are MR negative but also facilitates dynamic evaluation of previously noted abnormality.

Learning Objectives:

1. To understand if it is possible to use a structured report in those patients.
2. To explain the medico-legal value of your report.
3. To demonstrate the importance of the report at follow-up.

A-665 17:00

C. MRI, electroclinical and neuropathological correlations

N. Colombo; *Milan/IT (nadia.colombo@ospedaleniguarda.it)*

A multimodality approach is needed in patients with epilepsy both for the diagnosis and the pre-surgical planning. Imaging of epilepsy is mainly based on MRI that is utilised for the detection, characterisation and location of the anatomical brain lesions, associated with epilepsy. In addition to morphological MRI study, fMRI and DTI-tractography are now used in the routine practice for performing topographic correlations between the anatomical lesion, the eloquent brain areas and the white matter tracts. In epileptic patients MRI protocol should be optimised, using both 1.5 Tesla and 3 Tesla magnet. MRI study should also be addressed in every single epileptic patient, knowing the suspected location of the epileptic zone (EZ). 7 Tesla magnets are now available both for research and for patient's studies opening new insight into the characterisation of the epileptogenic lesions. Some MRI features, found in epileptogenic lesions, can be explained by scanning the surgical specimens with 7 Tesla magnet. FDG PET is an additional tool used for the localisation of the epileptogenic focus. Focal cortical dysplasias (FCDs) are specific malformations of cortical development (MCD) frequently associated with drug-resistant partial epilepsy (DRPE). They have been recently reclassified by Blumke et al. in three subgroups. An extensive review of the three variants of FCDs with neuropathological correlations will be presented.

Learning Objectives:

1. To understand the importance of a multimodality approach in patients with epilepsy.
2. To show the importance of high field MR in those patients.
3. To show MR and neuropathological correlation.

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

E³ - ECR Academies: Hybrid Imaging (advanced)

E³ 1618

Advanced hybrid imaging in oncology

Moderator:
K. Ahlström Riklund; Umea/SE

A-666 16:00

A. In female pelvis
P.R. Ros; *Cleveland, OH/US (Pablo.Ros@UHhospitals.org)*

MR/PET raises the hope to provide a comprehensive TNM staging of a pelvic malignancy in one single-imaging examination. In our own preliminary experience, PET/MR is distinctly helpful in a) advanced endometrial cancer for staging and treatment planning, b) in a post-treatment setting of recurrence and c) in equivocal cases where other methods failed to determine the exact origin and extent of the neoplastic disease. In advanced endometrial cancer, PET/MR can be helpful to clarify the degree and extent of disease beyond the clinical staging with FIGO classification and PET/CT. The additional information gained from MRI over PET is essentially used for the treatment planning in radiation oncology. Another important benefit of combining PET and MRI is the comprehensive staging for T, N- and M-stage of these patients in one single examination. The initial experience with PET/MR in an oncologic setting shows another potential significant benefit of PET/MR: the support for radiotherapy planning of cervical cancers. PET/MR is prone to play an important role in ovarian cancer for all stages of disease. In our own experience: 1) the use of DWI in MRI is helpful to detect small peritoneal deposits, which escape detection on PET; 2) better anatomic reference with MRI facilitates the distinction of FDG-avid peritoneal serosal bowel implants from FDG hypermetabolism due to bowel motility and 3) MRI can improve the detection and exact lesion localisation in critical interfaces such as the subdiaphragmatic area, where PET suffers from misregistration due to respiratory motion.
Learning Objectives:
1. To learn about indications for PET/CT and PET/MR in female pelvis.
2. To become familiar with evaluation.
3. To understand where MR/PET may be advantageous over PET/CT.
Author Disclosure:
P.R. Ros: Equipment Support Recipient; Philips Healthcare.

A-667 16:30

B. In head neck cancer
M. Becker; *Geneva/CH (minerva.becker@hcuge.ch)*

PET/CT and MRI with diffusion-weighted imaging (DWI) are complementary and reliable techniques for the assessment and staging of head and neck tumours. The recent implementation of hybrid MR/PET systems in clinical settings is promising as morphologic, functional and molecular information can be obtained in a single examination. This lecture focuses on clinical applications of MR/PET in head and neck tumours with special emphasis on squamous cell carcinoma. First, recent evidence about the combined use of PET/CT and MRI with DWI is discussed. Then the principles of MR/PET data fusion are reviewed, including current evidence regarding clinical feasibility, image quality, optimised imaging protocols and quantification with MRI-based attenuation algorithms. Current knowledge regarding the diagnostic performance of MR/PET in the head and neck is discussed and typical tumour manifestations are presented. The appearance of primary and recurrent squamous cell cancers, lymph node metastases and distant metastases on MR/PET, as well as the added value of multiparametric imaging are summarised. The variable appearance of functional phenomena mimicking disease, as well as potential pitfalls of image interpretation due to morphological or functional post-treatment changes are equally addressed.
Learning Objectives:
1. To learn about indications for PET/CT and PET/MR in head-neck cancer.
2. To become familiar with evaluation of head-neck imaging data.
3. To understand where PET/MR may be beneficial over other imaging of head-neck cancer.

A-668 17:00

C. Modern planning of radiation treatment
U. Nestle; *Freiburg/DE (ursula.nestle@uniklinik-freiburg.de)*

High-quality radiation oncology will always need to rely on high-quality imaging for diagnosis, treatment planning, treatment application and follow-up. The advent of molecular imaging has opened new perspectives to all these fields, as beyond anatomical information, the metabolism of tumour and normal tissues are of high interest in the context of radiation oncology. In the field of radiotherapy treatment planning, beyond the accurate depiction of the "gross tumour volume", also subvolumes of tumours with varying metabolic properties are important, where the concept of dose painting, enabled by new technology, is a hot topic for actual research developments. This lecture will give an overview on the key fields of hybrid imaging in radiation oncology.
Learning Objectives:
1. To learn about dose painting in radiation treatment.
2. To understand the role of hybrid imaging in radiation treatment planning.
3. To understand potential strength of hybrid imaging in radiation treatment.

Sunday, March 8

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

E³ - ECR Academies: Interactive Teaching Sessions

E³ 1721

Cardiac CT: from stenosis assessment to risk stratification

A-669 08:30

A. CT for risk stratification

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 from 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 demonstrates coronary atherosclerosis, providing 2 distinct means for CAD-assessment: the CACS and the CCTA. The technical evolution and x-ray dose reduction allow to scan patients with less restricted inclusion criteria for CCTA, with 2 compelling application in the field of CAD-detection: the risk stratification of asymptomatic individuals to target/personalise therapy to prevent CHD, and as gatekeeper to catheterisation to minimise unnecessary invasive procedures. The lecture will focus 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 programme.

Learning Objectives:

1. To learn the different criteria for risk stratification.
2. To learn the practical way of doing image assessment.

A-670 09:15

B. Cardiac CT in the emergency room

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

Aims of this teaching session are (1) to review current indications for using coronary CTA in the ED (when and why), (2) to learn about risk stratification and how to report high-risk plaque features by CT, (3) to understand myocardial perfusion imaging for detection of ischemia and (4) to review coronary CTA cases in acute care setting.

Learning Objectives:

1. To understand the imaging technique.
2. To become familiar with the differential diagnosis.

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

Abdominal Viscera

RC 1701

Colorectal cancer liver metastases: assessing tumour response

A-671 08:30

Chairman's introduction

C.D. Becker; *Geneva/CH*

The liver is a common site of metastases from colorectal cancer. Although surgery offers the best chance for cure, modern treatment is also based on chemotherapy, surgery, and interventional radiologic techniques. According to the patient's individual context, combined or sequential approaches may include a variety of new drugs, portal vein embolisation, percutaneous ablation, and resection. Diagnostic imaging with CT, MRI and PET offers the opportunity to study both qualitative and quantitative criteria of metastatic disease before, during and after treatment. The radiologist should not only be familiar with the appearance of metastatic disease on these different imaging techniques, but also with the changes that may occur after the the different forms of treatment and distinguish them from recurrent disease.

A-672 08:35

A. Current treatment options

T.K. Helmberger; *Munich/DE (Thomas.Helmberger@klinikum-muenchen.de)*

Hepatic metastases in colorectal cancer may occur in 20% to 80% of the cases. Considering the general oncological (isolated hepatic tumour load; prognostic benefit), and technical (size, number, location of hepatic metastases; expected hepatic functional reserve) framework surgical resection is still considered to be the method of choice for curative treatment, even if this statement had never been verified by RTCs. Nevertheless, in clinical reality only 20% to 30% of patients who with liver metastases may qualify for resection. In consequence, the majority of patients need other or at least modified therapeutical pathways including adjuvant or neo-adjuvant chemotherapy and more and more image-guided local ablative therapies. The latter encompass chemo- (transarterial chemoperfusion/-embolisation), thermo- (radiofrequency-, laser-, microwave-ablation, high-intensity focused ultrasound), and radio-ablative (radio embolisation, interstitial brachytherapy, etc). techniques. Particularly, the thermal-ablative techniques gained wide acceptance over the last years since ample evidence could be presented that these methods can be applied as not only primary but also complementary therapies in resectable and non-resectable metastatic disease. Furthermore, recent data confirm that in multimodality therapy concepts progression-free survival and overall survival in patients with primarily unresectable and with unfavourable prognosis is comparable to surgery with 5-year survival rates more than 50 %. Minimal-invasive, image-guided therapies will not replace surgical resection, however, this therapy modalities are eligible in a large number of cases and should be implemented consequently in multimodality treatment regimens according to an interdisciplinary consensus of oncologists, interventional radiologists, and surgeons.

Learning Objectives:

1. To understand the different scenarios in which liver metastases may present in relation to patient prognosis and therapeutic options.
2. To understand the existing therapeutic approaches to liver metastases in different scenarios.

Author Disclosure:

T.K. Helmberger: Speaker; BTG, Celonova, Sirtex.

A-673 08:58

B. Morphological biomarkers

S. Skehan; *Dublin/IE (stephenskehan@me.com)*

Colorectal liver metastases are typically identified as low-attenuation lesions on portal venous phase CT. Planning of optimal therapy depends on accurate localisation and characterisation of all focal liver lesions and this is best achieved with MRI, which should include diffusion-weighted imaging and use of hepatocyte-specific contrast medium. The typical MRI signature of colorectal metastases includes low signal on T1w, moderately increased signal on T2w, irregular peripheral arterial phase enhancement with low signal on portal venous phase, restricted diffusion and absent hepatocytes. Morphological tumour response can be assessed with either modality. Size-based systems for assessing tumour response are widely applied, with RECIST 1.1 the most widely used at present. RECIST 1.1 includes several modifications that make it more user-friendly than RECIST 1.0. More advanced morphological criteria have been described for new targeted and molecular therapies, including

overall attenuation, the tumour-liver interface and the appearance of the peripheral rim of enhancement. As hepatic surgeons become more aggressive in their approach to resection in patients with liver metastases, it is important to understand that disappearance or calcification of liver metastases after treatment does not necessarily equate to a complete pathological response. The timing of imaging is, therefore, critical in assisting the surgeon to remove all previously affected hepatic segments after chemotherapy. Modern treatment regimens can cause several types of toxicity in normal liver, such as sinusoidal obstruction syndrome and steatosis and the radiological features of these conditions will be described.

Learning Objectives:

1. To learn about the algorithm for detecting and characterising liver metastases.
2. To understand conventional imaging criteria for assessing tumour response.
3. To learn about the rationale for monitoring patients after radical and palliative treatments.

A-674 09:21

C. Functional biomarkers

D.-M. Koh; *Sutton/UK*

Conventional size measurement criteria remain the most widely used method to determine the response of colorectal liver metastases to treatment. However, tumour size reduction is assessed relatively late (e.g. 12 weeks after treatment) and new targeted treatment may be effective without reducing tumour size. New functional imaging techniques can be applied to quantify different aspects of tumour biology and to develop response, predictive and prognostic biomarkers. We discuss the use of diffusion-weighted MR imaging, dynamic contrast-enhanced MR imaging and FDG-PET imaging in the evaluation of treatment response in patients with colorectal liver metastases.

Learning Objectives:

1. To understand the different functional imaging techniques that can be used to monitor response to therapy including perfusion, diffusion MRI and PET/CT.
2. To learn about efficient algorithms for assessing therapeutic response of liver metastases that influence prognosis.
3. To understand how functional biomarkers are incorporated into multicentric trials.

09:44

Panel discussion: The "vanishing" lesions: what should you do?

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

E³ - ECR Academies: Modern Imaging of the GI Tract

E³ 1722

Gastrointestinal stromal tumours (GIST)

Moderator:
M. Zins; Paris/FR

A-675 08:30

A. Pathology and treatment options

B. Seddon; *London/UK (beatrice.seddon@uclh.nhs.uk)*

Gastrointestinal stromal tumours (GIST) are rare malignant tumours arising within the wall of the gut from the interstitial cells of Cajal, which act as pacemaker cells controlling peristalsis. The crude annual incidence of clinically detected GISTs is approximately 10 cases per million in Europe. The median age at diagnosis is approximately 63 years, and 80% of patients are older than 50 years. However, a small number of cases do occur in younger people and children, and these are usually syndromic GISTs. GISTs can occur at any site of the gut from oesophagus to rectum, although they can also arise in extra-gastrointestinal abdominal and pelvic locations, so-called e-GISTs. The commonest location is stomach (55%), followed by small intestine (35%) and rectum (5%). Diagnosis is by biopsy, with spindle cell or epithelioid morphology, and immunohistochemical staining for CD117 (the protein product of the KIT gene) and/or DOG-1 receptors. Approximately 80% of GISTs have mutations in the KIT gene, 10% have mutations of the PDGFRA gene, and the remaining 10% have no mutation (wild type) or rare gene mutations. Early-stage disease is managed by surgery, followed by 3 years of adjuvant imatinib (a tyrosine kinase inhibitor with activity against KIT and PDGFRA receptors) for cases at high risk of relapse. Advanced metastatic disease is treated with imatinib, with a median duration of response of approximately 2 years. At disease progression, second-line treatment is with sunitinib, with a median duration of response of approximately 6 months.

Learning Objectives:

1. To learn about the prevalence and typical location of GIST tumours.
2. To understand the histological and genetic characteristics of GIST tumours and the differential diagnosis.
3. To become familiar with the treatment options for GIST tumours.

A-676 08:50

B. Disease staging and treatment planning

C. Hoeffel; *Reims/FR (choeffel-fornes@chu-reims.fr)*

GISTs may localise anywhere along the gastrointestinal tract. The role of imaging is not only to detect, diagnose, and characterise these tumours but also to assess their extension and prognosis. Imaging modalities include endoscopic methods as well as cross-sectional imaging. Contrast-enhanced CT scanner of the thorax, abdomen and pelvis is the standard method for baseline staging but pelvic or abdominal MR also has a role to play. PET-CT with FDG is useful when early detection of tumour response to molecular-targeted therapy is of special concern. GIST is typically a smooth margined, exophytic hypervascular tumour of bowell wall, undergoing haemorrhagic or cystic changes when it increases in size and without any lymphadenopathy. Determination of the origin of the mass often needs reformats. Complications are rare and include intussusception, bowel wall obstruction, rupture and peritonitis. Signs suggesting high risk of malignant GIST such as necrosis and large size, irregular margins, mesenteric infiltration, smooth invasion of adjacent organs, and liver metastases or peritoneal nodules have to be searched for. Management of these tumours relies on multidisciplinary team decision and biopsies are important before starting chemotherapy or in particular locations. This lecture reviews the role of imaging in terms of diagnosis and management of these tumours before treatment.

Learning Objectives:

1. To appreciate the imaging modalities available for staging GIST tumours, and to understand the advantages and disadvantage of each.
2. To learn about optimised acquisition protocols.
3. To become familiar with the imaging differential diagnosis of GIST tumours and the role of biopsy.
4. To appreciate the radiological staging of GIST tumours, including typical sites of metastatic disease.

A-677 09:10

C. Treatment response assessment and disease follow-up

A. Graser; *Munich/DE (Anno.Graser@med.uni-muenchen.de)*

Gastrointestinal stromal tumours (GISTs) are treated with targeted therapy regimes. These treatment strategies are based on the suppression of tumour vasculature using the tyrosine kinase inhibition pathway. Drugs like imatinib and sunitinib exhibit specific changes in tumours and metastases that can be detected on cross-sectional imaging. These changes differ significantly from standard treatment effects of cytotoxic chemotherapy. While the latter leads to destruction of tumour cells and thereby to a reduction of tumour size, the former will cause a decrease in vascularity and thereby in attenuation and enhancement of lesions while the size may remain unchanged. Radiologists have to be aware of these specific patterns of response to treatment. This presentation will include a review of the Choi criteria which have been developed for the assessment of GIST lesions under treatment. Also, current imaging strategies focusing on time-resolved CT imaging (CT perfusion imaging) will be presented. The aim of this lecture is to provide a practical approach to response imaging in GIST patients integrating both existing and novel strategies.

Learning Objectives:

1. To understand the role of imaging in disease treatment response assessment and the pros and cons of available modalities.
2. To appreciate the imaging criteria used in the assessment of disease response.
3. To learn how imaging can help guide appropriate therapy.

Author Disclosure:
A. Graser: Grant Recipient; Bayer Healthcare, Siemens Healthcare. Research/Grant Support; Bayer Healthcare, Siemens Healthcare. Speaker; Siemens Healthcare, Bracco Diagnostics, Pfizer Pharma, GlaxoSmithKline.

A-678 09:30

D. Interactive case discussion

M. Zins; *Paris/FR*

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

EDiR talk

FA (b)Q frequently asked (burning) questions - with answers

A-679 08:30

Questions about registration

Y. Menu[1], E. Jordan[2]; [1]*Paris/FR*, [2]*Barcelona/ES*

How can I register? Am I eligible? Should I take the examination in Vienna or during a national meeting?

A-680 08:45

Questions about preparation

W. Schima; *Vienna/AT*

What about the importance of language? Is it a disadvantage not to be an English speaking person? What kind of documents would be helpful for the preparation? Are there other organised teaching and training sessions dedicated to the diploma? What about an online testing?

A-681 09:00

Questions about written examination

S. Barter; *Cambridge/UK*

How difficult is the written examination? Am I expected to answer correctly every single question?

A-682 09:15

Questions about oral examination

L. McKnight; *Swansea/UK*

What kind of cases will be presented during the oral examination?

A-683 09:30

Questions about the future

Y. Menu[1], V. Iranzo[2]; [1]*Paris/FR*, [2]*Barcelona/ES*

What is the official recognition of EDiR? Do I really need to take it?

A-684 09:45

Panel discussion: More FA (b)Q and its answers

J. Vilar; *Valencia/ES*

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

Paediatric

RC 1712

Imaging the head and skull base

Moderator:
J.W. Casselman; Bruges/BE

A-685 08:30

A. Faciocraniosynostoses revisited

F. Di Rocco, E. Arnaud; *Paris/FR (federico.dirocco@nck.aphp.fr)*

The management of faciocraniosynostoses requires a multidisciplinary and repeated evaluation of the single patient. Their evolution, in fact, depends on the specific genetic anomalies but also on the phenotype, which can vary in time, of their clinical expression which may lead to different degrees in severity of the associated functional disturbances (CSF dynamics impairment, visual deficits, respiratory anomalies, etc). Consequently, these conditions may require several surgical steps, the timing of which are dictated by the exact clinical diagnosis and the evaluation of the functional status at different ages. Current management of faciocraniostenoses is thus based not only on radiological studies but also on the functional assessment of the brain function (e.g. MRI imaging studies, metabolic and cerebral blood circulation investigations, respiratory pathways volume evaluation, sleep recording). The surgical multidisciplinary management nowadays may benefit from a large variety of techniques which extend from free-bone cranioplasty with intraoperative active-fixed expansion to more dynamic and less-invasive methods which exploit the physiological brain expansion in infants or the gradual cranial vault expansion mechanically stimulated by springs or distractors. In the present report, we will review the decision-making process and the rationale on which, at the Necker-Enfants Malades, we base the use of the currently available techniques for skull expansion and correction of cranial malformations according to the accurate dynamic radiological and functional evaluation at different stages of the disease.

Learning Objectives:

1. To learn about the imaging patterns of faciocraniosynostoses.
2. To learn how and when to image.
3. To become familiar with associated brain anomalies.

A-686 09:00

B. All about the paediatric pituitary gland

M.I. Argyropoulou; *Ioannina/GR (margyrop@cc.uoi.gr)*

MR is the imaging modality of choice for the assessment of the pituitary gland (PG) and the hypothalamus. The normal adenohypophysis is bright during the first two months of life and appears in isosignal to the brain parenchyma afterwards. The neurohypophysis is bright provided that the child is well hydrated. The PG height decreases during the first year of life and then increases until puberty. Adenohypophyseal deficiency has been associated with a small pituitary size, an ectopic neurohypophysis, an hypoplastic or absent pituitary stalk, hypothalamic gliomas, craniopharyngiomas and iron overload states. Precocious puberty may be idiopathic but it has also has been associated with hypothalamic hamartomas, craniopharyngiomas and hydrocephalus. Diabetes insipidus may be secondary to histiocytosis X, germinomas and trauma causing pituitary stalk interruption. The hypothalamo-pituitary axis is evaluated by using sagittal and coronal T1-weighted images without and with contrast administration. Dynamic contrast enhancement may be useful in the evaluation of disorders responsible of diabetes insipidus. Magnetization transfer imaging may be useful in the evaluation of pituitary deficiencies or precocious puberty.

Learning Objectives:

1. To become familiar with age-related changes of the normal pituitary gland.
2. To learn about congenital and acquired pathology of the hypothalamo-pituitary axis.
3. To understand the pathophysiologic substrate of different imaging patterns.

A-687 09:30

C. Imaging of the orbit: the globe and the lacrimal gland

P.C. Maly Sundgren; *Lund/SE (Pia.Sundgren@med.lu.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 and geneses to many different lesions that can occur in the orbits 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 and lachrymal gland especially in the paediatric population. The lecture will also present suggested imaging protocol and standard of care with respect to imaging.

Learning Objectives:

1. To understand the embryology and imaging findings of the most common malformations.
2. To learn about space-occupying lesions and the differential diagnosis of tumours and inflammatory conditions.
3. To be aware of the role of conventional and advanced MR sequences in the diagnostic approach to lesions in the orbit.

08:30 - 10:00 **Studio 2015**

Joint Session of the ESR and ERS

Lung cancer screening: why and how to implement a comprehensive preventive programme

Moderators:
M. Prokop; Nijmegen/NL
J.-P. Sculier; Brussels/BE

A-688 08:30

Should we do lung cancer screening now? The evidence
C.J. Herold; *Vienna/AT (Christian.Herold@meduniwien.ac.at)*

In 2011, the largest prospective randomized trial involving low-dose computed tomography (LDCT) demonstrated a significant mortality reduction (20.2 %) in individuals investigated with CT versus those studied with chest radiography. Based on this evidence, numerous scientific organisations now recommend a systematic lung cancer screening program for individuals at risk. To establish a screening program, several factors have to be taken into consideration. First, the target population for screening has to be well defined. Recent data demonstrate that a more sophisticated risk stratification increases the number of true-positive findings and thus, the beneficial effect of screening. In this context, it appears that certain co-morbidities such as exposure to asbestos add to the risk for developing lung cancer. Second, false-positive findings pose a significant challenge to lung cancer screening. In recent trials, positive results at baselines screening ranged from 9 to 51% with less than 4% of individuals demonstrating a true-positive test. Therefore, management strategies for individuals with a positive finding need to be clearly defined, with the focus on noninvasive (imaging) methods, and avoidance of potential complications from invasive testing. Finally, with respect to complications and adverse affects, radiation dose from repeated screening tests is a concern. However, based on current data and risk models, the benefit provided by screening outweights the cancer risks from radiation by far. Likewise, screening does not seem to affect long-term anxiety or overall health-related quality of life.
Learning Objectives:
1. To learn about the evidence generated by randomised controlled trials using CT.
2. To appreciate the caveats of the current evidence.
3. To understand the potential impact of the evidence on health-care in Europe.

A-689 08:52

CT requirements and nodule workup
F. Gleeson; *Oxford/UK (fgleeson@mac.com)*

Scanning parameters and reconstruction algorithms play a critical part in the detection, accurate measurement and follow-up of pulmonary nodules identified in both lung cancer screening programmes and nodules detected incidentally. There is extensive literature on different algorithms used for detection and follow-up. Section thickness, reconstruction algorithms, the use of intravenous contrast and both nodule size, shape and position all affect nodule measurement. It has been shown that high spatial frequency algorithms may increase measured nodule volumes as does the use of intravenous contrast. The use of variable radiation doses between scans does not appear to affect measured volumes. This presentation will discuss the evidence on CT scanning parameters and algorithms and their effect on nodule detection and measurements.
Learning Objectives:
1. To consolidate knowledge of the requirements of a standardised quality-controlled low dose CT protocol.
2. To become familiar with the challenges of CAD-supported measurements of size, volume and growth.
3. To acknowledge the rationale for follow-up intervals for positive CT scans.
Author Disclosure:
F. Gleeson: Advisory Board; Blue Earth Diagnostics. Consultant; Alliance Medical Limited. Grant Recipient; NIHR. Research/Grant Support; CRUK/EPSRC.

A-690 09:14

Diagnostic and treatment approaches to lesions found in CT screening
F.J.F. Herth; *Heidelberg/DE (Felix.Herth@med.uni-heidelberg.de)*

Using relatively low radiation exposure to create a low-resolution image of the entire thorax, LDCT screening is capable of detecting very small, early-stage cancers so that their shape and growth can be observed noninvasively. The national lung screening trial (NLST) showed significantly fewer lung cancer deaths among those screened with LDCT than among those randomised to chest radiography. One risk of screening studies is the potential for both false-negative and false-positive results. In the NLST, the sensitivity and specificity of LDCT screening were 93.8% and 73.4%. Although 24.2% of LDCT screens were positive, the vast majority of these represented false-positive studies, because only 3.6% of patients with positive examinations actually had lung cancer. Despite the high false-positive rate, the majority of patients were managed noninvasively with follow-up imaging; only 11.4% of patients required invasive testing. Of those patients who underwent invasive testing, the rate of major complications was 0.06% for those without cancer and 11.2% for those with lung cancer. This suggests that, although LDCT screening has a higher rate of false-positive screens compared with other screening modalities and, therefore, a definitive guidance, how to handle a nodule is necessary.
Learning Objectives:
1. To appreciate the size-adapted approach to diagnose and treat lesions found at CT.
2. To understand the limitations of diagnosis and the possibility of overdiagnosis.
3. To become familiar with the possibility of complications during diagnostic work-up and treatment.

A-691 09:36

Designing a screening programme
N. Peled; *Tel-Aviv/IL (nirp@post.tau.ac.il)*

Screening for lung cancer by annual low-dose CT (LDCT) reduced lung-cancer-related mortality by 20% (NLST); however, with high false-positive rate. More than 20% of the screened patients had abnormal CT scan, where 95% were not malignant. Therefore, the implementation of screening programs require a better pre-test high-risk definition, a better definition of what is "positive" scan, and additional tools and/or biomarkers to support the management of "positive" cases. As for now, many programs select their population upon the NLST cohort. However, other risk models may provide a more specific selection, e.g. the Liverpool lung project model (LLP). Selecting the true high-risk population will increase the benefits of screening programs and will encourage payers to cover this effort. The exact definition of "abnormal" scan is still unclear and deserves further investigation. One must consider previous scans and growing rate as additional measures. Once positive, the risk for malignancy should take into consideration before invasive procedure take place. Cancer incidence increases with age, female gender, family history of lung cancer, existence of emphysema, upper lobes location, part solid pattern, and specualtion. Non-invasive biomarkers such as miRNA, circulating proteins, auto-antibodies, sputum cytology and exhaled breath may also support patient management after having a positive scan. This approach is still under development. In summary, LDCT-based screening program for lung cancer has a proven survival benefit. Risk models and the use of non-invasive biomarkers may assist with its implementation in the near future.
Learning Objectives:
1. To appreciate the rationale for a longitudinal and comprehensive preventive programme.
2. To learn about the possibilities to increase pretest probability, e.g. novel biomarkers.
3. To understand the potential of broadening the scope of the CT-read-outs.

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

E³ - Rising Stars Programme

Basic 6: Interventional radiology

A-692 08:30

Uterine Fibroid Embolization

T.J. Kroencke; *Augsburg/DE (thomas.kroencke@klinikum-augsburg.de)*

Uterine artery embolisation (UAE) for fibroids also referred to as uterine fibroid embolisation (UFE) is an interventional radiological procedure for treating symptomatic uterine leiomyomas and represents an alternative to surgical removal by means of myomectomy or hysterectomy. The indication for uterine artery embolisation crucially relies on the pre-interventional assessment of symptomology and burden of disease. Especially the location, size, and number of leiomyomas are important to determine treatment options. UAE is an option for most patients in whom intervention is considered to be appropriate. In general, neither size nor number of leiomyomata or the types of associated complaints are a limitation for UFE. There is, however, some evidence that patients with larger single fibroids and larger uteruses may have less symptomatic improvement and are less satisfied with the results of UAE. There are few contraindications to UAE for leiomyomata: pregnancy, suspected uterine or adnexal malignancy, active infection, or indeterminate endometrial or adnexal abnormalities requiring further evaluation.

A-693 09:00

Management of trauma patients

M. Krokidis; *Cambridge/UK (mkrokidis@hotmail.com)*

The management of trauma patient is complex and multidisciplinary. Modern trauma management requires the immediate patient transfer to tertiary referral centres where diagnosis is made and lifesaving procedures follow. Interventional Radiology offers rapid and minimally invasive endovascular treatment for bleeding patients and for more than 40 years plays a significant role in the management of trauma. Advances in cross-sectional imaging have significantly shortened the time to diagnosis and raised the detection rate of active bleeding and organ injury. With image-guided endovascular techniques, technological devices such as stent grafts, balloon-mounted or self-expandable covered stents, mechanically and electrically detachable coils, plugs and liquid embolic materials may nowadays be used to control bleeding and offer a first lifesaving measure for trauma patients.

A-694 09:30

Varicocele

P. Haage; *Wuppertal/DE (patrick.haage@helios-kliniken.de)*

The testicular varicocele is a pathological dilatation and tortuosity of the veins of the pampiniform plexus. Clinical presentation can include scrotal swelling and pain; a varicocele is more often seen in the subfertile or infertile man. The primary diagnostic imaging modality is ultrasound. Therapeutic alternatives include minimal invasive surgical and open microsurgical treatment as well as interventional radiological therapy. The IR treatment by percutaneous venography includes the selective catheterisation of the spermatic vein and subsequent embolisation or sclerotherapy. Technical and clinical success rates are encouraging; complications are rare. Diagnostic modalities, clinical and imaging features plus the indications for therapy will be depicted. Furthermore basic percutaneous treatment principles are going to be discussed.

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

E³ - ECR Master Classes (Musculoskeletal)

E³ 1726

Osteomyelitis vs gout: what are the pearls?

Moderator:
L.M. Sconfienza; San Donato Milanese/IT

A-695 08:30

A. X-ray: classical patterns and challenging features

A. Cotten; *Lille/FR (anne.cotten@chru-lille.fr)*

The radiographic features of chronic tophaceous gout usually develop after several years of recurring acute arthritis and in the absence of effective treatment. They include eccentric nodular and dense soft tissue masses, large and well-defined erosions of the bone and/or exuberant chronic bony proliferation opposite the tophus. Ultrasonography may demonstrate tophus and erosions earlier than radiographs, as well as the double contour sign and bright-dotted foci in the synovium and the synovial fluid. Other imaging modalities are less frequently performed. Although the diagnosis of gout is generally straightforward, it is more of a challenge when the joint involvement or radiological features is more unusual. This lecture will show the classical patterns and challenging features of gout.

Learning Objectives:
1. To review the appearance of gouty changes.
2. To learn more about differential diagnosis.

A-696 09:00

B. MRI features and their differential diagnosis

S.J. Ostlere; *Oxford/UK (sjostlere@doctors.org.uk)*

The diagnosis of bony gout is straightforward when characteristic features are seen on the radiograph. However, quite often gout can mimic other conditions and the diagnosis may be delayed. Bony gout is usually secondary to either a gouty arthritis or a deposit in a tendon. The signal intensities of gout are rather non-specific although the presence of calcification may result in a heterogeneous appearance, particularly on water sensitive sequences. When faced with a lesion with non specific signal intensities one should look for clues that might point towards the diagnosis, such as the site of the abnormality, whether the lesion is solitary or multiple, the radiographic and ultrasound findings, the involvement of tendons, and clinical features including serum uric acid levels. Occasionally there are no additional clues and biopsy is required to achieve a diagnosis. Typical sites for gout are the first MTP joint and around the knee. Involvement of the patellar tendon is particular characteristic and when bilateral, almost diagnostic of gout. The diagnosis is particularly difficult when unusual sites such as the spine are affected. Then main differential diagnoses are infection and tumour. Taking into account all the factors listed above one can usually differentiate gout from the other two conditions. However differentiating gout from infection is more problematic in diabetic feet when both infection and gout are common.

Learning Objectives:
1. To learn more about the appearance of gout using MRI.
2. To become familiar with differential diagnosis in acute settings.

A-697 09:30

C. Ultrasound and DECT features in gout

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

Dual-energy CT (DECT) is a recently developed technology that enables a high-definition imaging besides alteration of joints and bones also of soft tissue structures, such as tendons and ligaments, and the detection of MSU crystal deposits. It allows specific visualisation of urate depositions, however, very small MSU crystal deposits might not be detected. Tophus formation is a feature of longstanding gout, as well as erosions, seen usually next to phi. High-frequency transducers (12-18 MHz) provide a high-resolution imaging well suited for the evaluation of gout. Ultrasound (US) findings in gout include joint effusion, synovitis, erosions and deposition of MSU crystals in joints, over the hyaline cartilage, and within the capsule and soft tissues. The characteristic hyperechoic floating aggregates of MSU crystals (microtophi) are described as "snowstorm appearance". The deposits are found on the superficial layer of the hyaline articular cartilage with the appearance of a "double contour sign", a specific but not very sensitive sign for gouty arthritis. Subclinical MSU deposits may also be seen in patients without clinical evidence for acute gout. Artefacts of both imaging modalities will be discussed in detail. In summary, both US and DECT enables for imaging findings specific for gout, in order that these non-invasive diagnostic studies may be considered an alternative to joint aspiration for the diagnosis of gout in clinical routine and in the workup of differential diagnoses. Both imaging methods may also be potentially useful in assessing response to treatment.

Learning Objectives:
1. To review the appearance of gouty changes in DECT.
2. To understand strengths and weakness of US.

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

New Horizons Session

NH 17

Comprehensive personalised imaging of cardiothoracic diseases

A-698 08:30

Chairman's introduction: how to prepare for the future?

T. Benedek; *Targu Mures/RO (hintea_teodora@yahoo.com)*

This session aims to provide the audience with an update on comprehensive personalised imaging of cardiothoracic diseases, focusing on understanding the unique potential of radiologists to comprehensively assess cardiothoracic diseases and learning about the diversity of aetiologies that can be addressed by radiology. In the same time, the comprehensive approach needed for having clinical utility by imaging cardiothoracic diseases will be addressed. The applications of personalised imaging in cardiothoracic diseases will approach different clinical areas, from early detection for cardiothoracic disease in smokers to acute and chronic chest pain or acute and chronic shortness of breath. Also, the applicability of different imaging tools for diagnostic and quantification of thoracic lesion severity in daily practice will be explained, including presentation of advantages and disadvantages of the main imaging techniques in these clinical settings.

Session Objectives:

1. To understand the unique potential of radiologists to comprehensively assess cardiothoracic diseases.
2. To learn about the diversity of etiologies that can be addressed by radiology.
3. To appreciate the comprehensive approach needed for having clinical utility by imaging cardiothoracic diseases.

A-699 08:35

Patients with acute and chronic chest pain

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

Chest pain is a common and unspecific clinical symptom of many different diseases, and imaging plays an important role for differential diagnosis and management of patients suffering from acute or chronic chest pain. Coronary artery disease can be the cause of both acute and chronic chest pain; however, clinical implications and thus diagnostic targets differ between these two conditions. Chronic chest pain is caused by reversible myocardial ischaemia - usually during exercise - due to haemodynamic relevant luminal narrowing of at least one coronary artery. On the other hand, acute chest pain, i.e. acute coronary syndrome (ACS), is caused by possibly irreversible myocardial ischaemia due to rupture of a coronary plaque and subsequent thrombosis. The treatment strategy in case of ACS consists on urgent revascularisation of the acutely thrombosed coronary artery. In patients with stable angina the best treatment strategy is under discussion. Recently published papers have demonstrated the lack of benefit with regard to outcome of revascularisation and optimised medical treatment as compared to optimised medical treatment alone. Thus, the focus of imaging should be moved from isolated stenosis detection to a more integrative approach including plaque assessment, calculation of relevance of stenosis and myocardial assessment. In this presentation, the role of CT and MR in the management of patients suffering from acute or chronic chest pain will be discussed. The differences between ACS and stable angina will be explained, and current and future imaging trends including plaque analysis, culprit lesion identification and wall motion assessment will be introduced.

Learning Objectives:

1. To understand the clinical utility of CT and MRI in acute chest pain.
2. To understand the clinical utility of CT and MRI in chronic chest pain.
3. To appreciate comprehensive assessment of anatomy and function feasible in chest pain patients.

A-700 08:53

Patients with acute shortness of breath

J. Bremerich; *Basle/CH (jens.bremerich@usb.ch)*

Shortness of breath is a relevant cause for referral to an emergency unit. The purpose of the current paper is to present common causes, strategies, and algorithms for diagnostic workup. Frequent causes of acute shortness of breath are acute coronary syndrome, pulmonary embolism, pneumothorax, pneumonia, and obstructive pulmonary diseases. Chest x-ray is frequently used as a first-line modality, particularly when pneumothorax, pneumonia, or acute heart failure is suspected. Computed tomography is indicated in suspected pulmonary embolism, toxic pulmonary oedema, acute alveolitis, emphysema, pulmonary fibrosis, pulmonary haemorrhage, idiopathic interstitial pneumonia, aortic dissection, or intramural haematoma. Today, magnetic resonance imaging plays only a minor role in workup of acute shortness of breath but may disclose rare causes such as acute myocarditis. In the future, however, an increasing role of magnetic resonance imaging can be expected. Conventional chest x-ray and computed tomography are the first-line modalities for diagnostic workup of acute shortness of breath whereas magnetic resonance imaging is used in rare cases such as in acute myocarditis.

Learning Objectives:

1. To understand the high diagnostic accuracy of CT and MRI for assessing acute pulmonary embolism.
2. To learn about comprehensive approaches for assessing acute lung injury.
3. To appreciate the strengths of comprehensive cardiothoracic imaging for diagnosis of the most common diseases leading to acute shortness of breath.

A-701 09:11

Patients with chronic shortness of breath

E.J.R. van Beek; *Edinburgh/UK (edwin-vanbeek@ed.ac.uk)*

Patients with chronic shortness of breath pose a particular diagnostic problem for physicians. This is due, in part, to the insidious onset of symptoms. Furthermore, the range of conditions causing shortness of breath is quite extensive and it may be difficult to decide on the optimal diagnostic pathway. Much will depend on the referral to the correct specialist! This review will focus on some of the main causes of chronic shortness of breath: chronic obstructive pulmonary disease, pulmonary fibrosis, chronic thromboembolic pulmonary hypertension, cardiac failure and aortic valve stenosis. In addition, it will demonstrate the interaction of several of these pathologies, now commonly referred to as the heart-lung axis. This will be a multidisciplinary and multimodality approach to these most common entities.

Learning Objectives:

1. To become familiar with the most frequent diseases leading to chronic shortness of breath.
2. To consolidate knowledge about the etiologies of pulmonary hypertension and end-stage lung disease.
3. To understand the appropriate application of radiological imaging in the comprehensive diagnosis of chronic shortness of breath.

Author Disclosure:

E.J.R. van Beek: CEO; Quantitative Clinical Trials Imaging Services Ltd. Founder; Quantitative Clinical Trials Imaging Services Ltd. Speaker; Toshiba Medical Systems.

A-702 09:29

Early detection for cardiothoracic disease in smokers

M. Rémy-Jardin; *Lille/FR (martine.remy@chru-lille.fr)*

Despite the well-documented atherogenic effects of smoking, radiologists' attention remains mainly directed towards depiction of oemphysema and airway 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 not only the 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 become familiar with the broad spectrum of smoking-related diseases in the chest.
2. To learn about comprehensive imaging protocols for diagnoses of all smoking-related diseases of lung, heart and vessels.
3. To appreciate the necessity of software tools for computer-assisted detection and quantitation: opportunities and limitations.

09:47

Panel discussion: Comprehensive imaging and education in cardiothoracic diseases

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

Special Focus Session

SF 17b
Congenital heart disease: from infancy to adulthood

A-703 08:30
Chairman's introduction
M. Haliloglu; *Ankara/TR (mithath@hacettepe.edu.tr)*

This 'Special Focus' section is dedicated to the role of multimodality imaging in 'Congenital heart disease: from infancy to adulthood'. Recent advances in cardiac imaging technologies changed the traditional way of care in patients and adults with congenital heart diseases. The field developed from the early stages of cardiac imaging, including the use of coronary x-ray angiography and roentgen kymography, to nowadays the widely used echocardiographic, nuclear medicine, cardiac computed tomographic (CT), and magnetic resonance (MR) applications. These techniques, by entering into the clinical arena, aid in understanding the anatomy and physiology of the cardiovascular system on both cardiac defect and patient basis. Through this section, we will discuss the CT and MR imaging techniques, new applications, common features of congenital heart diseases, benefits and limitations of each technique. As a continuum, we will also discuss the key points in imaging of congenital heart diseases and postoperative evaluation in adult patients. Crosstalk between paediatric radiologists, paediatric cardiologists and cardiac surgeons, and appropriate/individuailised use of new cardiac imaging technologies will further help not only to evaluate and understand the pathophysiology but also improve patient care.
Session Objectives:
1. To recognise the role of multimodality imaging in congenital heart disease.
2. To become familiar with the common features of congenital heart disease.
3. To understand how to evaluate postoperative patients with congenital heart disease.

A-704 08:35
Cardiac CT: challenges in congenital heart diseases
M. Kantarci; *Erzurum/TR (akkanrad@hotmail.com)*

In parallel with developments in technology, the reduction of radiation exposure risk is essential for safe and effective health care imaging. Because of this concern, various dose-reduction techniques have been specifically designed for pediatric patients in cardiothoracic imaging by a number of major CT manufacturers, such as GE, Siemens, Philips, Toshiba. To ensure that CT is easily accessible and widely used, it is essential for manufacturers to develop dose-reduction techniques. CT can be regarded as a preliminary diagnostic option for congenital heart disease patients with implanted pacemakers and metallic surgical hardware. It enables the visualisation of coronary artery anomalies and extracardiac structures with 2D/3D reconstruction, rapid imaging, few artifacts and no need for patient sedation. CT may be preferred for the pre- and postoperative evaluation of non-cooperative patients. Although the radiation dose exposure is the primary disadvantage of CT, it can be used more frequently and safely by optimising the CT settings and by using an ECG-gated system. CT can also be used to systematically evaluate the aorta, pulmonary artery, pulmonary vein, cardiac chambers, ventriculoarterial connections, coronary artery, valves, and systemic veins (hepatic veins, superior, and inferior vena cava) to gain an understanding of the anatomy of the cardiovascular system during the pre- or postoperative period. The ever-increasing availability of CT makes it a preferred option for the evaluation of complex disease group, and radiologists who perform CT in children should be familiar with normal anatomy and pathological conditions in pediatric patients and with both advantages and disadvantages of CT.
Learning Objectives:
1. To become familiar with new cardiac CT techniques.
2. To understand benefits and limitations of the cardiac CT applications.
3. To understand cardiac CT characteristics.

A-705 09:00
Segmental approach to MR imaging of congenital heart disease
A.M. Taylor; *London/UK (a.taylor76@ucl.ac.uk)*

Congenital heat disease nomenclature and diagnosis is often shrouded in a mist of complexity that seems impenetrable to those that have not had years of training in this field. However, like all imaging the diagnostic process can be broken down into a set of simpler building block and simple language that can be used to describe cardiac anatomy in what is known as 'sequential segmental analysis'. The aim of this presentation will be to show how such analysis can be carried out with cross-sectional imaging (CT and MRI); correlating the imaging appearances with the actual anatomical appearance, so that any imager can describe the cardiac anatomy of any patient. The presentation will then focus on how these building blocks can be brought together to describe the common, important congenital heart disease anomalies. Such an understanding has increased in importance as the use of cross-sectional imaging has increased over the last 5 years. In particular, as more and more contrasted CTs of the thorax are performed, it is no longer possible to simply say that cardiac structures were not well seen!
Learning Objectives:
1. To learn about MR techniques.
2. To become familiar with the benefits and limitations of MR imaging.
3. To understand MR imaging features.
Author Disclosure:
A.M. Taylor: Research/Grant Support; Siemens.

A-706 09:25
Imaging of congenital heart disease in adults
S. Leschka; *St. Gallen/CH (sebastian.leschka@kssg.ch)*

Effective imaging of congenital heart disease in adults has become increasingly important due to the increasing population of persons with CHD surviving to adulthood. CT has become an important imaging modality in the follow-up of surgical procedures and natural progression of congenital heart disease supplementing the information of MRI-or being performed as a substitute to MRI in those patients with pacemakers or artefacts from surgical material. Sophisticated imaging is important to answer the clinical questions of interest and to limit the life-time radiation exposure of these patients commonly requiring several follow-up imaging during their life.
Learning Objectives:
1. To become familiar with imaging features of adult patients.
2. To understand imaging characteristics of postoperative patients.
3. To learn about management in terms of diagnostic approaches in adult patients with postoperative assessment.

09:50
Panel discussion: What is the impact of radiologists in the evaluation of congenital heart disease?

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

Breast

RC 1702
Emerging breast imaging technologies
Moderator:
P. Skaane; Oslo/NO

A-707 08:30
A. Digital breast tomosynthesis (DBT)
D. Bernardi; *Trento/IT (dnlbernardi@gmail.com)*

Digital Breast Tomosynthesis (DBT) is an emerging technique able to overcome some of the limitations of conventional 2D mammography for detection of breast cancer, above all the superimposition of breast tissue or parenchymal density which can obscure cancers or make normal structures appear suspicious. Several clinical studies suggested that the addition of DBT to 2D mammography improves cancer detection and reduces the number of false-positive. This increase of sensitivity and specificity is confirmed by the results of three large prospective population-screening trials, the Italian STORM trial, the Oslo trial (both with final results published) and the Malmo trial (interim report). These landmark studies are anticipated to transform future screening practice however, at present, there is insufficient evidence to justify a change from standard 2D mammography to DBT. In fact, while several studies have already evaluated and overcame the possible limitations of the method like the longer acquisition and reading times, the increased X-ray dose administered adding DBT to 2D mammography and the management of the suspicious lesions detected by DBT alone, to date there is very limited evidence about consistency and variability of the effect of the integration of 2D mammography to DBT between individual screening services and/or between radiologists. DBT has an important role not only in breast cancer screening but also in the diagnostic setting, either in symptomatic patients as well during assessment to otherwise equivocal imaging findings representing an efficient problem-solving tool.

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 learn about the potential role of DBT in the breast radiological algorithm.
Author Disclosure:
D. Bernardi: Equipment Support Recipient; Hologic, USA; Technologic, Italy.

A-708 09:00

B. Multiparametric high-field MRI and more
T.H. Helbich; *Vienna/AT (Thomas.Helbich@meduniwien.ac.at)*

MRI of the breast has evolved as a non-invasive imaging modality. These applications require a technique that offers high sensitivity and high specificity. Higher field strengths offer the possibility to introduce new imaging techniques, which can improve the differentiation and characterisation of breast lesion and well as treatment planning. These are techniques which assess tumour angiogenesis with contrast enhanced MRI, motions of molecules with diffusion-weighted imaging (DWI), and metabolic information with MR-Spectroscopy. The combination of these techniques is called multiparametric MRI. First results are encouraging. Combined PET-MR imaging methods have been demonstrated for structural, functional, and molecular imaging of breast tumours as well. This lesson will focus on the future of breast MRI which may allow insights in the molecular level of breast tumors thus enabling accurate characterisation and well as treatment planning.
Learning Objectives:
1. To understand the management of breast lesions based on current MRI applications.
2. To learn how to improve the specificity of breast MRI by adding new developing techniques.
3. To appreciate future developments and limitations.
Author Disclosure:
T.H. Helbich: Research/Grant Support; Siemens, Hologic, Bracco.

A-709 09:30

C. High-resolution radionuclide breast imaging (PEM and molecular imaging)
M. Herranz, I. Dominguez-Prado, S. Argibay-Vazquez, P. Aguiar, A. Ruibal; *Santiago/ES (michel.herranz.carnero@sergas.es)*

Breast cancer is one of the most common cancers in women. Continued progress in the control of breast cancer will require sustained and increased efforts to provide high-quality screening, diagnosis, and treatment. The modality of choice for screening in Breast Cancer is mostly X-ray mammography; however, for women with dense breasts the sensitivity of this technology may drop to 50%. There are other imaging modalities that can be used in addition to X-ray mammography, but each of them has its own drawback. All these considerations suggest that other modalities might be helpful in breast cancer diagnosis. Radionuclide imaging or Molecular Breast Imaging (MBI) could offer advantages over other modalities in the conspicuity of tumours, with resulting more facile imaging interpretation by providing functional information. Breast-specific gamma-imaging (BSGI) is breast scintigraphy using a small-field-of-view gamma-camera and 99mTc-Sestamibi. BSGI is a cost-effective, highly sensitive and specific technique focused primarily on detection of tumours, especially in women with dense breasts. Positron Emission Mammography (PEM) or dedicated breast PET (dbPET) has emerged as an additional imaging tool for breast cancer diagnosis, clarification of complex lesions and therapy follow-up. Dedicated breast PET, by looking at metabolic information, reduces the number of false-positive findings with other techniques, define therapy success and help to differentiate benign and premalignant condition.
Learning Objectives:
1. To become familiar with the current status: what is available and how does it work?
2. To understand the indications: local staging, distant staging, therapy monitoring and limitations.
3. To learn about future prospects: MR/PET and targeted tracers.

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

Special Focus Session

SF 17a
Metabolic bone diseases

A-710 08:30

Chairman's introduction
G. Guglielmi; *Andria/IT*

Metabolic bone disorders represent a challenging condition to be managed for their huge impact on health and economy. Nowadays, imaging plays a central role from the diagnosis to treatment monitoring and to the evaluation of complications. Among all metabolic bone diseases, osteoporosis is the most common disorder and vertebral fractures (VF) are recognised as a major consequence cause of disability, morbidity and mortality. Therefore, a critical appraisal of VF identification is required for their proper identification and characterisation. Beside primary and secondary osteoporosis, diabetes, renal failure and hyperparathyroidism, it has usually underestimated the impact of chronic inflammatory gastrointestinal (GI) disorders on bone metabolism. Nowadays, osteoporosis and osteomalacia induced by GI disorders need to be fully understood and require proper assessment and follow-up by DXA and the other imaging techniques. As osteoprorosis and osteomalacia refer to different pathophysiologic mechanisms, bone mineral density (BMD) alone may not be a fully comprehensive parameter to assess metabolic bone diseases. High resolution techniques as MDCT or HRpQCT can separately assess cortical and trabecular bone quality in terms of microstructure and skeletal geometry analysis leading to a better fracture prediction.
Session Objectives:
1. To become familiar with recognising fractures in metabolic bone diseases.
2. To understand the role of malabsorption on fracture risk.
3. To learn the impact of metabolic bone diseases on bone quality.

A-711 08:35

A critical appraisal of vertebral fracture identification
A. Bazzocchi; *Bologna/IT (abazzo@inwind.it)*

When bone become frail and insufficient due to metabolic disorders one or more vertebral fractures (VFs) typically occur. The mechanical load and the trabecular composition of the vertebral body makes the vertebra a typical site for osteoporotic fractures. VFs are a hallmark of osteoporosis. After bone density criteria, a VF represents the most searched-for imaging sign of osteoporosis, in both daily practice and research settings. VFs refer to the severity of the disease as well as they often represent the endopoint in clinical trials. VFs also represent an important risk factor for subsequent fractures at any site, even independently from bone density criteria. Although VFs are frequently silent, they can produce important symptoms with significant impairment of life and with huge costs and impact on healthcare. A number of clinical and radiological papers have been written about VFs. However, which is the definition of "fracture"? How to detect it? How to recognize as "osteoporotic"? How can you date the fracture, as "new or old"? The definition and identification, the origin and time of VFs are all still a matter of investigation, from DXA to MRI methods. In the flow-chart and management of osteoporosis, several techniques have been tested and established for VFs assessment, and some are currently the most widely used. VFs can be discovered incidentally in different examinations performed for other clinical purposes. Radiologists should always remind the importance of reporting on this finding, the importance of being clear while referring to a "fracture" and with no misleading terms.
Learning Objectives:
1. To understand the impact of discovering an osteoporotic vertebral fracture, and to know how this may impact the patient.
2. To learn about the definition of "vertebral fracture" in metabolic bone diseases.
3. To review the techniques and methods, both conventional and non-conventional, useful in the identification and characterisation of vertebral fractures.

A-712 09:00

Metabolic bone disorders in patients with malabsorption
C.M. Phan; *Paris/FR (catherine.phan@sat.aphp.fr)*

Gastrointestinal disease is often overlooked or simply forgotten as a cause of osteoporosis, osteopenia or osteomalacia. The aetiology of pathologic bone alterations in gastrointestinal disease is multifactorial. Bone alterations were thought to result simple from intestinal malabsorption, but a more complex interaction between cytokines and local/systemic factors influencing bone formation and resorption is envisaged. Special focus will be held on learning

about osteoporosis, osteopenia and osteomalacia in patient with malabsorption, understanding the physiopathology of metabolic bone disorders associated with Crohn's disease, Ulcerative Colitis and Celiac disease and understanding how it differs from primary osteoporosis and what are their main risk factors. Also discussed will be, for screening and follow-up of patients with malabsorption, how to identify patients at risk for metabolic bone disorders and the controversies about DEXA scans and anti-osteoporotic treatment.

Learning Objectives:

1. To learn about osteoporosis, osteopenia and osteomalacia in patients with malabsorption.
2. To understand the radiological findings of metabolic bone disorders associated with inflammatory bowel diseases.
3. To learn how to screen and follow-up on patients with malabsorption.

A-713 09:25

Bone quality beyond BMD: what do we know already and what more does the future hold?

J.S. Bauer; *Munich/DE (jsb@tum.de)*

Osteoporosis is the most common cause of low bone quality. Diabetes, renal failure and hyperparathyroidism are also associated with low bone mass, but different pathophysiological pathways, patterns of bone loss and clinical consequences. Beside the measurement of bone mineral density (BMD), bone structure can be assessed by MDCT or high resolution peripheral quantitative CT (HRpQCT), with a spatial resolution of up to 80µm isotropic at the peripheral skeleton. The radiologist should know the pathophysiological and main structural differences detected by high-resolution imaging and plain radiographs among these metabolic bone diseases. High-resolution imaging can successfully be analysed using conventional histomorphometric parameters as well as with nonlinear scaling measures and Finite Element Models. Cortical and trabecular bone quality can be assessed separately and give new insight in different ways of bone loss that still are summarised in the term "osteoporosis", but may be related to different pathophysiologic mechanisms. Beside bone quality on a microscopic scale, the skeletal geometry has to be considered on a macroscopic scale, to push limits towards a better fracture prediction and understanding of clinical consequences. Other new techniques, like X-ray vector radiography (XVR), assessment of properties of the bone marrow by MRI and the body composition by DXA hold promise to further optimise pathophysiological understanding and outcome prediction in metabolic bone diseases.

Learning Objectives:

1. To learn about clinical implications of low bone quality.
2. To understand differences between bone mass and bone quality.
3. To review recent advances in imaging of bone quality.

Author Disclosure:

J.S. Bauer: Research/Grant Support; German Research Foundation (BA 4085 2/1).

09:50

Panel discussion: How do radiologists get involved?

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

Radiographers

RC 1714
Looking into PET/CT

A-714 08:30

Chairmen's introduction

K. Åhlström Riklund[1], D. Pekarovic[2]; [1]*Umea/SE*, [2]*Ljubljana/SI*

To evaluate hybrid imaging examinations with PET/CT or PET/MR demands skills and knowledge of both nuclear medicine and radiology. This need can be solved in different ways. Either with one specialist being educated in both specialities evaluating the entire examination or with a combination of two specialists taking care of one part each of the examination. A similar approach can be used for the radiology nurses or radiographers performing the image acquisition. They can be either double, trained in both part of the hybrid imaging or they can work in pairs with one trained in PET acquisition and the other in CT or MR imaging. Independent of which model the department choose to use it is important to have a patent-centred imaging facility with focus on quality and safety. Knowledge of both radionuclide and contrast administration are needed as well as the influence of the clinical indication on the selection of imaging protocol. The PET/CT is a highly sensitive instrument and to achieve reliable image data, it is of utmost importance the quality controls are done in a proper way. The timing is another important factor for achieving high quality and keeping the validity of follow-up examination high. Clinical indications or appropriateness criteria are important since if they are evidence-based, they help to select highly justified patients to be examined. There are an increasing amount of guidelines and national programs including PET/CT in the staging, treatment planning and follow-up of patients with oncological diseases.

Session Objectives:

1. To learn about PET/CT procedures and the clinical indications.
2. To be aware of the importance of a quality control program and safety principles in PET/CT.
3. To understand the role of radiographers in PET/CT.

A-715 08:35

A. Clinical indications of PET/CT

P.H. Hogg; *Manchester/UK (P.Hogg@salford.ac.uk)*

This presentation is aimed primarily at people outside PET/CT who wish to gain insight into some of its current and future uses. PET radiopharmaceutical localisation methods will be considered. Over the last decade PET/CT has grown in importance. Cyclotron availability and automated chemistry synthesis has aided this. PET/CT is currently used for diagnosis of benign and malignant pathologies and radiotherapy planning. Benign indications cover a range of organs and systems, common examples include brain and heart. Malignant indications include primary and secondary cancers. PET/CT for radiotherapy planning is of growing interest; experience has demonstrated organ preservation benefits. Through the creation of specific molecules, highly targeted PET imaging can occur, resulting in the opportunity for personalised medicine in which better quality diagnostic and prognostic information can be obtained. This can lead to highly tailored management / treatment, resulting in a move away from the traditional 'one size fits all' to more bespoke personalised approaches. PET radiopharmaceuticals, often termed Probes, interact chemically with their surroundings. They permit visualisation of cellular function. The target may be a transporter, an enzyme, a receptor or any other biomolecule that allows good affinity binding of the probe. Probe development is slow and expensive; it involves in vitro and pharmacokinetic in vivo testing before licencing. Selection of the radiolabel depends upon its availability and whether radiolabel-probe binding is lengthy; lengthy processes can exclude short-lived radionuclides.

Learning Objectives:

1. To become familiar with contemporary indications of PET/CT in diagnosis and radiotherapy planning.
2. To appreciate the bases of PET radiopharmaceutical localisation in molecular imaging.
3. To be aware of the potential of PET/CT in molecular imaging.

A-716 08:58

B. Quality control for PET/CT

W.J.M. van den Broek; *Nijmegen/NL (wim.vandenbroek@radboudumc.nl)*

Performing frequent quality control (QC) procedures is paramount towards safeguarding good functioning of medical imaging equipment. With the implementation of the European Council Directive 97/43/Euratom in 2000 in all counties of the European Union, there is a Legal requirement for a Quality Assurance (QA) program which includes appropriate QC procedures. Initially, acceptance testing is performed before the first use of the equipment for clinical purposes and thereafter performance testing is conducted after major maintenance and on a regular basis. QC helps to ensure that the equipment performs throughout its useful life, at the levels specified by the manufacturer and measured during the acceptance testing process. Ultimately, a comprehensive QC program should maximize the diagnostic quality of the images provided to the physician. During this presentation, a set of QC tests, such as routine QC, calibration QC and cross-calibration for Positron emission tomography (PET) combined with X-ray computed tomography (CT) will be discussed during this presentation. There are several QA/QC requirements for hybrid PET/CT imaging devices, including correct spatial alignment of PET with CT images. Depending on the role which the PET/CT imaging device should perform in the institute, there are additional requirements. This is particularly true if the PET-CT is to be used for radiotherapy planning, in which setup with appropriate patient supports, laser alignment systems and integrity of transferring images of PET-CT device to the radiotherapy planning system has to be tested.

Learning Objectives:

1. To understand how a successful Quality Assurance (QA) programme will reduce image artefacts.
2. To become familiar with the range and performance frequency of quality control procedures that should be conducted on PET/CT devices.
3. To comprehend how the most frequently required PET quality control procedures should be conducted.
4. To be aware of the tolerance criteria and actions to be taken if these tolerance criteria are exceeded.

A-717 09:21

C. Safety in PET/CT

J. Rio; *Coimbra/PT (joanaespinheirario@gmail.com)*

Combined positron emission tomography-computed tomography (PET-CT) is imaging modality with high clinical utility, particularly in oncology. PET radiopharmaceuticals are positron emitters with characteristic 511 keV annihilation photons detected by coincidence systems of the PET tomograph. In the last few years the rapid expansion of PET-CT facilities and the introduction of positron emitters in conventional nuclear medicine departments have given rise to new radiation safety concerns for radiographers and nuclear medicine technologists, and these should be familiar with these to ensure the safety of both patients and staff. There are factors that lead to an increased risk of occupational exposure for PET-CT technologists and for radiation exposure to the patient, including the relatively high administered activities, the high patient throughput and the high energy of the 511-keV annihilation photons. However there are several strategies that can be used to minimise this radiation, like shielding requirements, workflow, and other radiation protection issues. The introduction of CT scanners into a nuclear medicine setting has created new and complex radiation protection issues concerning the radiation burden and attendant risks accrued by patients undergoing such multi-modality procedures. However, published studies have shown that, when proper radiation safety standards are followed, the radiation doses to personnel working in PET-CT facilities can be maintained below. The purpose of this presentation will be reviewing the radiation safety aspects, which includes shielding and workflow in the growing number of such facilities with PET-CT. This presentation also will approach the radiation dose achieved by the patients undergoing PET-CT exams.

Learning Objectives:

1. To understand the principles of PET/CT technology.
2. To learn about PET/CT safety procedures.
3. To become familiar with the knowledge, skills and competences needed to apply radiation protection measures for staff and patients in PET/CT.

09:44

Panel discussion: What is the role of a radiographer in PET/CT?

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

Neuro

RC 1711

Screening for cerebral aneurysms

Moderator:
A. van der Lugt; Rotterdam/NL

A-718 08:30

A. Who are the patients that I should screen for aneurysms? Why should I screen? What are the medicolegal ramifications?

M. Muto, G. Guarnieri; *Naples/IT (mutomar2@gmail.com)*

Intracranial (saccular or berry) aneurysms (IAs) are acquired lesions, accounting for about 80% of all nontraumatic subarachnoid hemorrhages. A WHO study found a geographic different annual incidence in Europe and Asia, especially in certain area. The familial occurrence and the association with heritable conditions indicate that genetic factors may play a role in the development of intracranial aneurysms and this group of patients need to be studied by imaging study, mostly MR and angio MR.mUntil now, there are no diagnostic tests for specific genetic risk factors to identify patients who are at a high risk of developing intracranial aneurysms or genetic test to predict the rupture risk.The natural history of UIAs and treatment outcomes are influenced by: Patient's clinical history, such as previous aneurysmal SAH, age, and coexisting medical conditions, alcohol-abuse, smoking; Aneurysm characteristics, such as size, location, and morphology, symptoms;´Strategy management, such as the experience of the surgical or endovascular team and the treating hospital;ISUA 1 and 2 study. In conclusion, the screening test with MR and Angio MR is necessary for certain type of category of patients with known genetic disease and collagenopathy. The management of this type of findings us related to UIAs experience and requires a deep knowledge of its natural history, risk factor, familiar factors basis for treatment decision.The medico-legal ramifications are related to which type of aneurysm to treat that up to now are related to size criteria and aneurysm growth at follow-up study.

Learning Objectives:

1. To understand which patients with cerebral aneurysms should be screened, and why.
2. To explain the medico-legal issue of screening patients with cerebral aneurysms.
3. To demonstrate how long screening and follow-up are necessary in those patients.

A-719 09:00

B. Which technique to use? CT angiography, time-of-flight MR angiography, contrast-enhanced MR angiography, catheter angiography

M. Voormolen, T. van der Zijden, O. d'Archambeau, C. Venstermans, F. De Belder, L. Van den Hauwe, J. Van Goethem, R. Salgado, P.M. Parizel; *Antwerp/BE (maurits.voormolen@uza.be)*

Intracranial aneurysms can be present because of subarachnoid haemorrhage, neurological symptoms, or can be found additional to another intracranial aneurysm, during screening in high-risk populations or as incidental finding. Depending on the nature of the aneurysm, additional imaging needs to be performed. The available imaging modalities are Computer Tomography (CT), Magnetic Resonance Imaging (MRI), and catheter angiography. Each of these modalities has its pros and cons. For general aneurysm screening, CT with contrast can be used. From the thin slice volumescan (arterial phase), intracranial arteries can be reconstructed in volume rendered (VR) and maximum intensity projections (MIP). The high radiation dose can be an issue. Alternatively, MR angiography (MRA) can be applied, either with Gadolinium: contrast-enhanced MRA, or without: Time-of-flight (TOF) MRA. To decide if an intracranial aneurysm is suitable for endovascular or surgical treatment, catheter angiography is the best imaging modality, often supplemented with 3D angiography. Catheter angiography provides additional information on the general vascular status, especially the head and neck arteries, and more precise measurements of the aneurysm and artery diameters. Intracranial aneurysms can be surgically clipped or closed by endovascular microcoils. Lately, (additional) stent placement or endosaccular occlusion devices may also be employed. For follow-up after aneurysm treatment, CT is inappropriate due to metal artefacts of the coils, stent or clip. After "simple" endosaccular aneurysm embolisation, MR angiography is suitable to observe aneurysm closure. In all other cases, catheter angiography is optimal to show occlusion with coils or clip of the aneurysm, and patency of stents.

Learning Objectives:

1. To understand the potential ways to screen those patients.
2. To become familiar with how to report abnormal findings.
3. To clarify in which cases it is necessary to perform cerebral angiography.

A-720 09:30

C. The interventional neuroradiology perspective on diagnosis, management and follow-up

L. Pierot, S. Soize, A. Benaissa; *Reims/FR (lpierot@gmail.com)*

Screening for intracranial aneurysms (IA) is performed in a limited number of patients (familial aneurysms, autosomal dominant polycystic kidney disease, etc). Interventional neuroradiologists will have mostly to deal with incidental IA discovered after a CT or MRI performed for non-specific symptoms (headache, vertigo, etc). In this situation, it will be important to carefully analyse using CTA, MRA, or DSA the aneurysm anatomy (aneurysm size, neck size, location, daughter sac) as well as the presence of multiple aneurysms. The strategy of treatment of incidental IA is primarily based on a careful analysis of aneurysm rupture risk and treatment risks. The risk of rupture is mostly dependent of aneurysm characteristics (size, location, etc). and has to be analyzed in light of patient's age as well as aneurysm risk factors (smoking, elevated blood pressure). Treatment risks include thromboembolic events and intraoperative leading to 1.7% morbidity and 1.4% mortality. 1. Several endovascular options are available to treat incidental IA including coiling, stenting, flow diversion, and flow disruption. 2. Indications of these different techniques are mostly depending of aneurysm anatomy. After endovascular treatment, aneurysm recanalisation can occur and patients have to be carefully followed up mostly using non-invasive techniques singularly MRA.

Learning Objectives:

1. To show the point of view of interventional neuroradiology reporting vascular pathology.
2. To understand when to treat those aneurysms.
3. To explain why it is important to follow-up with those patients.

Author Disclosure:

L. Pierot: Consultant; Blockade, Codman, Covidien/EV3, Microvention, Sequent, Stryker.

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

Special Focus Session

SF 17c
Technology for supporting clinical research in radiology

A-721 08:30
Chairman's introduction
D. Caramella; *Pisa/IT (davide.caramella@med.unipi.it)*

Are novel technologies available for supporting clinical research in radiology? Are online tools, searching PACS, or electronic case report forms suitable for clinical research? A panel of distinguished experts will answer to these and other related questions that pertain to an area which is gaining an increasing interest for our discipline. Andrew Scarsbrook (Leeds/UK), Daniele Regge (Turin/IT), and Tobias Bäuerle (Erlangen/DE) will describe how newly developed innovations have the potential to be effectively utilised to support clinical research and clinical trials in radiology.
Session Objectives:
1. To understand the challenges and opportunities of the different information technology that can be used for facilitating clinical research in radiology.
2. To become familiar with the limitations of current information technology for supporting research.
3. To appreciate the opportunities of innovative approaches to clinical research.

A-722 08:35
Online tools and software solutions for effective clinical research
A. Scarsbrook; *Leeds/UK (a.scarsbrook@nhs.net)*

A considerable array of resources of potential use to research-active Radiologists, are available on the Internet. Their quality is variable and much time could be wasted trying to find what is required. This talk will focus on carefully selected high quality resources and explain how these can be readily incorporated into daily routine. Web-based tools provide efficient ways of staying up-to-date with latest developments, including e-mailed table of contents updates from journals and customised e-mail citation alerts. Free software can easily be configured to provide a single reference point to summarised highlights from multiple websites and e-journals. Radiology-specific search engines can be utilised to provide more effective access to information. Free (open-source) software can be utilised to support clinical research in Radiology. A number of handy utilities will be highlighted and harnessing these to develop a personalised academic productivity suite will be explored.
Learning Objectives:
1. To become familiar with a range of web-based tools which provide efficient ways of staying up-to-date with and searching for relevant scientific literature.
2. To review a range of free (open-source) software which can be effectively utilised to support clinical research in radiology.

A-723 08:58
PACS for research
D. Regge; *Turin/IT (daniele.regge@ircc.it)*

In the research workflow, data enter the system from a rich variety of sources. These may include additional image data not normally used in clinical management (e.g. multimedia data or functional data), pathological and genomic data, etc. Data should be accessible from multiple clinical sites, sorted according to predefined arbitrary criteria and comply with data protection legislation. Advanced image analysis will usually require custom third-party software which could include tool to relate imaging data to digitized histologic data and when necessary with molecular and genetic analysis. Ideally, data processing pipelines should allow users to repeat analysis in an automated and reproducible way, at different time points and using different algorithms. Standardised and reproducible disclosure of research outputs should allow uniform presentation of study findings and auditing. Research PACS architecture should therefore be conceived to operate in a very different environment from that clinical routine, in a milieu were data comes from a rich variety of sources, is processed with non-conventional tools and were results are accessible to more academic sites. In the era of personalised medicine the concept of research PACS will inevitably merge with that of imaging Biobanks, organized databases of medical images and associated imaging biomarkers. Comparable to what occurs with biological specimens, this new concept stresses the importance of prospectively collecting imaging data for future analysis. The aim of this lecture will be to review the state-of-art of PACS in a research environment and to envisage future developments.
Learning Objectives:
1. To understand how research can be enhanced with PACS.
2. To learn about the advantages and difficulties of using PACS for research purposes.
3. To review the technical requirements to achieve inter-connectivity and give practical examples on the use of PACS in clinical research.

A-724 09:21
Using electronic case report forms for clinical imaging trials
T. Bäuerle; *Erlangen/DE (tobias.baeuerle@uk-erlangen.de)*

In the era of multi-modal and multi-parametric imaging, dedicated electronic solutions are needed to organize large amounts of data. Here, the following opportunities for standardised electronic case reporting within clinical imaging trials are presented: Software tools for (a) integration of multi-modal and multi-parametric imaging information, (b) data post-processing to acquire quantitative information and (c) response reporting during follow-up. Various imaging modalities from radiology and nuclear medicine are used in current imaging trials producing complimentary information on the morphologic, functional and molecular level. For structured electronic case reporting, software solutions will be discussed that are able to integrate and display multi-modal and multi-parametric imaging information. Second, these integrated imaging data require further post-processing steps for acquisition of relevant quantitative data such as the evaluation of functional data (dynamic contrast-enhanced techniques, diffusion-weighted imaging, etc). or pattern recognition algorithms in a semi-automatic or automatic manner to perform volumetric analysis of morphologic data. Third, within longitudinal clinical trials, assessment of treatment response requires the use of different classification systems in a standardised manner (e.g. RECIST, Choi criteria, etc. in oncologic radiology). Finally, organisation structures that allow long-term storage of electronic reports in dedicated databases will be briefly covered. Overall, this lecture requires no advanced prior knowledge and is suitable for all physicians performing clinical research using imaging techniques from radiology and nuclear medicine.
Learning Objectives:
1. To understand the fundamentals of electronic case report forms.
2. To learn about how to set up electronic case report forms for clinical trials in radiology.
3. To understand the added value of working with clinical research organisations.

09:44
Panel discussion: Are online tools, PACS, or electronic case report forms suitable for clinical research?

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

E³ - ECR Academies: Interactive Teaching Sessions

E³ 1821
Evaluation of patients with lung emphysema

A-725 10:30
A. Pretherapeutic evaluation of lung emphysema
M. Prokop; *Nijmegen/NL (m.prokop@rad.umcn.nl)*

"no abstract submitted"
Learning Objectives:
1. To understand the different types of lung emphysema.
2. To quantify the lung emphysema.

A-726 11:15
B. Diagnostic work-up after treatment of lung emphysema
N. Sverzellati; *Parma/IT*

Although lung volume reduction surgery and lung transplantation are still valid treatment modalities for patients with emphysematous chronic obstructive pulmonary disease (COPD) phenotype, the use of these interventions is very limited because of strict patient selection criteria, significant morbidity and donor shortage. There is also a number of less invasive treatments for emphysema such as the endobronchial valves and the coils techniques. This presentation will summarise both indications and complications of the different types of treatment for lung emphysema.
Learning Objectives:
1. To learn the different types of treatment for lung emphysema.
2. To recognise the complications of treatment.

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

ESR meets Turkey

EM 4
Turkey welcomes ECR

Welcome by the ESR President:
L. Bonomo; Rome/IT
Presiding:
A. Coskun; Kayseri/TR
B. Hamm; Berlin/DE

A-727 10:30
Introduction
A. Coşkun; *Kayseri/TR (coskunah@yahoo.com)*

Turkish Society of Radiology (TSR) was formed with the recent merger of two main radiology societies of Turkey, one of them founded as early as 1924. Just two years after the invention of x-Ray by William Rontgen in 1895, in 1897 a young military doctor named Esad Feyzi, began studying the field of radiology in Turkey with his colleague Dr. Rifat Osman. They took radiographies of soldiers wounded at war as the earliest examples of the application of x-ray technique into military surgery all over the world. TSR publishes diagnostic and interventional radiology (DIR) journal. It was accepted for indexing in science citation index expanded. Impact factor of DIR in 2013 was 1.4. Turkish Society of Radiology, which is an institutional member society of ESR, is in a strong relationship with European Society of Radiology for last 10 years. We expand our international relationships with other societies in Radiology. The Society annually organizes a well-known national congress of radiology as well as many other symposia and small-scale meetings. Attendance to the annual congress is about 1500 radiologists. Our 36th Turkish Congress of Radiology, TurkRad2015, will be held on October 21-25, 2014 in Antalya. The vision of TSR is to be a global pioneer in science, contributing to public health; a highly regarded society; and the primary decision making authority in the field of radiology. Its mission is to enhance the science of radiology in accordance with the public interest and to improve occupational scientific and social relations between its members.
Session Objectives:
1. To summarise the history of the TSR.
2. To explain radiology education in Turkey.
3. To give an overview of the radiological service quality in Turkey.

A-728 10:35
Liver hydatid cysts: percutaneous treatment
O. Akhan; *Ankara/TR (akhano@tr.net)*

The major criteria for assessing the indication of the treatment of the liver hydatid disease (CE: cystic echinococcosis) are primarily based on the imaging findings. Ultrasonography is the major and most important imaging modality for the classification of the liver hydatid cysts. Percutaneous treatment should be based on "stage-specific approach". The major indications (according to WHO classification) for percutaneous treatment of liver hydatid cysts include CE 1 which is treated by PAIR or catheterisation techniques, CE 2 which is treated by catheterisation or MoCaT (modified catheterisation techniques), CE 3 A which is treated by PAIR or catheterisation techniques and CE 3 B treated by modified catheterisation techniques. The patients with CE 4 and CE 5 should be regularly followed-up (wait and watch) since no treatment is indicated in these patients. The hydatid cysts which are perforated into biliary system, peritoneum and pleura are indicated for surgical treatment as a first option. The long-term follow-up of the lesions treated with percutaneous approach are highly successful and is reported to be over 98%. PT is associated with lower complication and recurrence rates and shorter hospital stay in comparison with the results of surgery. The main complications such as recurrences, biliary fistula and abscesses are also treated by percutaneous interventions. Percutaneous approach is also a treatment alternative to surgery for HC located not only in the liver but also in the other organs such as kidney, spleen, peritoneum, adrenal gland, soft tissue, parotid gland or orbit.
Learning Objectives:
1. To learn about the epidemiology and some structural characteristics of the disease.
2. To appreciate the importance of imaging, classifications and stage-specific approach.
3. To become familiar with the indications and techniques for the percutaneous treatment.
4. To learn about the results of percutaneous treatment in comparison with surgical results.
5. To understand complications of percutaneous treatment and their management.

A-729 10:55
Interlude I: Music show
I. Barutçu, M. Burçin Derçin, H. Barutçu; *Trabzon/TR*

A-730 11:00
fMRI of the brain: beyond expectations?
C. Calli; *Izmir/TR (cem.calli@gmail.com)*

Functional magnetic resonance imaging (fMRI) is a noninvasive technique for measuring and mapping of brain activity. The signals derived for fMRI is not directly related to neuronal activity but secondary to it, as the neuronal activity is followed by increase in regional blood flow and the fMRI contrast is dependent on the blood oxygenation level at the activated region of the brain. In this presentation some basic steps of both performing and postprocessing of fMRI studies will be discussed. Some basic clinical applications will be presented. Furthermore, some research fMRI data acquired in Ege University Medical Faculty Department of Radiology will be discussed (e.g. fMRI findings in music perception, foreign language speaking, children with attention deficit and hyperactivity disorder, etc).
Learning Objectives:
1. To give an introduction to the fMRI techniques.
2. To discuss the limitations and advantages of fMRI.
3. To give some interesting examples of fMRI studies.
4. To discuss the future projects of fMRI.

A-731 11:20
Interlude II: Music show
I. Barutçu, M. Burçin Derçin, H. Barutçu; *Trabzon/TR*

A-732 11:25
Advanced hepatopancreaticobiliary imaging
S.M. Ertürk; *Istanbul/TR (smerturk@gmail.com)*

Two of the primary objectives of the hepatopancreaticobiliary imaging are to distinguish benign from malignant lesions and to diagnose diffuse liver diseases confidentially to avoid unnecessary interventional procedures such as liver biopsies. Moreover, since the therapeutic approach may substantially differ, primary and secondary malignant liver lesions need to be properly characterised, as well. Diffuse liver diseases such as chronic hepatitis and nonalcoholic fatty liver disease are other disease entities that require a thorough radiological workup and patient follow-up. Cystic lesions of pancreas constitute another diagnostic dilemma. Malignant diseases of biliary system tend to remain silent for a long time. They need to be detected early to ensure a definite treatment. Magnetic resonance imaging with its different components such as dynamic contrast-enhanced imaging, diffusion-weighted imaging and "fat and iron" imaging, imaging with hepatocyte-specific contrast agents, magnetic resonance cholangiography, computed tomography, and PET/CT imaging are tools which can be effectively used to diagnose, characterise and monitor hepatopancreaticobiliary diseases.
Learning Objectives:
1. To understand novel imaging approaches that are used in the diagnostic work-up of pathologies of the liver, pancreas and biliary system.
2. To understand state-of-the-art imaging algorithms regarding the pathologies of liver, pancreas, and biliary system.
3. To learn pearls and pitfalls regarding the imaging of the hepatopancreaticobiliary system.

11:45
Panel Discussion

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

E³ - European Diploma Prep Sessions

E³ 1823
Neuro

A-733 10:30
Chairman's introduction
B. Ertl-Wagner; *Munich/DE (birgit.ertl-wagner@med.uni-muenchen.de)*

The EDiR Prep session in Neuro-Imaging offer the unique opportunity to review the most important high-yield facts in a subject area. They are mainly meant to support radiology trainees (residents) in their preparation for the European Diploma in Radiology (EDiR). However, they are also suitable for radiology trainees wishing to obtain an overview of the various topics relevant to imaging and for those preparing for their national board examinations. The topics are oriented along the European Training Curriculum (ETC) reflecting

both Level I and Level II contents. Sample questions are provided in the introduction.
Session Objectives:
1. To describe relevant imaging and interventional algorithms and important imaging features of neurovascular disorders of the brain and spine.
2. To understand imaging features and prognostic implications of tumours of the brain and spine.

A-734 10:33

A. Congenital and white matter disorders of the brain
A. Rossi; *Genoa/IT (andrearossi@ospedale-gaslini.ge.it)*

The paediatric central nervous system is a complex structure undergoing rapid development. As such, there is a rapid, continuous modification of what is "normal" in relation with age and the stage of development. Knowledge of the normal patterns of brain development in the clinically relevant ages from 0 to 18 years is necessary to interpret neuroimaging findings correctly. Knowledge of embryology and normal variants is also greatly helpful. MR imaging equipment and parameters need to be adjusted and optimised for pediatric studies. Pitfalls often occur from the misunderstanding of normal conditions that are perceived as abnormal based on a comparison with the appearance of the normal brain in adults. This includes, for instance, the evaluation of the brain in the first 2-3 years of life during the course of the process of myelination. Congenital malformations may also be viewed as arrests, or disruptions, along the steps of normal development of the brain. Neuroimaging studies, in particular MRI, are fundamental in the diagnosis of these abnormalities, as well in the detection of neurocutaneous syndromes, in which dysplastic abnormalities and central nervous system tumors typically coexist. Finally, MRI provides crucial information regarding white matter disorders, which can be further categorised on the basis of a pattern-recognition approach based on characteristic MRI findings; thus, congenital (i.e. metabolic) and acquired (i.e. inflammatory/demyelinating) white matter disorders can be differentiated from one another and further categorised based on MRI.
Learning Objectives:
1. To describe the development, normal anatomy and normal variants of the brain.
2. To differentiate common congenital disorders of the brain and neurocutaneous syndromes.
3. To understand imaging features and differential diagnoses of white matter disease, inflammation and neurodegeneration.

A-735 11:02

B. Neurovascular disorders and trauma of the brain
M. Forsting; *Essen/DE (michael.forsting@uk-essen.de)*

"no abstract submitted"
Learning Objectives:
1. To describe the normal anatomy and normal variants of the craniocervical arterial and venous system and its relevance to interventional neuroradiology.
2. To understand the causes and imaging features of stroke, haemorrhage and other common vascular lesions of the brain.
3. To differentiate the imaging features of traumatic injury to the brain and spine.

A-736 11:31

C. Tumours of the brain and spine
M.M. Thurnher; *Vienna/AT (majda.thurnher@meduniwien.ac.at)*

The fourth edition (2007) of WHO classification of tumours of the CNS is the worldwide standard for classifying and grading brain neoplasms. MR imaging (MRI) is the preferred technique for the diagnosis, treatment planning, and monitoring of patients with CNS tumours. Standardised brain tumour protocol is crucial for the preoperative assessment and interpretation of postoperative changes. Profound knowledge about the value of different conventional and advanced MRI techniques in evaluation of CNS tumours is essential for tumour grading and specific diagnosis. Brain tumour imaging objectives include: the diagnosis of brain tumour and the ability to distinguish it from non-tumoral lesions, assessment of histological grade of the tumour, delineation of the tumour borders and extension, differentiation between tumour and peritumoral edema, and finally the evaluation of possible recurrence and therapy-induced phenomena. In this lecture following questions will be discussed: 1. what is each sequence telling about the tumour. 2. Imaging characteristics of benign and malignant tumours. 3. How to grade brain tumours. 4. Systematic approach for evaluation of brain tumours.
Learning Objectives:
1. To describe the normal anatomy and normal variants of the spine, spinal cord and nerve roots.
2. To understand imaging features of benign and malignant tumours of the neurocranium.
3. To differentiate imaging features of benign and malignant tumours of the spine.

10:30 - 12:00 **Room L 1**

ESR: Patient Advisory Group for Medical Imaging (ESR-PAG)

ESR-PAG 2

Communicating the results of radiological studies to patients: from high-tech to human touch imaging

A-737 10:30

Chairmen's introduction
N. Bedlington[1], B. Brkljacic[2]; [1]*Vienna/AT*, [2]*Zagreb/HR*

At the ECR 2013, the ESR patient advisory group for medical imaging was established. The group comprises of seven patient representatives and five ESR representatives. The group has identified six core aims, including 'the improvement of the communication between radiologists and patients'. This session will outline the importance and challenges of doctor-patient communication relating to how to deliver news to a patient and how patients want to be informed and should provide a platform for direct interaction between patients and doctors on this important issue.
Session Objectives:
1. To understand the importance of patient-doctor communication.
2. To learn how the patient wants to be informed by the radiologist about the relevant findings.
3. To learn strategies on how to facilitate communication between patients and radiologists.

A-738 10:40

Who is the patient of the radiologist?
L.E. Derchi; *Genoa/IT (derchi@unige.it)*

The radiologist is a doctor and a doctor has the duty to communicate properly with his patients. But who is the patient of the radiologist? We have been working for years as "doctors' doctors", providing our report directly to the referring physicians. This is being challenged nowadays; it is becoming clear that our responsibilities are towards the patient, communication included. Then, our practice has to change. Although it may be difficult and time consuming, we have to develop a new way of practice in which there will be the possibility of a dialogue between the radiologist and his patient, both before and after our examinations. An informed patient will guarantee better cooperation during the study, will be more satisfied, and will recognise our role as physicians who have a crucial role in their diagnosis, treatment and follow-up. Talking to patients may be difficult, especially when bad news have to be given. There is consensus on the duty of the radiologist to respond truthfully and with careful consideration of patient's sensibilities and feelings, but we need to learn how to do it. A patient-centred approach is needed also in radiology, but it has to produce a paradigm shift in the way we practice: from attention to patients' examinations as products to attention to patients as persons; from department efficiency to examinations effectiveness; from radiology departments as "examination factories" to radiology departments as true "clinical services".
Learning Objectives:
1. To comprehend existing good practice regarding patient-doctor communication models in radiology.
2. To understand the importance of informed consent.
3. To become familiar with techniques/methods to deliver news to a patient.

A-739 11:00

Communicating results of radiological studies to the patient with breast cancer: view of the patient who is also a physician
A. Balenovic; *Zagreb/HR (almenka.balenovic@yahoo.com)*

The patient group "Everything For Her" was founded in Croatia in 2008 by women treated for breast cancer (BCA). Its primary aim is to deal with psychological problems of women treated for BCA, especially to help in the first months after the disease is diagnosed. Other aims are to promote awareness of women about BCA, importance of healthy lifestyle and to emphasise the need for early detection and regular medical examinations, to reduce risks associated with BCA and to enhance early detection and participation of women in the programme of national mammographic screening. The PG created very successful "Centre for Psychological Help for Women". Activities were well accepted by our patients, and were also translated to neighbouring countries. Cooperation with Croatian radiologists is important and very successful from the beginning. The collaboration with radiologists is formal, with the national radiology society, as well as with prominent radiologists who deal with the BCA and who regularly participate in our activities, lectures,

workshops, fund-raising, etc. In addition we cooperate closely with psychologists, oncologists, surgeons and psychiatrists. Being the physician diagnosed and treated for BCA, I understand better than average patient all the steps in the diagnosis and treatment and understand that the importance of radiologists is often overlooked. The knowledge about the role of mammography, ultrasound and breast MRI is very important to patients, and proper information is needed since our members are often confused with press articles that speak against mammographic screening and promote some unconventional and useless imaging methods.

Learning Objectives:

1. To present a personal experience regarding communication by a radiologist at the time diagnosis was established and during follow-up examinations.
2. To present the need for radiological presentation of mammographic findings, communication during ultrasound examinations, core biopsy of the breast, and breast MRI from the patient's point of view.
3. To present the need for psychological support for women treated for breast cancer and to discuss the position of the radiologist from the point of view of the chair of the patient group dedicated to providing psychological support to women with breast cancer.

A-740 11:20

Brain disorder - the communication challenge

D. Walsh[1], M. Messmer-Wullen[2]; [1]*Brussels/BE*, [2]*Lochau/AT*
(executivedirector@efna.net)

For communication in life, several centres of the brain need to collude to make interaction between humans or other beings possible. So, communicating effectively with those affected by brain disorders, where this collusion is interrupted, can be challenging. Certain brain disorders restrict the ability of the patient to communicate, listen and absorb information: dyssomnia, aphasia, dyspraxia, dysarthria, etc. Sudden changes of mood and aggressive approaches to communication from the patient can further complicate the situation; with a lack of time, understanding, training and experience amongst the healthcare team compounding the problem. As neuro-imaging is now an essential tool in diagnosing and managing many brain disorders, the radiologist is an integral part of the multi-disciplinary healthcare team for neurology patients. This presentation will outline case studies of communication issues arising from brain disorders/injury and solutions on how to overcome these barriers.

Learning Objectives:

1. To understand how communication with those affected by brain disorders is especially challenging - in terms of the neurological deficits of patients, coupled with the complexity of the pathology and the severity of the diagnosis.
2. To appreciate that doctors and patients have different views on what makes good and effective communication, and to discuss ways in which these differences can be bridged.
3. To learn what steps patient organisations are taking to improve the communication and understanding for both patients and doctors, and to explore how the health professionals can become involved.

Author Disclosure:

D. Walsh: 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. **M. Messmer-Wullen:** 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.

11:40

Panel discussion: From high-tech to human touch - how do we ensure this transition and what are the roles for the ESR and member societies?

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

E³ - The Beauty of Basic Knowledge: Breast Imaging

E³ 25E

High-risk lesions: solving the dilemma

Moderator:
J. Camps Herrero; Alzira/ES

A-741 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 is straightforward, a small group of lesions, "high risk" lesions, pose 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 (variable) 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 core samples, imaging guidance) may influence the risk of underestimation. The role of conventional imaging in guiding the management of these 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 risk.
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: Skeletal Radiology

E³ 24E

Metabolic, endocrine and marrow disease

Moderator:
V. Cassar-Pullicino; Oswestry/UK

A-742 12:30

Metabolic, endocrine and marrow disease

B. Vande Berg; *Brussels/BE (bruno.vandeberg@uclouvain.be)*

The current lecture aims at providing an overview on important imaging features observed in metabolic bone diseases. Limitations of medical imaging in the quantitative assessment of metabolic disorders will be stressed. Common and uncommon imaging findings observed in insufficiency stress fractures will also be reviewed and illustrated. The value of MR imaging will be emphasised.

Learning Objectives:

1. To appreciate the musculoskeletal manifestations of systemic disorders and their underlying pathomechanisms.
2. To understand the pathological processes involved in these imaging abnormalities.
3. To appreciate the strengths and weaknesses of imaging modalities in assessing these disorders.

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

E³ - European Diploma Prep Sessions

E³ 1923

Principles of imaging and radiation protection

A-743 14:00

Chairman's introduction

P. Vock; *Spiegel/CH (peter.vock@med.unibe.ch)*

As in the daily life of any diagnostic radiologist, imaging principles and radiation protection are an underlying basic prerequisite for passing the EDiR examination. This session will overview those characteristics of CT and MRI that are most important in correctly choosing the method, adapting the protocols to the individual patient and extracting the maximum of information out of an examination. Medical radiation exposure has grown in most countries over the last two decades and CT is currently the major source of exposure. Therefore, this session will also summarise the physical and biological background, risk versus benefit assessment and concrete measures of radiation protection. Test MCQs will illustrate the lectures.

Session Objectives:
1. To understand the technical and methodological principles of computed tomography.
2. To understand the technical and methodological principles of magnetic resonance tomography.
3. To know the principles of radiation biology and radiation protection.

A-744 14:03

A. Principles of computed tomography

W.A. Kalender; *Erlangen/DE (willi.kalender@imp.uni-erlangen.de)*

The introduction of x-ray computed tomography (CT) in 1972 meant the transition from conventional 2D projection imaging to superposition-free slice imaging. To understand the basic principles of CT to a certain degree, the data acquisition and the image reconstruction process will be explained in a general form. The resulting CT images not only provide morphology but also give quantitative CT values according to the Hounsfield scale which will be explained in detail. There is an impressively broad spectrum of technical solutions and CT scanner types. It all started with single-slice imaging, was developed further into true 3D imaging by the introduction of spiral scanning approaches, and was augmented significantly by the introduction of multi-row detectors. Multi-slice imaging is today's standard. In addition to the typical clinical scanner design, a variety of scanner types such as dual source CT and C-arm CT have to be mentioned; small dedicated peripheral CT scanners also gain increasing acceptance in clinical practice. Aspects of image quality and dose efficiency are of great importance. High spatial resolution and low image noise are contradictory goals and both may imply elevated radiation dose levels. Many innovative technical means for dose reduction are available today and are used to reduce dose at unimpaired image quality. Some important options, such as the use of optimised spectra, will be explained. Modern CT allows imaging at very high quality with effective dose values in the low mSv or even sub-mSv range.

Learning Objectives:
1. To have an understanding of the physical basis of image formation of computed tomography and of the physics of helical, multidetector and dual-source CT.
2. To explain the scale of Hounsfield units and the principle of window centre and width.
3. To list the major sources of artefacts in CT.
4. To describe the principles of optimising protocols for a variety of CT scanner types and examination
including the principles of contrast media application, reconstruction algorithms and kernels.

Author Disclosure:
W.A. Kalender: Consultant; Siemens Healthcare Erlangen, Bayer Healthcare Berlin.

A-745 14:32

B. Principles of magnetic resonance imaging

T. Metens; *Brussels/BE (tmetens@ulb.ac.be)*

Magnetic resonance imaging (MRI) is based on proton nuclear magnetic resonance (liquid NMR): inside a strong magnetic field (1.5 T/3 T) the tissue NMR signal is induced in coils as response to radiofrequency pulse sequences and is localised by magnetic field gradients fast switching. Due to water and mobile lipids abundantly present in living tissue, the MRI signal provides an excellent soft tissue contrast. Indeed the signal intensity depends on NMR relaxation times T1 and T2 (spin-echo sequences) or T2* (magnetic susceptibility-dependent gradient-echo sequences) and soft tissue contrast occurs because relaxation times are tissue dependent. The detailed sequence structure controls the image contrast: T1-weighted or T2-weighted (or T2*-weighted) images are commonly used for diagnostic purpose. When an inversion radiofrequency pulse precedes the main sequence by a time delay TI, a T1-based selective tissue suppression can be achieved (fat suppression in STIR, fluid suppression in FLAIR sequences). The injection of a Gd-based contrast agent or the presence of an intrinsic paramagnetic agent shortens the tissue T1 relaxation time and contributes to lesion detection or characterisation. The MRI signal can be made sensitive to blood flow: flow-void in spin-echo or inflow hyper-intensity in gradient-echo sequences. Angiography is also obtained with Gd-enhanced gradient-echo sequences. Sequence structure, operator choices and tissue characteristics influence image quality, including signal-to-noise ratio and artefacts. MRI contraindications and staff or patient safety issues are mostly related to the strong magnetic field, to RF and gradient pulses or to contrast agent use.

Learning Objectives:
1. To have a basic understanding of the physical basis of image formation in MRI including the principles of pulse sequences and relaxation times.
2. To describe the principles and main diagnostic applications for the most commonly used sequences in MRI, including T2-weighted sequences, T1-weighted sequences, STIR sequences, FLAIR sequences, other inversion recovery sequences, T2*- / susceptibility weighted sequences and MR angiography sequences.
3. To describe typical artefacts on MR imaging and to discuss their respective causes.
4. To explain absolute or relative contraindications against MR imaging and safety issues in the MR environment with regard to patients and staff.

A-746 15:01

C. Radiation protection

M. Mahesh; *Baltimore, MD/US (mmahesh@jhmi.edu)*

The number of medical imaging procedures is growing exponentially across the globe (not just confined to Europe or the United States). The overall benefit from medical imaging procedures far outweighs any associated risks. However, it is upon us as users (Radiologists, Cardiologists, and any other physicians) who orders such medical imaging studies to ensure the studies are justified and optimally performed with the focus of keeping any associated risks to a minimum. This lecture will focus briefly on the types of X-ray interactions with matter in the diagnostic energy range and their impact on imaging. This lecture will also discuss the biological effects of radiation and the fundamental concept of radiation protection applicable to both patients and staff alike. Since there is an increasing demand from patients to know about their radiation exposures, this lecture will discuss the various radiation dose descriptors in CT, Fluoroscopy and Radiography. Finally, the lecture will discuss the various radiation dose optimisation strategies applicable to adults and paediatric populations.

Learning Objectives:
1. To explain the phenomena of x-ray interaction with matter and the consequences for image generation, image quality and radiation exposure.
2. To describe types and magnitudes of radiation exposure from natural and artificial sources and the concepts of dose determination and dose measurement for patients, occupationally exposed personnel and the public.
3. To describe types and magnitudes of radiation risk from radiation exposure in medicine.
4. To describe the basic principles of radiation protection, as outlined by the ICRP (International Commission on Radiological Protection).
5. To explain the concepts and tools for dose management in radiology with regard to adult and paediatric patients.

Author Disclosure:
M. Mahesh: Author; MDCT Physics: The Basics - Technology, Image Quality and Radiation Dose.