



Postgraduate Educational Programme

Categorical Courses (CC)
EFOMP Workshop (EF)
ESR meets Sessions (EM)
European Excellence in Education (E³)
Honorary Lectures (HL)
Mini Courses (MC)
Multidisciplinary Sessions (MS)
New Horizons Sessions (NH)
Opening Lecture (OL)
Professional Challenges Sessions (PC)
Refresher Courses (RC)
RTF - Radiology Trainees Forum (TF)
Special Focus Sessions (SF)
State of the Art Symposia (SA)

Thursday, March 7 5
Friday, March 8 19
Saturday, March 9 53
Sunday, March 10 83
Monday, March 11 125

Thursday, March 7

12:30 - 13:30

Room N/O

The Beauty of Basic Knowledge: Head and Neck

MC 24 A

A taste of the oral cavity and salivary glands

A-001 12:30

A taste of the oral cavity and salivary glands

A. Borges; Lisbon/PT (borgalexandra@gmail.com)

The oral cavity is a large mucosal space open anteriorly, bordered superiorly by the nasal cavity and posteriorly by the oropharynx, containing a central muscular piece- the oral tongue. Inferiorly, the floor of the mouth, composed by the mylohyoid muscles, separates the mucosal space from the sublingual and submandibular spaces which contain the homonym salivary glands. The parotid gland, the largest of the salivary glands, lays in the parotid space with its major duct traveling through the buccal space and opening in the oral mucosa opposed to the second upper molars. It surrounds the ascending ramus of the mandible and is traversed by the main trunk of the facial nerve which divides the gland into superficial and deep lobes; the later insinuating itself into the parapharyngeal space through the stylomandibular tunnel. Although the mucosal space is widely accessible to clinical inspection, imaging is crucial to depict pathology spreading to or originating from the submucosa as well as to adequately depict areas of difficult clinical access such as the retromolar space- a small triangular area of mucosa posterior to the last molars. Superficial structures in the submandibular and parotid-bucco-masseteric region can be adequately depicted by ultrasound whereas deep seated structures are best evaluated using CT and/or MRI. Here, we will review the basic anatomy, imaging technique and main pathological processes affecting these head and neck structures.

Learning Objectives:

1. To become familiar with the anatomy of the oral cavity and salivary glands.
2. To learn how to tailor imaging approaches to the patient's clinical presentation.
3. To appreciate the main pathologic processes of the oral cavity and salivary glands.

12:30 - 13:30

Room P

The Beauty of Basic Knowledge: Musculoskeletal Imaging

MC 25 A

Trauma

A-002 12:30

Trauma

A. Kassarian; Majadahonda/ES (akassarian@gmail.com)

A basic understanding of anatomy and biomechanics is crucial for the understanding of musculoskeletal injuries. Such thorough knowledge allows one to look beyond the obvious/primary injury and search for commonly associated injuries that may be quite subtle, are often overlooked, and may have significant clinical implications. This session will cover upper and lower extremity injuries and explore the biomechanics, pathophysiology and constellation of injury patterns as seen on imaging.

Learning Objectives:

1. To learn about the basic mechanisms of musculoskeletal trauma.
2. To become familiar with typical musculoskeletal injuries and injury patterns.
3. To understand the impact of different radiological methods in the trauma setting.

14:00 - 15:30

Room B

Interactive Teaching Session

E³ 220

Lung cancer

A-003 14:00

A. Detection

S. Diederich; Düsseldorf/DE (stefan.diederich@vkkd-kliniken.de)

Lung cancer most often presents as a pulmonary nodule or mass, less commonly as a hilar mass or endobronchial lesion. Most small tumours radiologically present as pulmonary nodules. Chest radiography (CXR) is limited in demonstration of small nodules and even lesions as large as 3 cm may be missed. Digital tomosynthesis has been shown to markedly improve sensitivity for pulmonary nodules as compared to CXR but is not yet widely available. Magnetic resonance imaging (MRI), too, is more sensitive than CXR, but is not routinely performed due to cost and limited availability. The gold standard for detection of pulmonary nodules as small as 1-2 mm is multidetector computed tomography (MDCT). Technically, MDCT can demonstrate pulmonary nodules with a sensitivity close to 100%, however, sensitivity of individual radiologists is much lower. Computer-assisted detection (CAD) software may improve sensitivity but may be limited by false positive findings. Positron emission tomography (PET)-CT using 18 F-Deoxyglucose (18 FDG) has a high sensitivity for lung cancer, however, false negative findings may be due to well-differentiated adenocarcinoma, carcinoid and nodules < 10 mm whereas false positive findings may be due to inflammatory lesions. This interactive session will include examples of manifestations of lung cancer as well as data on the accuracy of different imaging methods for lung cancer detection. Endobronchial and hilar tumours are more difficult to detect radiologically. Flat mucosal lesions may go undetected altogether with bronchoscopy representing the gold standard for these lesions.

Learning Objectives:

1. To learn which imaging techniques are appropriate for detecting lung cancer.
2. To learn about the most relevant imaging findings in lung cancer.
3. To understand the behaviour of lung cancer related to imaging.

A-004 14:45

B. Follow-up

F. Gleeson; Oxford/UK (fergus.gleeson@orh.nhs.uk)

Although the initial staging of lung cancer is well worked up and agreed, the method of follow-up, and the frequency of follow-up investigations is less well investigated or agreed. There are now second line treatments available for patients with lung cancer initially treated with intention to cure. The second line treatments are in part dependent upon the volume of disease at relapse. It is important to understand which patients should be carefully followed up for potential second line treatment. Second line treatments include surgery, radiotherapy, percutaneous ablation and chemotherapy. All have evidence to demonstrate an increase in survival following relapse or disease progression. This presentation will summarise the current evidence and suggest algorithms that may be implemented to reduce cost and maximise patient benefit.

Learning Objectives:

1. To know the common features of lung cancer recurrence.
2. To learn how to establish follow-up protocols after treatment of lung cancer.

16:00 - 17:30

Room B

Interactive Teaching Session

E³ 320

Malignant pancreatic tumours

A-005 16:00

A. Solid tumours

W. Schima; Vienna/AT (wolfgang.schima@khgh.at)

The most common pancreatic malignancy is ductal adenocarcinoma, with neuroendocrine tumours (NET), lymphoma and metastases being important differential diagnoses. Non-neoplastic pitfalls include focal pancreatitis and lipoma. Multi-phasic hydro-MDCT is very effective in detection of hypoattenuating adenocarcinoma (sensitivity up to 90%). In 5-11% of patients, isoattenuating cancers will show only indirect tumour signs (duct dilatation, contour deformity, loss of lobulation, mass effect). MRI is a problem-solving tool in equivocal CT to depict small cancers. Best pulse sequences for detection are unenhanced T1w GRE fatsat, dynamic enhanced 3D-GRE fatsat and DWI. Important issues in cancer staging are presence of vascular involvement (celiac axis, SMA, SMV, portal vein), lymph nodes, or liver metastases. 3D reformations (MIP, VRT, CPR) of MDCT datasets are helpful to demonstrate vascular invasion, although minimal invasion may elapse CT or MR imaging. NET tend to be hypervascular, which is best seen in the arterial phase. RCC metastases to the pancreas are not uncommon. They are typically hypervascular, mimicking NET at imaging. Most important non-neoplastic solid mass is focal pancreatitis. The duct penetrating sign at MRCP helps to differentiate focal inflammation from cancer, although multimodality imaging including biopsy is often required to make a definitive diagnosis. Focal steatosis or lipoma is easily diagnosed by chemical shift MRI (T1w GRE in- and opposed-phase). In conclusion, multi-phasic hydro-MDCT is excellent for cancer detection, with 3D reformations for demonstration of vascular involvement. For differentiation between cancer and tumour-simulating disease (focal pancreatitis, steatosis), MRI is complementary to MDCT.

Learning Objectives:

1. To learn how to differentiate tumours from other non-tumoural pathology.
2. To understand how to choose the proper imaging technology.
3. To appreciate how to determine resectability and extension of the tumour.

Author Disclosure:

W. Schima: Advisory Board; GE Healthcare. Speaker; Siemens.

A-006 16:45

B. Cystic tumours

G. Morana; Treviso/IT (gmorana@ulss.tv.it)

Cystic lesions of the pancreas can be recognised in up to 8%-10% of abdominal studies, although most of them are benign. Real cystic tumours of the pancreas are more rare and less frequent than solid lesions; quite often they are occasionally recognised, as many of these lesions are small and asymptomatic, but they may be associated with pancreatitis. An accurate differentiation between different cystic lesions is important because they require a different treatment according to their histological type and differentiation, but due to the frequent lack of specific clinical and laboratoristic signs, the overlap of imaging findings between different cystic tumours and between non-neoplastic and neoplastic cystic lesions of the pancreas, the management of these patients is complex, and knowledge of symptoms of the patients, natural history and predictors of malignancy are important. When dealing with pancreatic cysts, aim of the imaging is to differentiate cystic tumour from tumour-like lesions and to characterise cystic tumour, distinguishing benign tumour, which usually do not require surgical excision, from border-line or malignant ones, which must be resected whenever possible. On the basis of imaging criteria alone, it can be very difficult to differentiate non-tumoural cystic lesions from neoplastic ones; in order to achieve a correct diagnosis, it is important to correlate the imaging findings with the clinical history of the patient, the presence or absence of symptoms, and their type. US, CT and MRI are excellent tools which permit to accurately evaluate these lesions, making thus possible their correct management.

Learning Objectives:

1. To learn how to choose the proper imaging modality.
2. To understand the criteria of malignancy and benignity.
3. To learn how to follow-up the lesions.

16:00 - 17:30

Room C

GI Tract

RC 301

Staging and restaging of rectal and anal cancer

A-007 16:00

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 and anal cancer is well recognised and MR imaging has become the imaging method of choice for staging these tumours. Although organ saving treatment has been adopted in patients with anal cancer, it is still debatable in patients with rectal cancer. Partly, this is because in rectal cancer, in contrast to anal cancer - where clinical examination is accurate for selection of patients for organ preservation -, it is not reliable to solely base decision-making on the endoscopic inspection of the luminal aspect of the rectal wall. The shift in rectal cancer treatment however is eminent and the role of imaging pushing forward this shift is obvious. Hence, the relevant questions that will be asked to radiologists in the coming years are: "how accurate can we assess response to treatment and how accurate can we monitor sustained response during the long term surveillance?" The objective of this session is to understand the value of modern planar imaging method for primary staging of rectal and anal cancer patients (MRI, PET/CT). A second objective is to know the performance of these imaging techniques for assessment of response, for selection of patients for organ preserving treatment and for monitoring of sustained response at long term follow-up. The session will elaborate on the similarities and differences of diagnostic questions for anal and rectal cancer.

A-008 16:05

A. Local staging of anal and rectal cancer and impact on initial therapeutic strategy

S. Gourtsoyianni; London/UK (sgty76@gmail.com)

New generation MRI scanners with optimal phased array body coils, resulting in improved contrast and spatial resolution images due to better signal to noise ratio, have contributed to production of high-resolution images in which visualisation of anatomical details such as the mesorectal fascia, mesorectal lymph nodes with a diameter down to 2 mm and the bowel wall layers are feasible. Pre-operative MRI of the rectum using mainly high-resolution T2 weighted sequences has gained significant accreditation, especially after the introduction of total mesorectal excision (TME) surgery and neoadjuvant therapy in the treatment regimen of rectal cancer. MR Imaging is so far the only method that can preoperatively identify patients most likely to benefit from neoadjuvant therapy as well as demonstrate high-risk patients for local recurrence. Anal cancers are more rare, account for < 1% of large bowel tumours, are predominantly squamous cell carcinomas and are treated with definitive chemoradiation. Imaging and especially MRI with multiple advanced contrast mechanisms may play a significant role in radiotherapy planning as it may accurately delineate the extent of the primary tumour and allow for more precise gross tumour volume and potentially target volume definition.

Learning Objectives:

1. To learn about optimised MR techniques for rectal and anal cancer staging.
2. To become familiar with the role of endorectal ultrasound in anorectal cancer staging.
3. To understand basic TNM staging and assessment of the CRM on imaging.
4. To understand how imaging findings influence the initial therapeutic approach.

A-009 16:35

B. Assessment of rectal cancer response

L. Curvo-Semedo; Coimbra/PT (curvosemedo@gmail.com)

The objective of neoadjuvant therapy is to downstage and downsize the tumour in order to improve resectability and achieve better local control. Preoperative chemoradiation therapy (CRT) has become standard of care for locally advanced rectal cancer and led to a decline in local recurrence rates. Post-CRT MRI for assessing invasion of mesorectal fascia (MRF) based on morphologic criteria alone shows both high sensitivity and NPV. Its main challenge is the assessment of hypointense "fibrotic" tissue in the initial tumour area that may contain small residual tumour nests. DWI can help differentiate neoplastic from radiation-induced fibrosis and inflammation within the MRF, potentially improving the overall diagnostic accuracy. The reported overall accuracy of MRI in assessing the T stage

of irradiated rectal cancer is 47%-54%. The major cause of overstaging is diffuse hypointense tissue infiltration into the mesorectal fat, related to marked fibrosis of the bowel wall and desmoplastic reaction. Replacement by fibrotic scar tissue with an island of residual adenocarcinoma can make it difficult to identify viable tumour on MR images, causing understaging. Imaging after CRT is not sufficiently accurate for identifying complete responders, with PPVs ranging from 17 to 50%. In most cases, a hypointense scar replaces the site of disease, and the major component of error on MRI is overstaging due to its limited capability to differentiate between viable tumour, residual fibrotic tissue, and desmoplastic reaction. DWI in addition to standard MRI significantly improves the performance of radiologists to select complete responders.

Learning Objectives:

1. To learn the rationale for following-up on patients after neoadjuvant chemotherapy.
2. To understand conventional imaging criteria for assessing tumour response.
3. To learn about new techniques for assessing response, including diffusion MRI and PET/CT.

A-010 16:55

C. Assessment of anal cancer response

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

Anal cancer is an uncommon cancer, accounting for 1.5% of all gastrointestinal cancers, but is increasing in incidence. Anal cancer is predominantly a loco-regional disease; less than 5% of patients have disease outside the pelvis at presentation. Definitive chemoradiation, combining radiotherapy with concomitant 5-fluorouracil and mitomycin C, is recognised to be the optimal treatment modality for squamous cell cancers of the anal canal and margin, offering good loco-regional control and survival rates similar to surgery. Traditionally clinical examination and proctoscopy have been the main tools for locoregional tumour assessment, however, in recent years, imaging has become the method of choice for assessing tumour regression following chemoradiation. The advantage and limitations of the different imaging techniques in assessing response will be described. The complications of treatment and imaging appearances will also be discussed.

Learning Objectives:

1. To learn the rationale for restaging after therapy.
2. To know how to assess the tumour response with conventional imaging criteria.
3. To learn about new techniques for assessing response in anal cancer, including diffusion MRI and PET/CT.

Panel discussion:

What clinicians expect from us in rectal and anal cancer staging and restaging? How should we image patients?

17:15

16:00 - 17:30

Room D2

Cardiac

RC 303

Cardiac imaging: the cutting edge

Moderator:

E. Di Cesare; L'Aquila/IT

A-011 16:00

A. Cardiac MRI: do we need more than 1.5 T?

B.J. Wintersperger; Toronto, ON/CA (Bernd.Wintersperger@uhn.ca)

1.5 T cardiac MR imaging is a mainstay of cross-sectional imaging of various cardiac diseases and has proven high accuracies and new insights into diseases. Based on its success, diagnostic approaches have changed and also risk assessment for some cardiac diseases has become possible. Based on continuous technical developments though higher field strength have become available in recent years with clinical use of 3 T and research use of 7 T. However, specific changes that come along with the increase in B0 have to be incorporated in most aspects of a cardiovascular MR imaging procedures; from patient screening to imaging technique details. Basic changes at higher B0 are: B0 proportional increase of SNR, substantial increase in RF deposition, changes in magnetic tissue properties and B0/B1 inhomogeneities. While most of these changes affect all aspects of cardiac imaging at 3 T, some may only affect certain applications (e.g. assessment of myocardial iron). CE MRA benefit from SNR increase at higher B0 (e.g. 3 T) and improved background suppression based on short TR and prolonged T1 values. While some applications at higher B0 have not yet been proven to impact diagnosis signal starving applications at 1.5 T (e.g. myocardial perfusion), also

substantially benefit from the B0 increase. The work horse of cardiac MRI, cine SSFP is affected by off-resonance artifacts at higher B0, with proper adjustments (shimming, frequency scouting) though diagnostic image quality can be maintained. Most importantly, in daily routine also the safety aspect of the patient with potential devices has to be taken into account.

Learning Objectives:

1. To learn about the differences between 1.5 T and 3 T cardiac MRI.
2. To understand the clinical applications of high-field cardiac MRI.
3. To become familiar with the problems of using high-field cardiac MRI in daily routine.

Author Disclosure:

B. J. Wintersperger: Speaker; Siemens Healthcare, Bayer Healthcare.

A-012 16:30

B. Cardiac CT: technique in 2020; where to next?

K. Nikolaou; Munich/DE (konstantin.nikolaou@med.uni-muenchen.de)

In recent years, technical advances and improvements in cardiac computed tomography (CT) have provoked increasing interest in the potential clinical role of this technique in the non-invasive work-up of patients with various cardiac diseases - most importantly in patients with suspected coronary artery disease (CAD). Within the next years, several trends are foreseeable: from a research standpoint, the strengthening of clinical evidence by larger, randomised, clinical multicentre trials for cardiac-CT indications can be expected. From a technical standpoint, there are two main fields of interest and technical developments to be expected: further optimising radiation dose and image quality, by techniques such as high-pitch scanning, iterative reconstruction algorithms, wide detectors with single heart beat acquisitions and digital detector technology. On the other hand, introduction of new applications and protocols, such as the combined assessment of cardiac morphology, function, and viability/perfusion, will broaden the clinical applicability of cardiac-CT.

Learning Objectives:

1. To learn about the latest technical developments in state-of-the-art cardiac CT.
2. To explore what new developments will influence cardiac CT over the next few years.
3. To understand if what you need is a lot of rows, tubes or both for optimal cardiac CT.

A-013 17:00

C. Cardiac hybrid imaging: "One-Stop-Shop"

P.A. Kaufmann; Zurich/CH

"Abstract Not Submitted"

Learning Objectives:

1. To understand the principles of cardiac hybrid imaging.
2. To learn about the diagnostic value of hybrid imaging.
3. To know about possible indications for performing hybrid imaging.

16:00 - 17:30

Room E1

Molecular Imaging

RC 306

Molecular imaging in oncology

Moderator:

O. Clément; Paris/FR

A-014 16:00

A. New PET-tracers for oncology

P.L. Choyke; Bethesda, MD/US (pchoyke@nih.gov)

PET tracers represent an exciting development in the imaging of cancers. Because of the sensitivity of PET (nano-pico molar sensitivity vs. micromolar for MRI), it is possible to image cell membrane-based receptors responsible for the abnormal growth associated with cancers and detect subtle changes in the integrity of cancer cells. FDG-PET/CT has been the trailblazer agent, demonstrating unique sensitivity for cancers, however, while FDG uptake does reflect glycolysis, it is relatively non-specific and, to date, has not dictated the choice of therapies. The promise of new PET agents is that they will aid clinicians in adding or deleting therapies depending on the pharmacodynamics of the imaging biomarker. For instance, classes of agents have been developed to investigate angiogenesis, proliferation,

hypoxia, apoptosis, hormone sensitivity and amino acid transport. Each of these provides a unique window on the biology of each cancer and will hopefully guide therapies in the near future. In the specific example of metastatic prostate cancers, Sodium Fluoride PET is proving far more sensitive than conventional bone scans. Agents such as F-ACBC (amino acid transport), F-DCFBC (Prostate Membrane Specific Antigen PSMA), F-DHT (androgen receptor) and F-Choline (cell membrane turnover) are proving efficacious in the detection of metastatic disease and reflect actual tumour burden in contrast to existing methods that only indirectly image tumour (bone uptake). Thus, there is a rich future in new PET tracers for oncology that is only in its infancy.

Learning Objectives:

1. To learn about the new specific tracers that can be used in oncologic patients.
2. To become familiar with their possible impact on patient management.
3. To understand their potential and limitations for practice.

Author Disclosure:

P. L. Choyke: Other; Research Agreements with GE, Siemens and Philips.

A-015 16:30

B. Potential of MRI for molecular imaging in oncology

F.A. Gallagher; Cambridge/UK (fag1000@cam.ac.uk)

Imaging targets in cancer range from simple size measurements to more specific biomarkers on functional, cellular, metabolic and molecular levels. As our understanding of basic tumour biology has advanced, techniques have been developed to exploit this information to produce increasingly specific molecular imaging tools. The biodistribution of these molecular imaging probes should be more specific in diagnosing and assessing cancer than the morphological information acquired using anatomical imaging alone. This lecture will discuss current and emerging functional and molecular imaging techniques using MRI and their applications in oncology. Functional measures of tumour blood flow and vascular permeability can be made using dynamic contrast-enhanced MRI. Diffusion-weighted imaging is a surrogate for the cellular content of the tumour and emerging methods can be used to probe features of the extracellular space such as tumour pH and stromal content. On the molecular level, cell surface expression of specific proteins and enzyme activity within the cell can be imaged; labelled probes have been developed which bind to these proteins and a new MR technique is being developed for assessing tumour glucose in a similar way to PET. Hyperpolarisation methods are emerging to overcome the major limitation of MR: its low sensitivity. One such approach is dynamic nuclear polarisation, which can probe carbon metabolism non-invasively in patients with cancer. Functional and molecular imaging techniques with MRI 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.

Learning Objectives:

1. To become familiar with the different approaches to molecular imaging with MRI.
2. To understand the role of molecular imaging in oncology.
3. To learn about emerging MRI techniques for molecular imaging.

Author Disclosure:

F. A. Gallagher: Grant Recipient; GE Healthcare.

A-016 17:00

C. Emerging molecular imaging techniques

F.M.A. Kiessling; Aachen/DE (fkiessling@ukaachen.de)

Optical in vivo imaging derives from microscopy techniques and is establishing as a valuable and cheap tool in preclinical research. Some optical methods have recently been translated to the patient and show promising results. However, the ability to gain quantitative or spatially high resolved data differs between optical imaging methods. Therefore, principles, strengths and limitations of optical reflectance imaging, mesoscopic epi-fluorescence tomography (MEFT), and fluorescence molecular tomography (FMT) will be discussed. Optical imaging benefits from being combined with CT or MRI and it will be shown how μ CT not only improves the localisation of fluorescent spots within animals but also improves the reconstruction of fluorescent raw data. Also in PET-CT, CT data is not only used as a morphological correlate but also to perform the attenuation correction. This is much more difficult, when using PET in combination with MRI. A possible solution is the use of UTE-Dixon MR sequences that can reliably distinguish fat, soft tissue and bone, which are the tissue components with most different photon absorption. The last part of the talk is dedicated to molecular ultrasound imaging. Here stabilised gas bubbles linked to targeting moieties are used as intravascular contrast materials. Markers of vascular inflammation and of angiogenesis can be addressed. Many preclinical studies successfully applied molecular ultrasound imaging to characterise cancer

and to monitor cancer therapy. First molecular ultrasound microbubbles are currently under clinical evaluation. Since microbubbles can also be used to permeate the vasculature locally and to transport drugs, its theranostic potential will be outlined.

Learning Objectives:

1. To become familiar with optical imaging techniques and probes.
2. To learn about the potential of targeted US contrast agents.
3. To appreciate emerging hybrid imaging techniques.

Author Disclosure:

F. M. A. Kiessling: Board Member; ESR Research Board, Council ESML. Founder; invivoContrast GmbH. Grant Recipient; DFG, BMBF, EU. Research/Grant Support; Financial support by Bracco, Bayer, Philips, Roche, Astra Zeneca.

16:00 - 17:30

Room E2

Multidisciplinary Session: Managing Patients with Cancer

MS 3

Colorectal liver metastases

A-017 16:00

Chairman's introduction

V. Vilgrain; Clichy/FR (valerie.vilgrain@bjn.aphp.fr)

Patients with colorectal liver metastases require a multidisciplinary approach including hepatobiliary surgeons, oncologists, diagnostic and interventional radiologists. This session will cover the most important issues in these patients. The role of imaging in assessing intra- and extrahepatic staging will be discussed. Cases will illustrate the most recent improvements in imaging such as diffusion-weighted and liver specific contrast-enhanced MR imaging. Curative hepatic surgery is standard of care for resectable patients, but most patients are not initially resectable. The resectability depends on the size, location, and extent of disease. Resectable and non-resectable cases will be shown as well as two-step procedures such as portal vein embolisation which allow surgical resection in patients who cannot initially meet the surgical criteria. The role of systemic chemotherapy with or without targeted therapy is crucial in patients with resectable or non-resectable colorectal liver metastases. Notably, chemotherapy can render resectable patients who are unresectable. Yet, these treatments can induce hepatotoxicities. Last, interventional radiology plays an important role in these patients allowing local ablation or endovascular treatments such as hepatic arterial chemoembolisation and selective internal radiation therapy.

Session Objectives:

1. To learn about the prognostic factors of colorectal liver metastases.
2. To become familiar with the most common therapeutic strategies.
3. To understand the role of the multidisciplinary team in patients with colorectal liver metastases.

A-018 16:05

Role of imaging in the pretreatment assessment

V. Vilgrain; Clichy/FR (valerie.vilgrain@bjn.aphp.fr)

There are various treatments for liver metastases from primary colorectal cancer including surgical resection, non-surgical ablative treatments, and chemotherapy. Yet, surgical resection with perioperative chemotherapy has been shown to be the best treatment option for cure in these patients. Therefore, the role of imaging in the pretherapeutic assessment is key and can be splitted into four topics: 1) diagnosis of liver lesions as liver metastases, 2) extrahepatic staging including nodal metastases, peritoneal implants, regional or local recurrent or residual disease, and pulmonary metastases, 3) intrahepatic staging which aims to define number and extent of liver metastases in the segmental and lobar distribution in order to evaluate surgical resectability or feasibility of non-surgical ablative treatments, 4) and eventually response to chemotherapy with or without targeted therapy. Multimodal imaging is needed to answer all these questions. The most important imaging modalities are CT, MR imaging and PET. Multidetector CT is particularly helpful for whole body investigation and anatomic information for surgical planning. MR imaging is better than CT for lesion detection and lesion characterisation in the liver in particular with diffusion-weighted images and sequences using liver-specific agents. PET imaging is highly sensitive in detecting extrahepatic metastatic lesions, particularly when CT and PET interpretation can be combined. Pretherapeutic and intraoperative contrast-enhanced ultrasound may complete the work-up.

Learning Objectives:

1. To become familiar with imaging findings indicating surgical resectability.
2. To understand the role of CT and MR imaging in staging liver metastases.
3. To learn about the role of new imaging techniques in staging liver metastases.

A-019 16:20

Surgical resection of liver metastases: when and how

J. Belghiti; Clichy/FR (jacques.belghiti@bjn.aphp.fr)

Liver resection (LR) remains the only curative option for patients with colorectal liver metastases (CLM). Chemotherapy increases the possibility and the efficiency of LR. The indication of LR is increasing to patients with multiple and bilobar liver metastases whatever their size and location if a sufficient remnant liver volume is preserved and even to selected cases with localised carcinomatosis and/or pulmonary metastasis. There is an ongoing debate regarding: (a) the optimal timing for LR in patients with synchronous liver metastases which can be performed before, during or after resection of the primary lesion; (b) the exact benefits of neoadjuvant chemotherapy in patients with solitary metachronous metastases; (c) the trend in extending the indications for surgery for patients with initially unresectable CLM. Increased efficiency of chemotherapy regimen using targeted therapies or intra-arterial chemotherapy currently provides response rates up to 70%. Refinements in surgical technique such as liver volume modulation using portal vein occlusion and two-step strategies allow overcoming technical issues formerly considered as limitations to surgery. Altogether, secondary resectability can be achieved in approximately 25-30% of initially unresectable patients. However, both existence of chemotherapy liver injury following numerous cycles and complex resection in order to achieve adequate surgical margins can impair the post-operative course and jeopardise post-operative chemotherapy. It therefore appears that these patients would get benefit from both repeated morphological evaluation of the response to chemotherapy and more limited resection conservative strategies.

Learning Objectives:

1. To become familiar with surgical indications of liver metastases.
2. To understand treatment planning strategies.
3. To learn about prognostic factors for surgical candidates.

A-020 16:35

Chemotherapy and novel therapy in colorectal liver metastases: rationale, indications and results

S. Faivre; Clichy/FR (sandrine.faivre@bjn.aphp.fr)

During several decades, the only agent for the treatment of metastatic colorectal cancer was 5-fluoro-uracile (5 FU), yielding < 25% response rates and median overall survivals (OS) of 8-12 months. In the 1990s, oxaliplatin and irinotecan, 2 major active compounds have been made available in combination with 5 FU (FOLFOX and FOLFIRI regimens), reaching #50% response rate and median OS > 16 months. From 2005 to 2006, the introduction of targeted therapies (cetuximab-ERBITUX; bevacizumab-AVASTIN) was shown useful to optimise the effects of FOLFOX/FOLFIRI by blocking proliferation (EGFR for cetuximab in KRas non-mutated tumours) and angiogenesis (VEGF for bevacizumab), further improving OS > 20 months. Doublet and triplet chemotherapies (CT) were usually well tolerated. Importantly, systemic CT increases the proportion of patients who become candidate for liver surgery from #12% to #22%, several cases of patients with liver metastasis being finally cured following multimodality treatments including CT and surgery. This highlights the importance of multidisciplinary management for liver metastasis to offer patients the best strategy. Baseline radiological assessment is crucial to address surgical resectability and urge deciding for the most efficient CT regimen. Optimally, the first radiological evaluation, along with blood tumour markers, must be performed between 8 and 12 weeks. An objective response by RECIST criteria warrants continuing on the same CT if the patient remains not operable, or start planning liver resection if the patient is recognised operable by the multidisciplinary tumour board. In addition to tumour shrinkage, a decrease in tumour density may indicate antitumour effects for patients treated with antiangiogenic agents.

Learning Objectives:

1. To appreciate the rationale behind chemotherapy and novel therapy.
2. To learn about the most common protocols of chemotherapy and novel therapy.
3. To consolidate knowledge in treatment efficacy.

A-021 16:50

Role of image-guided treatment in colorectal liver metastases

M. Abdel Rehim, A. Sibert, V. Barrau, Z. Ben Lakhdar, V. Vilgrain; Clichy/FR (m_solouma@hotmail.com)

There are more than 200,000 cases of colorectal cancer (CRC) each year in Europe. More than half of patients with newly diagnosed (CRC) will develop metastatic disease (25% synchronous, 30% metachronous). Hepatic resection is the standard local treatment of hepatic metastases. Yet, only onethird of patients are eligible for curative resection. Survival following hepatic resection of all metas-

tases approaches 35-50%. However, approximately half of the patients will have a recurrence within 5 years. In spite of the significant progress made in systemic treatment of metastatic disease, the development of image-guided percutaneous techniques for local tumour ablation has been one of the major advances in the treatment of non-resectable liver and pulmonary metastases. If tumour load is still limited, local ablative therapy such as Radiofrequency ablation, Microwave or more recently Irreversible Electroporation are relevant treatment options. Particularly in patients who previously underwent surgery, minimal invasive percutaneous ablative procedures are preferred not only because of lower morbidity and mortality but also because the procedure is easy to repeat in case of residual/recurrent tumour. Trans-arterial techniques are a feasible salvage treatment for chemorefractory metastatic colorectal cancer that remains a leading cause of cancer-related death with promising results of DC Beads loaded with doxorubicin and Irinotecan drug-eluting beads. Although chemoembolisation represents the mainstay, 90Y microsphere therapy has recently gained increasing awareness. Last, recent studies have shown the safety and efficacy of intra-arterial hepatic chemotherapy and percutaneous isolated hepatic perfusion in the treatment of liver metastases of colorectal cancer.

Learning Objectives:

1. To learn about the most common image-guided treatments.
2. To understand advantages and drawbacks of each treatment.
3. To become familiar with the role of image-guided treatments.

Case presentation and discussion

17:05

16:00 - 17:30

Room F1

Professional Challenges Session

PC 3

Bringing radiology to medical undergraduates

A-022 16:00

Chairman's introduction: why does it matter?

S.J. Golding; Oxford/UK (stephen.golding@nds.ox.ac.uk)

Today all radiologists face competing demands for their time and skills. Prioritisation has become an essential tool of the efficient radiologist. In this scenario, it is inevitable that the greatest demand is clinical service, with the risk that other activity will be displaced or excluded. This Professional Challenges session arises from work of the ESR Working Group on Undergraduate Education. It addresses the need for radiologists to ensure that their involvement with medical undergraduates is not lost due to pressure of clinical demand. The work is important because it ensures that: (1) medical undergraduates are equipped to practise appropriately, (2) their use of radiological resources is efficient and effective, (3) Radiology achieves a greater profile in undergraduate career choice, and (4) the opportunities that Radiology offers to support learning elsewhere in the curriculum are realised. To achieve effective involvement, radiologists require understanding of the needs of the undergraduate, the skills necessary to use their time efficiently, knowledge of which of the available educational options are appropriate to the speciality, and the skill and ability to maintain Radiology's voice in curricular planning and medical school direction. These presentations, from leaders in radiological education, are intended to assist the teaching radiologist in their efforts to make such an impact on the medical undergraduate.

Session Objectives:

1. To understand why radiologists need to make undergraduate teaching a priority.
2. To become familiar with the effect of teaching undergraduates on the student and the institution.
3. To appreciate the objectives with which the undergraduate should be taught.

A-023 16:05

Establishing a radiological presence in the undergraduate curriculum

R.N. Gibson; Melbourne/AU (r.gibson@unimelb.edu.au)

Establishing a radiological presence in the undergraduate medical curriculum embeds the perception of a specialty which is pivotal in medical education, health care delivery and research. It also attracts students into radiology. Educational outcomes relate to: (a) imaging as a learning tool for anatomy, pathology, and clinical medicine (b) the principles and practice of radiology (image generation and interpretation, procedural radiology, interpretation skills for common or life-threatening conditions, diagnostic accuracy, referral guidelines, and the consultative process, safety and risk, cost and resource management, and the patient experience of diagnostic and procedural imaging). Gaining a curricular presence requires: (a) proactive engagement with university and clinical campus leaders in developing explicit

core curriculum and (b) identification of key radiologists as leaders. Preclinical involvement is most appropriate via anatomy learning and can introduce principles of image generation and interpretation. Engagement in clinical years should be strong and integration with the clinical curriculum is desirable. Small versus larger group teaching depends on overall curriculum and human resources. Resources include print texts, CDs or on-line resources, and PACS teaching files and must be pitched at medical student level. Development of local resources raises the local status of radiology and its place in the curriculum. Direct interface with the radiology department can include structured departmental visits, clinicoradiological working meetings, electives or clerkships. Opportunities should be provided for research if part of the overall curriculum. Involvement in assessment throughout the course is critical and linked to the curriculum.

Learning Objectives:

1. To understand the importance of radiology's undergraduate profile.
2. To understand the effect of a presence throughout the curriculum on education.
3. To become familiar with the ways in which radiology's curricular presence may be achieved at individual stages.

A-024 16:20

Finding the time and resources in the radiology department

J. del Cura; Bilbao/ES (joseluis.delcurarodriguez@osakidetza.net)

One of the problems of undergraduate teaching of Radiology is the lack of time for teaching, due to competition for resources with other academic disciplines. Available classroom time and hours of practice are often insufficient to teach the increasingly complex modern Radiology. Also, the availability of financial resources to hire staff or access to educational facilities is competitive and limited, especially in a context of economic crisis. A good solution is to shift the paradigm of education, changing theoretical teaching into self-learning by students. This change allows to free class time to effectively teach Radiology. Classes are converted in workshops, doubt-solving sessions and problem-based learning, all of which matches better with a visual discipline like Radiology. Both on-line classes and e-learning can be useful for this purpose. This kind of teaching also makes Radiology a very attractive discipline for Medicine students. Also, Radiology practices can be carried out using custom computer applications. The lack of professors (and time) for practices can be solved with the help of residents, who are willing to participate as they are more prone to understand the learning needs of the students. Finally, the lack of economic resources makes it is necessary to seek alliances: with the industry, professional associations or with professors from other universities, sharing resources. Internet also provides free materials that can be used to teach.

Learning Objectives:

1. To be aware of the competing demands on departmental resources.
2. To understand the available methods for creating time for teaching.
3. To understand the physical resources that aid effective and efficient teaching.

A-025 16:35

Involving the undergraduate with the radiology department

K.L.A. Verstraete; Gent/BE (koenraad.verstraete@ugent.be)

There are many opportunities to involve students in a radiology department. A basic investment of the radiology staff is required, but the return from the students is certainly worthwhile for the whole department. In basic years: bring students into contact with the radiological techniques (x-ray, US, CT, MRI), and use this opportunity to let them discover „normal anatomy“ (usually in guided visits to the department or short clerkships). After basic years: 1. allow free clerkships to let students discover „radiology“ as discipline (workload, workflow, techniques, research) and as potential future career, 2. involve students in the creation of teaching cases for students (practical methods will be explained in the lecture), 3. involve students in routine radiological practice (take history of patients, perform physical exam, follow radiological investigation, preview imaging studies, make differential diagnosis, discuss their findings with radiologist); in some departments: students can perform the exams (ultrasound, take radiography), 4. involve students in ongoing research in the department (as volunteers; for gathering „data“, for processing „data“, for statistical analysis, as co-author or author of abstracts and publications); this student involvement can be integrated into the undergraduate curriculum (e.g. via Master thesis), 5. allow longer clerkships for scientific work (e.g. 5 months during last year) for larger projects - studies and 6. other (literature studies). In the lecture, practical examples of student involvement in the radiology department will be provided.

Learning Objectives:

1. To understand the effect of involvement in radiology on learning.
2. To become familiar with the potential methods of undergraduate involvement.
3. To understand the value and management of short-term and long-term attachments to the radiology department.

A-026 16:50

How to ensure teachers are suitably trained

E. Szabó, Z. Morvay, E. Nagy, I. Mátéka; Szeged/HU (endrebacsi@gmail.com)

The presentation will give a result-oriented overview of the history of research on learning methods from Skinner to Wenger-Trayner, tries to highlight the most appropriate ones necessary for teaching the undergraduates and hopes to fertilise further discussions and future ECR involvement in this area. Some aspects of course composition and examinations will also be discussed.

Learning Objectives:

1. To learn that teaching is a psychomotor skill with its own training requirements.
2. To understand the importance of course design and methods of assessment to learning.
3. To understand the ways in which radiological teachers may obtain training appropriate to their needs.

Panel discussion:

What needs to be done to overcome the constraints on radiologists? 17:05

16:00 - 17:30

Room F2

Breast

RC 302

Functional imaging of the breast

Moderator:

G. Esen; Istanbul/TR

A-027 16:00

A. Contrast-enhanced mammography

C.S. Balleyguier¹, E. Fallenberg², S. Canale¹, C. Dromain¹; ¹Villejuif/FR, ²Berlin/DE (balleyguier@igr.fr)

Contrast-Enhanced Spectral Mammography (CESM) is a new imaging technique combining Digital Mammography and injection of iodinated contrast agent. Mammography images are acquired at two (high and low) energy levels. Based on different attenuation characteristics between iodine and soft tissue, parametric images showing enhancement are reconstructed. There is some mandatory hardware adaptation, for instance adding a copper filter and a dedicated software is required. However, interpretation of images is based on morphological criteria. Two sets of images are acquired (CC and MLO). Obtained images compete with subtraction images obtained after dynamic contrast-enhanced MRI. Radiation dose is 1.2 more that of a normal Digital Mammogram. Indications for CESM are quite similar to that of MRI. CESM significantly improves characterisation of breast lesions as compared with mammography. For breast cancer staging, as compared with MRI, CME carries a slightly lower sensitivity, but conversely a better specificity, cutting down the number of false positives. Some false negatives were observed in case of Infiltrative Lobular carcinoma and DCIS. CESM might become a very practical, cost-saving, alternative to Breast MRI in specific clinical situations.

Learning Objectives:

1. To understand the underlying physical principles of contrast-enhanced mammography (CEM).
2. To become familiar with different protocols.
3. To appreciate the potential impact of CEM on every day clinical practice.

A-028 16:30

B. Ultrasound elastography

A. Athanasiou; Paris/FR (alex_athanasiou@hotmail.com)

Breast ultrasound elastography provides information about tissue elasticity Young modulus $E = s / e$, where s is the compression (stress) and e is the deformation (strain) of the tissue. It is a complementary tool to breast ultrasonography, easily performed in clinical practice. Two elasticity modes are currently available: strain imaging, where manual compression is applied to the ultrasound probe and tissue displacement is registered; tissue deformation is then calculated by means of dedicated software providing real-time elasticity images (color- or grey-coded) superimposed on B-mode imaging. This is a qualitative or semi-quantitative mode. Shear wave imaging, where US probe is used to induce mechanical vibrations using acoustic radiation force generating local tissue displacement. This mode provides quantitative information about either tissue displacement velocity or tissue stiffness itself in kPa. Functional information provided by elasticity imaging can be particularly useful for BIRADS 3 or 4a lesions. Various studies indicate that elasticity combined to B-mode imaging can improve breast ultrasound specificity up to 75-88%. False

negative findings may be encountered in case of "soft" lesions (mucinous, medullary or cystic carcinomas) or inflammatory cancers. Differentiation between echogenic cysts and homogeneous solid lesions (such as fibroadenomas) can be improved as cystic features are usually specific in elasticity imaging. Iso-echoic lesions such as infiltrating lobular carcinomas may be better delimited. Lymph-node characterisation and microcalcification assessment can be improved, although few data are available and need further validation. 3D elastography is actually in progress and would be useful in monitoring response to neoadjuvant treatment.

Learning Objectives:

1. To understand the basic principles of US elastography.
2. To learn about the difference between strain and shear wave elastography and their respective results.
3. To appreciate the additional value of US elastography to B-mode US.

A-029 17:00

C. MRI diffusion, perfusion and spectroscopy

P.A.T. Baltzer; Vienna/AT

Dynamic contrast-enhanced MR-mammography is the most sensitive method for detection of breast cancer. Diagnostic results using this technique may vary due to reader experience as image interpretation is to some degree a subjective task. In the last years, further, more or less quantitative MRI techniques have been investigated. While pharmacokinetic modelling of high-temporal resolution dynamic contrast-enhanced imaging (perfusion imaging) promises further, quantitative insights into the pathological characteristics of neoplastic vasculature, diffusion-weighted imaging (DWI) and MR-spectroscopy (MRS) are based on entirely different concepts. While MRS is a molecular imaging technique able to quantify biochemical tissue properties, DWI is influenced by microstructural tissue changes. This talk aims to outline the concepts of perfusion, DWI and MRS, provide knowledge to implement these techniques into clinical practice and critically discusses the possible diagnostic benefit of doing so.

Learning Objectives:

1. To understand the diagnostic value of diffusion weighted imaging (DWI) in its present clinical applications.
2. To learn about the technical basics and potential use of MRI perfusion in the breast.
3. To understand promises and challenges of MR spectroscopy in clinical practice.

16:00 - 17:30

Room G/H

Genitourinary

RC 307

Renal and adrenal tumours

Moderator:

B. Brkljacic; Zagreb/HR

A-030 16:00

A. Adrenal masses, a practical approach

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. Most of these incidentally discovered lesions are non-functioning benign lesions of cortical origin. However, incidentalomas may also represent functioning (clinical or subclinical) lesions arising from either the cortex or the medulla and malignant masses. Clinical diagnostic and biochemical evaluation is used to further subdivide functional and non-functional adrenal lesions. 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% by using these techniques. Differentiating benign from malignant adrenal masses using non-invasive imaging methods can reduce the need both for percutaneous adrenal biopsy in patients with underlying malignant disease and the follow-up imaging of incidentally detected adrenal adenomas.

Learning Objectives:

1. To become familiar with the different imaging appearances of adrenal masses including pathological relation.
2. To learn the different imaging techniques to improve evaluation of benign versus malignant adrenal masses.
3. To understand the impact of imaging given the information that the patient has/has not a known malignancy.

A-031 16:30

B. Staging renal cancer

R. Pozzi-Mucelli; Verona/IT

The diagnosis of renal cell carcinoma (RCC) by means of imaging modalities include the identification of the lesion, its characterisation, the staging and the follow-up. Staging is an important part of the diagnostic process since it has direct effect on the therapeutic decision. In the case of renal tumour, staging is based on the TNM (AJCC Cancer Staging system) which has replaced other staging classifications such as the Robson classification. Based on the TNM classification, two main types of renal tumours can be defined, the localised RCC (T1-T2) and the locally advanced RCC (T3-T4). In the case of T1 and T2 RCC, the most important parameter is tumour size: the cut point is 7 cm which separates T1 from T2 tumours. T1 tumours are further divided into T1a and T1b if less than 4 cm or between 4 and 7 cm, respectively. This further division has impact on type of surgery, i.e. partial versus radical nephrectomy. In the case of T3 and T4 RCC, different features should be carefully evaluated: these include the perirenal fat invasion, the direct infiltration of the ipsilateral adrenal gland, the infiltration of renal sinus fat, the vena cava and renal vein thrombosis, the urinary collecting system invasion and metastatic disease to local lymphonodes and other organs. CT still represents the method of choice for the staging of renal tumours since, also by using MPR and VR images, it gives all the information for the local and distant evaluation. MRI can support CT in complex cases.

Learning Objectives:

1. To recognise the CT/MRI/US findings for staging.
2. To learn about the optimal imaging protocol for the diagnosis and staging of renal cancer.
3. To understand treatment options and implications.

A-032 17:00

C. How to deal with small indeterminate renal masses

O. Hélénon; Paris/FR (olivier.helenon@nck.aphp.fr)

Renal masses include three categories with respect to the size and the gross architecture of the lesion: indeterminate very small masses, cystic and solid renal masses. Very small lesions (< 10 mm) usually remain unclassified because of partial volume effect that prevents accurate CT attenuation measurement. With the exception of patients at risk of renal neoplasms such as familial-hereditary renal tumour disease and patients with history of removed carcinoma, such lesions are likely to be microcysts and do not require further workup. If better characterisation is needed, MRI using T2 and Diffusion-Weighted imaging or contrast-enhanced US may help differentiate very small cysts from solid neoplasms. Characterisation of small cystic masses relies on the Bosniak's classification which consists of 5 categories: benign (I) and minimally complicated (II) cysts, indeterminate cystic lesions (IIF and III) and malignant cystic masses (IV). Certain cases of cystic masses remain not categorisable at CT because of their proper atypical attenuation characteristics or enhancement properties. US and MRI play a major role by providing useful additional diagnostic information that help distinguish between atypical fluid fill masses and atypical solid neoplasms especially solid papillary RCC with poor vascularity. The goal of imaging in characterising small solid renal tumours is to differentiate typical angiomyolipoma containing macroscopic fat from non-fatty indeterminate renal neoplasms that should be removed. Percutaneous-guided biopsy is performed when accurate characterisation is needed before surgery or when renal metastases or lymphoma are suspected.

Learning Objectives:

1. To become familiar with the various appearances of small indeterminate renal masses.
2. To learn about the respective roles of US, CT and MR imaging in investigating small renal masses.
3. To learn the main pitfalls in assessing small renal masses.

16:00 - 17:30

Room I/K

Chest

RC 304

How I report

Moderator:
J. Cáceres; Barcelona/ES

A-033 16:00

A. Bedside chest radiography

R. Eibel; Schwerin/DE (roger.eibel@helios-kliniken.de)

Film-based imaging has been the workhorse of radiology ever since the x-rays had been discovered nearly 120 years ago. Despite well-known problems (projection of a volume onto a two-dimensional screen, over- or underexposure of the film, positioning of the patient, post-processing, and reproducible technical quality from one day to another), e.g. the portable chest x-ray is still one of the most important parts of the work up and treatment of the patient in the ICU. The first part of this lecture is focussed on technical features, necessary to gain the best quality from this medium. The second part deals with the interpretation principles and careful film analysis. Of course, a CT is in some instances much easier to interpret with regard to anatomy and pathology. It offers more tools for post-processing. On the other hand, the radiation exposure, the time and efforts and last not least the risk for the patient to perform a CT in the radiology department is much higher than investigating the patient in the ICU with portable chest x-ray. From this point of view, it makes sense, to interpret plain film as comprehensive as possible including most probable differentials. But it is also necessary to be familiar with its limitations. And of course, it is a condition sine qua non to have clinical information. In the last part and intrinsically tied to the second part a side-by-side comparison between standard radiography and CT follows to better understand the imaging findings and discover the main pitfalls.

Learning Objectives:

1. To learn a structured reporting approach.
2. To understand key imaging findings in different clinical settings.
3. To improve confidence by linking pattern recognition, interpretation and diagnosis.

A-034 16:30

B. CTA and MRA of the pulmonary arteries

J.E. Wildberger; Maastricht/NL (j.wildberger@mumc.nl)

The clinical impact of CTA and MRA of the pulmonary arteries will be outlined. Multislice spiral CT allows for a robust examination of the entire chest with submillimeter collimated protocols within a single breath-hold. This acquisition is the basis for dedicated analysis of the thoracic vasculature, especially in an interactive setting. CTA is mainly used for clinically suspicion of acute pulmonary embolism (PE) and may be regarded as the current clinical gold standard in this respect. CTA can also be included in the work-up of patients with acute chest pain. Iodine mapping, depicting the (sub)segmental defects in iodine distribution in locations corresponding to embolic vessel occlusions, has become technically feasible, e.g. using quantitative dual-energy acquisition protocols. This might further improve detection of emboli and give insights into the effects on perfusion deficits in the adjacent lung parenchyma. MRA has made substantial improvements in the last years which are not always reflected in the current literature (e.g. PLOPEDIII). At this moment, there is no dedicated „official“ role for MRA in the assessment of acute PE. However, substantial efforts are made to provide MRA protocols on a 24/7 basis, also under emergency conditions. Time-resolved angiography, steady-state free precession sequences and utilisation of other new techniques, such as parallel imaging, will be discussed. MR is becoming increasingly popular in the follow-up setting and for the evaluation of chronic disease. MRA and MR-derived pulmonary perfusion imaging are the current gold standard for non-invasive and quantitative assessment for chronic PE and pulmonary hypertension.

Learning Objectives:

1. To learn more about recent improvements in CT and MR angiography.
2. To learn a structured approach to reporting CTA or MRA.
3. To become familiar with the role of CT angiography in comparison to MR angiography.

Author Disclosure:

J. E. Wildberger: Research/Grant Support; Institutional: Siemens, Philips, GE, Bracco, Bayer. Speaker; Siemens, GE, Bayer, Boston Scientific.

A-035 17:00

C. PET/CT

C. Keyzer; Brussels/BE (caroline.keyzer@erasme.ulb.ac.be)

FDG-PET/CT has proven diagnostic value for evaluating primary malignancy and metastatic disease. Integrated PET/CT systems provide PET and CT images that are acquired nearly simultaneously and are capable of producing superimposed, coregistered images, giving anatomic and molecular informations together susceptible to facilitate interpretation. Many interpretation pitfalls are however encountered particularly in relation with biological factors, such as normal variants of FDG uptake. Knowledge of these pitfalls is thus important for preventing misinterpretation. Interpretation of PET/CT may be complicated by the presence of benign conditions that can display high metabolic activity simulating malignancy. These conditions include brown fat, granulomatous disease, post-therapeutic changes, infection and inflammatory disease. Conversely, some malignant disease may exhibit only modest FDG uptake due to their histology, partial volume averaging effects, or respiratory motions. Hence, factors other than intensity of FDG uptake are often essential to discriminate benign and malignant diseases. Additional helpful information includes patient history, lesion distribution and symmetry and CT characteristics of the lesions. The approach to interpretation and strategies for discriminating malignant from benign diseases will be highlighted with a special attention to the evaluation of thoracic neoplasia and their usual metastatic sites, as well as non-oncologic chest disorders.

Learning Objectives:

1. To understand the basic principles of PET/CT using FDG.
2. To become familiar with physiologic FDG uptake and frequent pitfalls.
3. To learn about FDG PET/CT in non-oncologic and oncologic disorders and how to report.

16:00 - 17:30

Room L/M

Organs from A to Z: Heart

MC 322

Technical and anatomical fundamentals for imaging the heart

Moderator:

A. de Roos; Leiden/NL

A-036 16:00

A. Anatomy: too many details in cardiac imaging?

A.J.B.S. Madureira; Porto/PT (ajbmadureira@gmail.com)

There has been a marked increase in the utilisation of cardiac CT and MR in the evaluation of cardiac and pericardial diseases. All those involved in these examinations must possess a solid knowledge of the anatomy of the heart and great vessels, in order to be able to identify normal structures and variants and not to misdiagnose them as disease or pathological lesions. Each cardiac chamber has specific and unique characteristics that allow its precise identification. The aortic arch can be located on the left or on the right and can have different branching patterns. These must be recognised and diagnosed as such. Incidental findings are relatively frequent when imaging the heart. When present they have to be divided into non- or clinically significant.

Learning Objectives:

1. To learn about the detailed anatomy of the heart.
2. To learn about the anatomy of the thoracic vasculature and great vessels.
3. To get an overview of important incidental findings in cardiac imaging.

A-037 16:20

B. Examination protocols for imaging the heart: CT

H. Alkadhi; Zurich/CH

This presentation is aimed at a demonstration of the many steps that were undertaken in the last decade for lowering the radiation exposure of patients undergoing cardiac CT examinations. Employing these various techniques, the effective radiation dose of a CT coronary angiography study can be reduced from around 15 to as low as 1 mSv in selected patients. In parallel to these options for lowering the radiation dose, it is important that radiologists adhere to the appropriate, defined indications for CT of the heart.

Learning Objectives:

1. To get an overview of different examination protocols.
2. To learn about various strategies in radiation dose optimisation.
3. To identify suitable clinical indications for cardiac CT.

A-038 16:40

C. Examination protocols for imaging the heart: MRI

N.L. Kelekis; Athens/GR (kelnik@med.uoa.gr)

Cardiac MRI is among the most demanding MR applications, due to the complex 3D movement of the heart during contraction and relaxation. The goal of the wide arsenal of fast/ultrafast/real time sequences, motion compensation techniques (triggering/gating/navigator gating), acceleration techniques (such as parallel imaging, k-t BLAST), flow sensitive and MR angiography sequences is to provide information on:

Cardiac anatomy: all kinds of dark-blood SE or TSE single-phase sequences (diastolic or systolic), single-slice or multislice multi-phase GE sequences (bFFE, FIESTA, TrueFISP).

Anatomy of thoracic vessels: non-gated white-blood GE sequences, single-slice or multi-slice multi-phase gradient echo sequences, MR angiographic sequences (static or time-resolved MRA with ultrafast techniques). Myocardial tissue: single-phase STIR sequences mainly for oedema, T1- and T2-weighted SE or TSE for tissue characterisation. Contrast-enhanced 2D or 3D IR sequences for ischaemic scar, myocardial necrosis, presence of fibrosis (of diverse etiology), presence of thrombi. Myocardial blood flow: ultrafast GE sequences (SR, bFFE) during first pass of contrast medium. Myocardial contraction and relaxation: multislice multi-phase GE sequences covering the whole extent of ventricles, myocardial tagging sequences, phase-contrast flow sequences to assess myocardial velocity patterns. Flow quantification: phase-contrast sequences (through-plane in all 4 valves and thoracic vessels, in-plane for jet and stenosis quantification), combination with volumetric measurements for complete quantification of normal/abnormal flows and volumes in both circulations. White-blood, dark-blood or contrast-enhanced coronary angiography sequences. Regarding imaging planes, a multislice acquisition should cover both ventricles in the short-axis plane, as well as at least in 4-chamber plane when addressing RV or congenital heart disease.

Learning Objectives:

1. To get an overview of different examination protocols.
2. To learn about typical cardiac MR artefacts and pitfalls.
3. To identify suitable clinical indications for cardiac MRI.

A-039 17:00

Interactive case discussion

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

Case material using CT and MRI will be presented for cardiovascular disease evaluation. A number of common and uncommon cases will be presented, starting with the clinical presentation, imaging findings and summary of teaching points. The session is aimed to include incidental findings on routine chest imaging as well as more specific cardiac applications.

16:00 - 17:30

Room N/O

Interventional Radiology

RC 309

Percutaneous treatment of chronic back pain and sciatica

A-040 16:00

Chairman's introduction

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

It is a fact that 80% of the human population will have at least one crisis of back pain and/or sciatica. It is also a fact that amid a population of volunteers that had no incidence of back pain and/or sciatica, 60% will have at least one finding associated with disc/spine degeneration. Until now, most treatments associated with back pain/sciatica were addressed by other medical communities either by medication or surgery. This has created a lot of inconsistencies. The interventional radiologist or neuroradiologist, who is trained in back pain interventional techniques has many advantages. First, he is professionally trained to read and evaluate adequately the imaging information. Second, he has the skill to guide, through imaging, specific tools and medication in selective spine regions, being thus more efficient than other specialties. The interventional spine and back pain treatments is the Eldorado of Interventional Radiology and can be compared to the 1970s of the percutaneous vascular Interventional world. As a new subspecialty, it is a fact that it lacks the necessary structure of formal clinical training, but in modern back pain centers, imaging-guided interventions have a key role in treatment, after medication and

before surgery. It is in the interest of the patient and of the imaging community that these medical acts are being performed by trained interventional radiologists!

Author Disclosure:

A. D. Kelekis: Consultant; Benvenue Medical.

A-041 16:05

A. Sacroiliac joint syndrome

D.J. Wilson; Oxford/UK (david.wilson@ndorms.ox.ac.uk)

Sacroiliac 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 anesthetics 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 know more about the available treatments.
3. To learn about clinical results and possible further developments.

Author Disclosure:

D.J. Wilson: Advisory Board; Chair ESSR research committee. Author; Editor of a multiauthor text on MSK Imaging (Springer). Owner; St Luke's Radiology Oxford.

A-042 16:28

B. Facet syndrome

M. Gallucci; L'Aquila/IT (massimo.gallucci@cc.univaq.it)

The most constant symptom of lumbar facet arthropathy is pain lateralized which can radiate below the knee. Other symptoms are local paraspinal tenderness over a facet joint, posterior pain aggravated by extension and rotation toward the involved side, hip and buttock pain in a non-radicular distribution, morning pain and stiffness. Differential diagnoses include fibromyalgia, lumbar compression fracture, lumbar degenerative disk disease, lumbar spondylolysis and spondylolisthesis, sacroiliac joint syndrome, overuse injury, piriformis syndrome. Radiological images may demonstrate abnormalities like osteophytes, articular fluid or a synovial cyst. However, up to 45% of false positive had been registered on the base of clinical exam only, and there is a poor correlation between pain and imaging. The diagnosis is, therefore, made on both clinical and radiological grounds, and is confirmed by analgesic facet joint block with elimination of pain. Anesthetic block include intra-articular or peri-articular injections and medial branch blocks. Some reports suggests that medial branch block is more accurate than direct joint injection for prediction of outcome. It offers both diagnostic information and therapeutic goals. However, since in 50% of cases, a recurrence of pain is registered after a period variable between 3 and 6 months, cryoablation or radiofrequency are often proposed offering longer term pain relief. Potential risks include allergic reaction, transient post-procedural pain, flare-up, bleeding, and infection. If steroids are administered, side effects and risks should be discussed mostly in case of diabetic subjects.

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-043 16:51

C. Intervertebral disc syndromes

A. Gangi, J. Garnon, G. Tsoumakidou, I. Enescu; Strasbourg/FR (gangi@rad6.u-strasbg.fr)

Pain management in disc herniation relies mainly on conservative care combining rest, physiotherapy and oral medication (analgesics and anti-inflammatory drugs). If early conservative treatment fails, treatment options turn to percutaneous techniques. Periradicular or epidural steroid injection (PSI) are the first minimally

invasive technique which should be considered early in the treatment regime. It aims to stop the biochemical inflammatory reaction around the nerve root. It is ideally performed under image guidance to ensure proper deposition of steroid and to avoid complications. Although periradicular steroid injection has been used for decades, its efficacy is still controversial. Non-controlled studies report success in 33% to 72% of patients. Short-term benefit of percutaneous nerve root block is quite high with good pain relief especially in irritative radiculopathy. Failure of 4 to 6 weeks of conservative therapy and a minimum of one selective image-guided steroid injection, the treatment is directed to the disc. The minimally invasive percutaneous techniques in use today, aim at removing a small amount of central nucleus pulposus, so as to reduce intradiscal pressure and thus obviate disco-radicular compression. Several alternative techniques of percutaneous nucleotomy have been developed, relying either on pure mechanical (automated percutaneous lumbar discectomy), chemical (alcohol, oxygen-ozone) or thermal (Laser, radiofrequency) decompression. Many non-controlled studies with large series report a high success rate of percutaneous thermal nucleotomy with 70 to 89% good results on radicular pain. The three most critical elements for successful nucleotomy are: proper patient selection, correct needle placement and effective cavitation.

Learning Objectives:

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

Panel discussion:

How can imaging methods separate candidates for percutaneous therapy and surgery?

17:14

16:00 - 17:30

Room P

Vascular

RC 315

Vascular imaging in ischaemic stroke

Moderator:

J. Hendrikse; Utrecht/NL

A-044 16:00

A. Intracranial atherosclerotic disease of carotid arteries

T. Jargiello; Lublin/PL (tojarg@interia.pl)

Intracranial atherosclerotic lesions of carotid arteries are relatively seldom, especially when compared with extracranial atherosclerosis. According to statistics, intracranial lesions do not exceed 2-3% of all carotid occlusive disease, and in a whole group, less than 1% needs invasive treatment. This means that the role of intracranial stenotic disease is not big, but still important, especially when not properly diagnosed. In practice, intracranial carotid lesions are the most frequently revealed during the imaging process for evaluation of extracranial atherosclerotic disease in patients qualified for carotid stenting or endarterectomy. In patients qualified for stenting, arteriography (DSA) is the main imaging modality, done right before intervention to look for possible tandem extracranial / intracranial stenosis. In patients qualified for open surgery, CT-angio and MR-angio are usually performed to assess intracranial circulation. CT-angio is more popular today (available and less expensive) but contrast-enhanced MR-angio (CE-MRA) seems to be superior - being free of radiation, iodine contrast medium and has less possible artefacts (skull base bones). Except stated above, there is a group of patients who are clinically suspected with intracranial stenosis with negative extracranial findings. For them, transcranial Doppler examination is a good solution as a screening test. When positive or even not evidently negative, CTA or CE-MRA are advised. Indications for invasive (endovascular) treatment depend strictly on the degree of stenosis, its location and coexistent other stenoses (tandem lesions). These factors are always evaluated together with visible and potential collateral circulation - individually for each patient.

Learning Objectives:

1. To become familiar with appropriate imaging protocols for all imaging modalities and the pros and cons of each modality.
2. To learn about imaging signs of atherosclerotic disease in the carotid artery territory.
3. To learn about the classification of lesions and indications for treatment.

A-045 16:30

B. Vertebrobasilar atherosclerotic disease

L. Valvassori, M. Piano; Milan/IT (Luca.Valvassori@ospedaleniguarda.it)

Intracranial atherosclerosis is a systemic and multifactorial disease, associated with atherosclerosis of carotids, coronaries, aorta, renal and iliofemoral arteries. Over one-third of ischaemic strokes occur in the posterior circulation, a leading cause of which is atherosclerotic vertebrobasilar (VB) disease. Symptomatic VB disease carries a high annual risk of recurrent stroke, averaging 10-15% per year, despite medical therapy. VB stroke is particularly prone to devastating consequences due to the eloquence of the regional brain tissue and is associated with high rates of death and disability. More common in older age and in Western countries, without differences of gender. CTA and/or MRA are excellent screening tool, but DSA is the gold standard to show focal stenosis, luminal irregularities, thrombosis, occlusion, arteries ectasia and elongation, serpentine aneurysms. Transient ischaemic attack, along with severe stenosis and progressive occlusion, are most common symptoms. An important stroke mechanism in VB atherosclerosis is regional hypoperfusion. Furthermore, both embolic and flow processes can synergize to increase stroke risk, reducing the wash-out of emboli from the distal circulation in hypoperfused regions. Posterior circulation collateral channels may maintain adequate distal flow. The existence and extent of these compensatory blood flow pathways, evaluated by DSA, may influence the risk of stroke. Percutaneous angioplasty and stenting for symptomatic atherosclerotic VB stenosis is a feasible and effective therapeutic method, but good experience and full understanding of neurology and haemodynamics are required, as well as for diagnostic purposes.

Learning Objectives:

1. To learn about the appropriate imaging protocol and the imaging signs of extracranial and intracranial atherosclerosis.
2. To learn about the epidemiology, symptomatology and natural history.
3. To learn about the classification of lesions and indications for treatment.

A-046 17:00

C. Dissection and vasculitis of intracranial and extracranial arteries

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

Dissection of the cervical arteries is a major cause of stroke in young adults and may also present with headache, neckpain, cranial nerve palsies. Intracranial dissections can cause subarachnoid haemorrhage. 80% of carotid artery dissections are extracranial and 20% are intracranial; vertebral artery dissections occur most often in the atlas loop or at the junction of the V2/V3 segments. Dissections are caused by a tear in the intima leading to an intramural haematoma which results in an expansion of the external vessel diameter with a variable degree of luminal narrowing. Compromise of the arterial lumen and complications, such as pseudoaneurysm formation, are visualised with angiographic techniques (CTA and MRA now mostly replacing DSA). The intramural haematoma can be directly visualised with cross-sectional CT and MR. The MR signal intensity of the haematoma is time-dependent: it is T2- and T1- hypo- or isointense in the acute stage before becoming T2- and T1-hyperintense in the subacute stage. Cerebral vasculitis of the large and medium-sized intracranial vessel causes segmental narrowing or "beading" of the intracranial vessels which is readily demonstrated on CTA and high-resolution intracranial MRA. Reversible Cerebral Vasoconstriction Syndrome (RCVS) is an important differential diagnosis for these appearances. Cerebral vasculitis affecting the small vessels (< 300 µm) is often difficult to diagnose, even on high-resolution DSA, and frequently requires confirmation with brain biopsy. Haemodynamic compromise caused by arterial dissections or by cerebral vasculitis can be assessed with CT perfusion and MR perfusion imaging.

Learning Objectives:

1. To learn the imaging signs of dissection and different types of large/medium vessel vasculitis.
2. To learn about lesion morphology and haemodynamic consequences of dissection and vasculitis.
3. To learn about imaging protocols for detection of dissection and large/medium vessel vasculitis.

16:00 - 17:30

Room Q

Computer Applications

RC 305

New PACS architecture: decoupling image management from image navigation

A-047 16:00

Chairman's introduction

H.U. Lemke; Berlin/DE (hulemke@cars-int.org)

Image-based diagnostic and therapeutic workflows, particularly in interventional suites, are essential for the health care of patients but they are also a very cost-intensive component in clinical settings. The understanding of workflows and ICT tools for image management beyond radiology, and in particular, for image-based interventional suites has become not only of concern to radiologists and surgeons but also to other healthcare providers, managers, and administrators. Communication, simulation, visualisation and navigation with images and associated patient-specific models are becoming essential features in the planning and implementation of complex digital PACS like infrastructures in support of diagnostic and interventional procedures (e.g. interventional radiology, minimally invasive surgery, computer assisted surgical procedures and image guided therapy). While the full potentialities of multidisciplinary image sharing within health care settings are being further explored, it is now increasingly common to see intense cooperation between radiologists and other clinicians for planning and guiding interventions. Surgical planning units are a typical example of such a multidisciplinary setting. During the session on "New PACS architecture: decoupling image management from image navigation", the lecturers - exceptional experts in their respective fields - will give insights into image sharing: from hospital-based applications to remote consultation, with specific reference to the support of surgeons (training and intraoperative guidance).

Session Objectives:

1. To introduce models of image management and workflow.
2. To present the evolution of image management outside of radiology (surgery, interventions etc).
3. To discuss the technical requirements for better image sharing and distribution.

A-048 16:05

A. Image navigation and new PACS architecture

J. Reponen; Raahel/FI (jarmo.reponen@oulu.fi)

Picture archiving and communication systems (PACS) have become an instrumental tool for storing and distributing medical images, not only within radiology but also in other medical domains. Typically, a PACS consists of imaging modalities like computed tomography (CT) and magnetic resonance imaging (MRI), image storage device and reading workstations all connected with a secure data network. New challenges are introduced when more and more images are distributed over wide area networks, even utilising mobile and web technologies. Thin clients are becoming more widely used especially in clinical setting. When PACS is used outside radiology (e.g. in surgical operating theatre or in clinical wards) and for other modalities than radiology (e.g. for ECG or photographs) different types of user interfaces are needed. A radiology information system (RIS) is mandatory in order to manage the information stored into the archive. As more and more hospitals utilise comprehensive electronic patient record, a seamless integration is necessary. Standardisation of the modules and pre-defined workflows through Integrated Healthcare Enterprise (IHE) profiles will make interoperability easier. Regional image archives and shared access to images make it possible to distribute workload remotely and also decrease repetitive examinations for moving patients. Teleradiology offers a means to share medical expertise and workload. Legal aspects have to be discussed if PACS storage is outsourced to a cloud-based PACS. Stored information should be backed up, so that a full disaster recovery without unwanted breaks in service is possible.

Learning Objectives:

1. To learn about recent changes in PACS design and infrastructure.
2. To understand the role of data management in PACS architecture.
3. To become acquainted with different PACS architectures.
4. To understand technical, workflow and legal aspects of innovative technologies.

A-049 16:28

B. Intraoperative imaging for surgeons

A. Pietrabissa¹, L. Pugliese¹, A. Peri¹, F.P. Tinozzi¹, V. Ferrari²; ¹Pavia/IT, ²Pisa/IT (andrea.pietrabissa@gmail.com)

Modern radiological scanners allow the acquisition of volumetric datasets describing human anatomy, functionality and pathology, with high level of detail. On the other hand minimally invasive surgery offers excellent views of surface anatomy but is unable to provide details on deeper or hidden structures and bears the limit of a low grade tactile feedback. The highly detailed information contained in radiological images, which are partially lost when passing to the surgical room, can be expressly used to overcome these limitations. In this setting, computer-assisted technologies allow to augment real views of the patient, taken by means of cameras and optical tracking systems, with virtual information obtained from pre-operative or intra-operative radiological images, coherently mixing them in order to obtain an accurate superimposition of both. This augmented-reality, or in general mixed-reality technique, introduces many advantages for some tasks where the surgeon has to interact with the patient (localisation of target lesion, sharp definition of nodule's margins, identification of vascular or other relevant adjacent anatomic structures, introduction of biopsy needle etc). improving the physician's perception of deep or unexposed tissues and consequently the precision level of the procedure. The surgical robotic platforms available, as computer-assisted systems provided with 3D stereoscopic vision, may support the application of these techniques in many fields of surgery. Further technological development should be claimed since the relevant implications involved with the clinical use of this promising new approach to enhance intra-operative visualisation during minimally invasive surgery.

Learning Objectives:

1. To understand why surgeons need more intraoperative guidance.
2. To learn about the role of robotics and augmented reality in general surgery.
3. To become familiar with patient-specific simulation.
4. To appreciate the place of surgical training and accreditation.

A-050 16:51

C. Dismantling PACS: separating image viewing from the data storage and sharing

B. Gibaud; Rennes/FR (bernard.gibaud@univ-rennes1.fr)

The evolution of a domain such as Picture Archiving and Communication Systems results from four main factors: (1) the emergence of new functional needs; (2) the evolution of basic technology (i.e. communication, storage, computing); (3) the existence and the maturity of standards; and (4) the evolution of general economic conditions. If we consider recent PACS evolution from these four viewpoints, we can notice: (1) the growing importance of image processing and the emergence besides radiology, cardiology and oncology of new sectors of medical imaging (e.g. surgery, pathologic anatomy); (2) the supremacy of internet technologies and the emergence of cloud storage and cloud computing technologies; (3) the maturity of interoperability standards such as DICOM, HL7 and IHE, and finally (4) a very stringent economical context in public hospitals, leading to the absolute necessity of mutualising resources as much as possible. In this context, separating storage/archiving resources and image viewing/processing resources appears as an appealing approach. It is not a new idea, since PACS operation based on Application Service Providers (ASP) appeared more than ten years ago, but they had limited impact, yet. In this context, the course aims at: (1) clarifying the advantages - from both functional and economical viewpoints - of PACS solutions based on a clear separation of components implementing storage/archiving and image viewing/processing; (2) reviewing and discussing the difficulties of a such evolution, especially with regards to security and confidentiality of information, on the one hand, and with compliance with existing interoperability standards, on the other hand.

Learning Objectives:

1. To learn about strategic issues of generic image archiving and distribution.
2. To understand new concepts of independent 'front ends' of PACS.
3. To become familiar with new examples of PACS implementation based on component architecture.
4. To appreciate new strategies of PACS architecture and migration.

Panel discussion:

How should we manage our images today?

17:14

1. New challenges for large-scale image sharing and image distribution.
2. Use of imaging outside radiology.
3. Regulatory issues in image sharing.
4. Practical and workflow issues of image distribution and management.

16:00 - 17:30

Room Z

ESR Radiation Protection Session

Security scanners at airports: are they safe?

Moderators:

J. Damilakis; Iraklion/GR

P. Vock; Berne/CH

A-051 16:00

X-ray backscatter security scanners: principles, performance and potential health risks

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

The operation of x-ray backscatter security scanners is based on backscattering of photons. The equipment consists of two x-ray tubes, collimators and detectors on both sides of the exposed passenger. Radiation detectors detect photons scattered back from the body and the scanner builds up front and back images of the individual. Studies show that the effective dose to an adult passenger from scanners used in aviation security screening is lower than 0.25 µSv per screening, which is the dose limit defined by the American National Standards Institute. However, children receive higher doses per screening than adults. This is a point of concern since children are more vulnerable to radiation than adults. Superficial organs receive higher doses than deeper organs. Pregnant passengers may also be exposed to radiation from security scanners. A screening that delivers 0.25 µSv effective dose to the mother would deliver approximately 0.12 µGy to the uterus. Little information exists on the detection performance of x-ray backscatter systems. A study (Kaufman and Carlson, J Transp Secur, 4:73-94, 2011) shows that contraband can remain undetected by x-ray backscatter security scanners under certain conditions. In conclusion, doses and associated radiogenic risks from exposing individuals to radiation for backscatter x-ray screening are negligible. The possible effects on public health, however, from very low-level exposure to ionising radiation remain unknown. For this reason, non-ionising technology should be considered before x-ray scanners become a primary screening tool in aviation security.

Learning Objectives:

1. To become familiar with the technological principles of security scanners.
2. To learn about the detection performance of x-ray security scanners.
3. To understand the radiation doses and risks from x-ray backscatter security scanners.

A-052 16:30

Cumulative low-level x-ray radiation exposure: is it harmful?

P. Vock; Berne/CH (peter.vock@med.unibe.ch)

While acute exposures of around 100 mGy and more of individuals and populations to ionising radiation have been studied quite well over the last 60 years, the evidence base of the impact of lower level and cumulative exposure is much weaker. This type of exposure tends to have similarities to the continuous natural exposure to cosmic radiation and - in certain geographical locations - to terrestrial radiation. The limits of the linear-no threshold (LNT) model of stochastic radiation effects and reasons for a different biological impact at low levels will be discussed; potential consequences to the individual person and to the population are important but can only be estimated. The age at exposure and the sex are key factors determining the impact, with a generally higher sensitivity of young and female individuals. Currently, in medicine repeated low-level exposures tend to increase due to follow-up imaging for disease and to new screening procedures; consequences of this development will be evaluated.

Learning Objectives:

1. To learn about risks of x-ray exposure in relation to age.
2. To appreciate the difference between individual and collective radiogenic risks.
3. To understand issues related to cumulative radiation doses and possible risks from medical x-ray screening procedures.

A-053 17:00

Security scanners using non-ionising radiation: current status and trends for development

M. Kemp; Cambridge/UK (mike.kemp@iconal.com)

Security scanners are used in aviation security and in other applications to detect metallic and non-metal explosives, weapons and other contraband concealed on the body. Whilst some types of scanner use low-dose x-rays, others avoid the use of ionising radiation by employing radio waves at millimetre wavelengths (1 cm - 0.5 mm; 30 - 600 GHz), which penetrate clothing and have short enough

wavelengths to resolve small concealed objects. The talk will describe properties of materials and contrast mechanisms, principles of operation of both active and passive imagers at millimetre-wave, submillimetre-wave and terahertz frequencies. Benefits, limitations, technology trends and a range of current and potential applications including aviation security, loss-prevention and stand-off detection will be discussed. Non-ionising radiation standards, ethical and privacy issues will also be discussed, together with the techniques and concepts-of-operation which are used to mitigate privacy concerns.

Learning Objectives:

1. To understand the current status of non-ionising radiation technology for the detection of explosives and other threats.
2. To learn about trends for development of millimetre-wave and terahertz technology.
3. To learn about the challenges and limitations of these technologies.

18:30 - 18:50

Room A

Plenary Session

OL

Presiding:

J.I. Bilbao; Pamplona/ES

A-054 18:30

Promises and facts of liver-directed gene therapy

J.M. Prieto; Pamplona/ES (jprieto@unav.es)

Gene therapy is based on the introduction of genetic material into the cells to promote local expression of a therapeutic protein. The transgene is incorporated into vectors, frequently of viral origin, to facilitate cell transduction. Due to the development of neutralising antibodies, gene therapy is frequently one-time treatment and therefore the duration and control of transgene expression is a key issue. Hepatotropic long-term expression vectors such as adeno-associated virus (AAV) and third generation adenovirus (gutless Ad) are preferred vectors for many applications. Recently, treatment of patients with haemophilia B with AAV encoding Factor IX resulted in cessation of spontaneous bleeding in most patients. Acute Intermittent Porphyria (AIP) is a hereditary metabolic disorder due to mutations of uroporphobilinogen deaminase (PBGD). Genetic supplementation of liver cells with AAV-PBGD normalises biochemistry in AIP mice and corrects the associated neurological alterations. A clinical trial involving 8 AIP patients is currently underway in our institution. In liver cirrhosis, hepatocellular insufficiency causes a sharp decline in IGF1 synthesis. In experimental hepatic cirrhosis, liver transduction with AAV-IGF1 leads to fibrosis reversal and improved liver function holding promise for clinical application. Primary and metastatic liver cancer can be treated by forcing the expression of molecules that stimulate antitumour immunity or block tumour progression by reducing vessel formation or altering tumour microenvironment. In experimental models of colorectal cancer metastatic to the liver, IL-12 immunogene therapy was found to synergise with oxaliplatin chemotherapy to control tumour growth. Summarising, gene therapy constitutes today a realistic option to treat previously intractable liver disorders.

Learning Objectives:

1. To learn about novel therapeutic approaches in hepatology.
2. To understand principles and applications of liver-directed gene therapy.
3. To appreciate flexibility, potential and limitations of the procedure.
4. To become familiar with gene therapy vectors and their clinical use.
5. To consolidate knowledge of novel approaches to treat liver diseases.

Author Disclosure:

J. M. Prieto: Advisory Board; Digna Biotech. Consultant; uniQure, Digna Biotech.

Friday, March 8

08:30 - 10:00

Room A

Abdominal Viscera

RC 401

Pitfalls in interpretation of pancreatic imaging

Moderator:

H.-J. Brambs; Ulm/DE

A-055 08:30

A. Pancreatic cancer or pancreatitis?

B.J. Op de Beeck, A. Snoeckx, M. Spinhoven, R. Salgado, P.M. Parizel;
Antwerp/BE (bart.op.de.beeck@uza.be)

A common diagnostic problem is how to differentiate malignant solid pancreatic lesions from benign entities like pancreatitis. Especially, if you are dealing with focal forms like paraduodenal pancreatitis (cystic dystrophy of the duodenum or groove pancreatitis) or autoimmune pancreatitis (IgG4 related pancreatitis). Paraduodenal pancreatitis is a distinct form of chronic pancreatitis characterised by inflammation and fibrous tissue formation, affecting the groove area near the minor papilla between the head of the pancreas, the duodenal wall and the common bile duct. Paraduodenal pancreatitis has been divided into pure (the head of the pancreas is spared), segmental (the pancreatic head and the ducts are affected) and non-segmental (secondary to established chronic pancreatitis) forms. Autoimmune pancreatitis is distinct from calcifying and obstructive forms of chronic pancreatitis. Destructive changes of the pancreatic ducts characterised by multiple or single strictures without marked upstream dilatation are important features. Pancreatic calcifications and pseudocysts are usually absent. We radiologists have the important role to differentiate these benign entities from pancreatic adenocarcinoma, neuroendocrine tumours, lymphoma and pancreatic metastases. The typical CT-findings and limitations will be demonstrated as well as the additional and complementary role of MRI. We will focus on morphological signs (pancreatic, peripancreatic and ductal), dynamic contrast behaviour and value/limitations of diffusion weighted imaging and ADC. Clues to a correct diagnosis will be given and pitfalls in imaging interpretation will be discussed.

Learning Objectives:

1. To become familiar with the common benign mimickers of pancreatic malignancy.
2. To learn how to differentiate between benign and malignant lesions.
3. To know the limitations and complementary roles of CT and MR.

A-056 09:00

B. How can we differentiate cystic neoplasms from pseudocysts?

T. Denecke; Berlin/DE (timm.denecke@charite.de)

The differential diagnosis of cystic lesions of the pancreas includes primary neoplasms and pseudocysts. The clinical relevance of cystic pancreatic lesions is given because cystic neoplasms can be malignant or premalignant. The differentiation of pseudocysts and cystic lesions can be demanding. Ultrasound, endoscopic ultrasound, computed tomography and magnetic resonance imaging are the imaging tools employed for differentiation of cystic lesions, supplemented by image-guided biopsies. The initial findings determine the sequence of further diagnostic steps and, if necessary, therapy. The initial non-invasive diagnostic work-up of incidental cystic lesions usually contains CT and/or MRI. Here, typical patterns of benign cystic neoplasms, signs of malignancy, and imaging features in favour of pseudocyst formations can be recognised. Prerequisites for differential diagnosis by radiologic imaging are a comprehensive examination protocol, exact knowledge of the entities possibly presenting as cystic lesion including their imaging features and clinical relevance, as well as important clinical and paraclinical cofactors which aid in the discrimination of cystic neoplasms and pseudocysts. These issues will be demonstrated and discussed in this presentation.

Learning Objectives:

1. To learn the most common cystic lesions of the pancreas.
2. To know typical imaging findings of pseudocysts and cystic tumours.
3. To become familiar with imaging elements that help differentiate between cystic lesions.

A-057 09:30

C. How to manage incidental findings

C. Triantopoulou; Athens/GR (ctriantopoulou@gmail.com)

The diagnosis and management of pancreatic cystic lesions is a common problem. Half of these lesions are asymptomatic and incidentally discovered at the time

of imaging for other reasons. Although small cysts are more likely to be benign, size alone cannot be an independent decision making variable. Radiologists must attempt to exclude the presence of morphologic abnormalities that raise the suspicion of a complex cyst (mural nodules, dilatation of the common bile duct, dilatation of the main pancreatic duct larger than 6 mm, duct wall enhancement, lymphadenopathy, and peripheral calcifications). Microcystic adenoma is the only type of cystic neoplasm that can be diagnosed with almost complete certainty, while diagnosis of mucinous cystic tumours is often hypothetical. Determination of CEA and amylase levels in cyst fluid aspirated by EUS-FNA is helpful in making the differential diagnosis. Concerning correct management of unclassified cystic lesions at imaging one should keep in mind that even small morphologically benign-appearing cysts present moderate frequency of malignancy. Several professional societies have developed guidelines for the management of pancreatic cysts. According to the white paper of the ACR incidental findings committee any cyst > 3 cm should be resected unless it is serous cystadenoma or proven to be pseudocyst through aspiration. For cysts < 2 cm, a single follow-up in 1 year is needed, while for the cysts measuring 2-3 cm, a follow-up of every 6 months for 2 years and then yearly is proposed. Any decision should be based on a balance between the risk of malignancy and the benefit of pancreatic resection.

Learning Objectives:

1. To learn how to differentiate between benign and malignant cystic lesions.
2. To know the correct management of unclassified cystic lesions through imaging.
3. To become familiar with the reference imaging criteria suggesting treatment.

08:30 - 10:00

Room C

Oncologic Imaging

RC 416

MR imaging for prostate cancer management: the essential guide for radiologists

A-058 08:30

Chairman's introduction

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

Prostate cancer has become the most frequent cancer in men of the industrialised countries over the last 30 years, and the incidence is still increasing. The disease is associated with high morbidity and accordingly high socio-economic impact. Although radical prostatectomy has been proven to prolong survival, avoidable morbidity and costs are feared in a selective but unpredictable patient group due to overdiagnosis and overtreatment. The conventional way of establishing the diagnosis and making individual treatment decisions relies on the individual PSA serum level and pathologic Gleason score from systematic TRUS biopsy samples, which has well-known limitations. Patient stratification for choosing the best individual treatment becomes increasingly challenging as various less invasive treatment alternatives and active surveillance has been established. 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 give an insight into the current diagnostic strategies and treatment options in prostate cancer and will discuss the role of MR imaging for patient management.

A-059 08:35

A. Clinical challenges: how to treat prostate cancer

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

Prostate cancer (PC) is the third leading cause of male cancer deaths in developed countries. PSA-based screening results in a modest reduction of PC mortality, but is associated with considerable overdiagnosis of PC, which, in turn, results in a significant burden of overtreatment. PC diagnosis is currently made by systematic TRUS-guided random biopsies. Indication for biopsy is preferably an individual risk assessment based on various parameters, predominantly PSA, age, prostate volume, digital rectal examination, family history, and co-morbidity. However, the majority of biopsies taken are negative. Moreover, random biopsies may miss important tumours and they also result in cancer detection in men who are unlikely to benefit from the diagnosis. Precise information of grade, stage and location of

tumours is mandatory in order to counsel men with prostate cancer and to individualise therapy. To prevent overtreatment of low-risk disease and to decrease treatment-related morbidity, active surveillance is the treatment modality of choice for men with indolent tumours. Unfortunately, in most places, it is not used frequently and men who are unlikely to die of their cancer undergo unnecessary treatment, including radical prostatectomy and radiation therapy, which significantly impairs quality of life. At the same time, still up to 40% of men shift to active therapy during their active surveillance due to tumour progression or reclassification towards higher risk disease. To safely increase widespread use of active surveillance and to pave the way for focal therapy, PC diagnostics need to be refined to correctly identify biologically significant disease.

Learning Objectives:

1. To understand how diagnosis is established through PSA evaluation and biopsy.
2. To learn about different treatment options.

A-060 08:58

B. The radiologist's contribution: how to detect and characterise a tumour
A.R. Padhani; Northwood/UK (anwar.padhani@stricklandscanner.org.uk)

The importance of detecting and accurately localizing significant intra-prostatic focal disease lies in two clinical areas. First, in men with persistently raised serum PSA levels and in whom there have been multiple negative biopsies or positive but low-grade/volume tumour with discordant PSA kinetics. These un- or under-diagnosed cancers need to be located and histologic evaluated before appropriate can be instituted. Second, the usage and future success of local ablative treatments such as high-intensity focused ultrasound (HIFU) is dependent on the accurate identification of the dominant intra-prostatic lesion, also known as the index lesion. Multiparametric MRI components including T2-weighted, diffusion, dynamic contrast enhancement and MR spectroscopy can all enable the accurate detection, localisation and characterisation of prostate cancer to be undertaken with high accuracy particularly when all components are combined into a single comprehensive assessment. This is because each technique interrogates the unique biology of cancers which differs from normal tissues. In order for MRI data to inform on patient management, multiparametric data need to be communicated to oncologists/urologists in a simple but meaningful way. This is best done using structured reporting systems, incorporating simple scoring systems via graphical interface that matches prostate anatomy. These aspects will be discussed in detail.

Learning Objectives:

1. To understand how multiparametric MRI detects prostate cancer.
2. To learn how to perform, interpret and communicate multi parametric MRIs.
3. To learn how to support image guided biopsy.
4. To understand the need for the standardisation of MRI protocols and reports.

Author Disclosure:

A. R. Padhani: Advisory Board; Siemens HealthCare. Speaker; Siemens HealthCare.

A-061 09:21

C. The radiologist's influence on management. Staging prostate cancer: how it impacts on treatment selection

H. Hricak; New York, NY/US

Treatment recommendations for prostate cancer continue to evolve and are affected by technological advances (e.g., robotics, image-guided radiotherapy [IGRT]), new discoveries regarding tumour biology, and the development of predictive and prognostic biomarkers. With the increased complexity of treatment decision-making, the role of MRI is evolving as well. While the value of MRI in staging prostate cancer, particularly for evaluating extracapsular extension and seminal vesicle invasion, has been documented, unresolved needs for uniform interpretation and standardised reporting still pose obstacles to its widespread use. MRI findings affecting treatment decision-making extend beyond those of staging. Tumour grade (aggressiveness), size/volume and location are all relevant to treatment selection. When added to T2-weighted MRI, newer MR techniques, such as diffusion-weighted MRI, dynamic-contrast-enhanced MRI, and MR spectroscopy improve tumour detection while providing an indication of tumour aggressiveness. However, MRI performance on all sequences is dependent on lesion size/volume and grade, and this should be considered when applying MRI results to treatment selection and planning. Today, most patients are diagnosed with low-grade, clinically non-palpable disease (stage T1c), and the role of MRI is expanding from staging advanced disease to evaluating intraprostatic disease. The more individualized and targeted the treatment approach, the greater the role of imaging in treatment planning. MRI is especially critical for planning technologically sophisticated treatment approaches such as robotic surgery, IGRT, or focal therapy and can help assess patients' eligibility for active surveillance.

Learning Objectives:

1. To learn how advanced MR techniques improve staging.
2. To learn how imaging impacts on clinical management (treatment selection and response monitoring).
3. To understand the need for the implementation of MRI in clinical practice and clinical trials.
4. To understand the need for specialised training of radiologists in prostate cancer imaging.

Panel discussion:

Is MRI an integral part of the clinical routine?

09:44

08:30 - 10:00

Room D1

Controversies in Breast Imaging

MC 423

Overdiagnosis from screening mammography: should we care about it?

Moderator:

T.H. Helbich; Vienna/AT

Teaser:

H.J. de Koning; Rotterdam/NL

A-062 08:30

A. The risk of overdiagnosis from screening mammography

E. Paci, D. Puliti; Florence/IT (paci.eugenio@gmail.com)

Overdiagnosis is the detection of a breast cancer through screening that would never have been identified in the lifetime of the woman, and is thus an adverse outcome of screening. EUROSCREEN WG reviewed the observational studies evaluating overdiagnosis in Europe and published a balance sheet of the outcomes of service screening in Europe. From a literature search, studies were classified according to the presence and the type of adjustment for breast cancer risk, and for lead time (statistical adjustment or compensatory drop). Estimates of overdiagnosis are percentage of the expected incidence in the absence of screening. There were 13 primary studies in seven European countries (The NL, I, N, Sw, DK, UK and S). Unadjusted estimates ranged from 0 to 54%. Estimates adjusted for breast cancer risk and lead time ranged from 2.8% in The Netherlands, to 4.6% and 1.0% in Italy, 7.0% in Denmark and 10% and 3.3% in England and Wales. A summary measure of 6.5% was considered the most likely estimate of overdiagnosis. Higher estimates in the literature are due to the lack of adjustment for breast cancer risk and/or lead time. A balance sheet of mortality reduction and overdiagnosis was estimated for a screened woman starting at 50 years of age a 20 years screening regimen and followed up till 79 years of age. Out of 1000 women, 30 deaths for breast cancer were expected and 7/9 lives saved. 4 breast cancer were estimated as overdiagnosed.

A-063 08:55

B. How breast radiologists should control the risk of overdiagnosis

U. Bick; Berlin/DE (Ulrich.Bick@charite.de)

Overdiagnosis, defined as the detection of malignant disease, which without screening would not have lead to significant morbidity for the patient, cannot be avoided completely in mammography screening. Aggressive pursuit of subtle mammographic findings - both masses as well as microcalcifications - is a prerequisite for the successful early detection of breast cancer, which in turn is the basis for the desired reduction in breast cancer mortality. However, mammography, as a modality primarily based on morphology, is inherently unable to reliably predict prognosis and outcome for lesions detected in screening. In addition, the so-called length-time bias in screening will lead to preferential detection of slow-growing, less aggressive tumours. A possible strategy to lower the risk of overdiagnosis in mammography screening is the additional use of breast MRI as an assessment tool, since MRI may be better able to predict the biological behavior of breast lesions, in combination with a short-term follow-up approach, e.g. for older patients, in whom based on imaging the likelihood of clinically relevant breast cancer is low. Ideally, the decision by the breast radiologist, whether to biopsy or not to biopsy a suspicious lesion detected in screening, should not be based on imaging alone, but should also incorporate clinical factors such as the individual breast cancer risk and the biological age of the patient as well as possible comorbidities.

Author Disclosure:

U. Bick: Equipment Support Recipient; Hologic, Inc, Toshiba Corporation. Patent Holder; Hologic, Inc. Speaker; General Electric Company, Carestream Health, Inc.

A-064 09:20

Discussion

T.H. Helbich¹, H.J. de Koning²; ¹Vienna/AT, ²Rotterdam/NL

The discussion will address the following issues:

1. Why do estimates of overdiagnosis differ?
2. Should we begin to think about stopping mammographic screening?
3. How to reduce overdiagnosis?
4. DCIS as major part of overdiagnosis.
5. How should we inform women about overdiagnosis?

08:30 - 10:00

Room D2

Emergency Radiology

RC 417

ER: basic principles

Moderator:

P. Valdés Solís; Marbella/ES

A-065 08:30

A. Logistics and organisation of an emergency radiology department

M. Körner; Landshut/DE (markus@dr-koerner.net)

The interest in emergency radiology has been growing over the last years. The European Society for Emergency Radiology is still young, and their first summer meeting in Munich in 2012 was a huge success, which is a strong indicator for the interest in this subspecialty. Besides optimising technical equipment and protocols for imaging, different logistic concepts have to be considered in planning and organizing emergency radiology departments. First of all, logistic concepts have to be considered for having an optimal workflow: the radiology department has to be in close proximity to the emergency department and the admitting area, in particular. The whole workflow must be optimised for speed and accuracy. This also mandates to have dedicated and standardised examination and viewing protocols for CT. In contrast to the USA, where dedicated emergency radiology departments are well established, the reading of emergency radiology cases is still frequently done by non-specialized radiologists in European countries. The radiologic staff involved has to be trained for interpretation of trauma and other emergent cases. This does not only account for residents but also for consultants and attending radiologists as well. Since a large number of such cases will arrive during after hours and on weekends, staffing has to be adjusted to this fact, which includes attending radiologists to be available during these hours on call or, preferably, on-site. This lecture will give an overview of logistic concepts, organization of an emergency department and will also discuss critical issues in polytrauma imaging.

Learning Objectives:

1. To understand how an emergency radiology department should be organised.
2. To become familiar with the logistics, staffing and technical equipment of an ER department operating 24/7.

A-066 09:00

B. Advanced trauma life support: basic knowledge for radiologists

D.R. Kool; Nijmegen/NL (dignakool@gmail.com)

Advanced trauma life support® (ATLS®) is an established systematic approach assessing trauma patients prioritizing the most life-threatening injuries. The term 'golden hour' is used to emphasize a sense of urgency, not to define a set time frame. The assessment is divided in a primary and a secondary survey. In the primary survey, the mnemonic ABCDE (Airway, Breathing, Circulation, Disability, Exposure and Environment) is used to guide the order of assessment. For efficient communication, it is helpful to report imaging in a comparable order. Although imaging should not postpone treatment, chest and pelvis radiographs and abdominal US can influence treatment decisions and should be performed in the primary survey. In the secondary survey, the patient is examined from head to toe and appropriate additional radiographs are performed. According to ATLS® and contrary to literature evidence, CT plays a minor role in the evaluation of trauma victims and indicated CT scans should be done in the secondary survey. Although improved in the most recent edition, the ATLS® is neither evidence-based nor up-to-date concerning imaging in trauma settings. However, surgeons use the ATLS® recommendations routinely to support indications for diagnostic imaging. In addition, surgeons refer to ATLS® in error with indications for imaging that are not supported by the present ATLS® guideline or radiological literature. In this refresher course, the rationale and indications of imaging will be assessed where it pertains to the ATLS® protocol.

The principles of ATLS® and discrepancies between the radiological literature, ATLS® and day-to-day practice will be addressed.

Learning Objectives:

1. To understand the relationship between ATLS and emergency radiology.
2. To know more about the rational use of CR, US and CT according to patient priorities in the emergency setting.
3. To become familiar with priority-oriented reporting of findings.

A-067 09:30

C. Mechanism of injury and MDCT protocols: choosing the right protocol for the right patient

S. Voelckel¹, M. Rieger²; ¹Innsbruck/AT, ²Hall in Tirol/AT
(sandra.voelckel@i-med.ac.at)

Polytrauma is the leading cause of death in younger people. Because of the broad consensus on the time sensitivity of the very first emergency procedures, namely "time is life", radiologists constantly attempt to devise new ways to reduce the amount of time needed to adequately image trauma victims while simultaneously improving image quality. Multidetector-row computed tomography (MDCT) is considered an accurate and reliable imaging modality for initial evaluation of patients with multiple injuries and is widely used in modern emergency radiology. In patients with haemodynamic and respiratory instability that is not appropriate for CT examination, the delay in the first emergency room phase is used for conventional radiographs and a comprehensive sonogram. Knowledge of trauma mechanism is essential to adapt the ideal diagnostic protocol. Choosing a surgical treatment strategy for patients with traumatic extremity injuries requires rapid detection, localisation, and characterisation of a possibly accompanying vascular injury. In these patients, a MDCT-angiography is included in the standard whole body protocol. Blunt cervical vascular injuries (BCVI) represent serious conditions with an increased risk of being initially underdiagnosed during the first patient management. If present, BCVI, e.g., arterial dissections, potentially can cause severe or even fatal cerebral damage. Therefore, a MDCA-angiography of the cervical arteries should be included in the standard work-up.

Learning Objectives:

1. To understand mechanisms of traumatic injuries.
2. To become familiar with established whole body MDCT protocols and their possible relation to injuries.
3. To know the impact of MDCT findings on patient management.

08:30 - 10:00

Room E1

State of the Art Symposium

SA 4

Diffusion-weighted imaging (DWI) of the abdomen

A-068 08:30

Chairman's introduction

Y. Menu; Paris/FR (yves.menu@sat.aphp.fr)

Diffusion-weighted imaging (DWI) is a very hot topic, because it comes with structural and physiological information, added to morphology. As the technique becomes mature, and as most of MRI machines are able to acquire DWI, it is increasingly popular and the number of indications extends continuously. However, there are still unanswered or partially answered questions: should we integrate DWI sequences in every single abdominal examination? How standard are the acquisition technique and ADC measurements? Does it improve the lesion detection and/or characterisation? Is there any benefit in predicting or evaluating disease response to treatment, whether inflammation or tumour? Can it compete with PET for detection and/or characterisation? In this session, the basic principles and tools for interpretation of DWI will be addressed, with a focus on abdominal organs. At the end of the session, the speakers will comment on clinical cases provided by the Moderator, in order to provide the attendees with clear and practical messages.

Session Objectives:

1. To understand DWI principles.
2. To learn about appropriate protocols for DWI of the abdomen.
3. To learn how to analyse and report DWI images.
4. To understand the clinical value of DWI for detection, characterisation and prognostic evaluation.

A-069 08:35

DWI of the abdomen: a tutorial for beginners

H.C. Thoeny; Berne/CH (harriet.thoeny@insel.ch)

DWI is a non-invasive imaging technique providing information on the Brownian motion of water molecules in the underlying tissue. The ADC is a quantitative DWI parameter and provides information on diffusion and perfusion depending on the choice of the applied b-values. Extracranial applications of DWI mainly in the abdomen-gained increasing acceptance in recent years, thanks to newer technical developments. It can easily be added to conventional MRI in daily routine and its interpretation is relatively easy - provided that accurate imaging protocols are used and correlation with morphological sequences is performed. In patients with renal insufficiency, DWI can also be applied as an alternative for contrast medium administration in various circumstances. DWI is helpful in lesion detection, lesion characterisation, functional evaluation of various organs, and treatment monitoring. Image interpretation can be performed qualitatively based on visual assessment of the high b-value images and the corresponding ADC map. In general, a cystic/necrotic lesion is dark on the high b-value images and bright on the corresponding ADC map, whereas a solid or hypercellular lesion as observed in most malignant tumours is usually bright on the high b-value images and dark on the ADC map. Abscess and haematoma can present with the same features, therefore, comparison with morphological images is a prerequisite for correct image interpretation. Quantitative analysis is performed by ADC measurement, however, caution must be used when comparing results to those published in the literature because the ADC depends on the choice of underlying b-values.

Learning Objectives:

1. To understand the principles of DWI.
2. To learn the different acquisition protocols (optimal b values, optimal sequences) and their advantages and disadvantages.
3. To learn how DWI can be integrated into acquisition protocols, and whether it precludes the need for other sequences.
4. To learn how to interpret ADC maps and values.

A-070 08:55

Liver and pancreas: answering burning questions

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

Diffusion-weighted MR imaging is gaining wide acceptance for liver and pancreatic imaging, due to its superior contrast resolution, overtly cooperating in lesion detection and/or characterisation. Focal liver lesion detection can be enhanced using DWI in a combined reading strategy of liver MR studies. The use of low b values are of utmost importance due to the black blood effect and higher b values assists further on to depict the type of restriction within the lesions. The ADC measurement helps on characterisation avoiding T2 shine-through effects. Pancreatic DWI may also assist on tumour detection increasing diagnostic confidence. The role of DWI for lesion characterisation is not clearly established since there is an overlap between benignancy and malignancy. Other strategies such as intravoxel incoherent motion (IVIM) may be foreseen in order to calculate the perfusion component. DWI, both in liver and pancreas, may play a role in tumour response evaluation but clinical validation still lacks behind. Intra and inter-vendor variations in the calculated ADC values of tumours may be the most important drawback to be solved in the near future. Major shortcomings of DWI are currently technique-related due to the use of EPI causing low resolution imaging and strong artifacts of various kinds. This, together with the lack of standardisation, are important problems that will be surely addressed and solved in order to increase the role of this technique for the daily practice in imaging the liver and pancreas.

Learning Objectives:

1. To understand the images observed in the main focal liver and pancreatic diseases.
2. To learn if DWI can provide useful information concerning tissue characterisation.
3. To understand the clinical circumstances in which DWI is most helpful.
4. To learn if DWI helps in the evaluation of diffuse liver diseases and how iron and fat could be misleading issues.

A-071 09:15

DWI of abdominal lymph nodes: PET competitive or just pseudo?

S. Gourtsoyianni; London/UK (sgty76@gmail.com)

Prognosis and appropriate treatment planning of patients with malignant disease depends on accurate tumour staging at presentation. Accurate identification of abdominal metastatic lymph nodes is of paramount importance as a single metastatic lymph node may change treatment from curative surgery to palliative

care. Abdominal lymph node evaluation alone is not an absolute indication for MRI. These are depicted on MR images acquired for local staging of primary tumours in the pelvis and abdomen and for whole body staging in case of extra abdominal primaries and systemic disease such as malignant melanoma, breast and lymphoma. Cross-sectional imaging relying on nodal size and morphology and PET on metabolic activity for lymph node characterisation have not yet produced sufficiently effective staging results due to considerable overlap in imaging features of benign and malignant lymph nodes. Diffusion weighted whole body imaging with background body signal suppression (DWIBS) with inversion of grey scale producing images similar to PET and axial single shot EPI DWI with fat suppression depict normal lymph nodes with a relative impeded diffusion, while both techniques increase conspicuity of small lymph nodes irrespective of histological composition. ADC map produced from the latter sequence using a wider range of b values is rendered necessary for quantification and thus characterisation of lymph nodes. ADC is relatively independent of lesion size and various criteria have been proposed to increase sensitivity of DWI in differentiation of metastatic from benign lymph nodes with a diagnostic accuracy comparable to PET/CT.

Learning Objectives:

1. To understand the signal of lymph nodes on DWI sequences, and to identify the correlation between histological changes and DWI signal in benign and malignant lymph nodes involvement.
2. To learn whether or not ADC value is helpful for characterisation.
3. To compare DWI and PET and understand their respective roles.
4. To open the door to the future combination of PET and MRI.

Clinical cases

09:35

08:30 - 10:00

Room E2

Foundation Course: Neuroimaging

E³ 420

The orbit, the petrous bone and the sella

Moderator:

B. De Foer; Antwerp/BE

A-072 08:30

A. Imaging of the orbit: the globe and conal lesions

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

There is a broad spectrum of diagnoses to orbital lesions including congenital malformation, traumatic, neoplastic, iatrogenic, inflammatory and infectious etiologies. The purpose of this lecture is to briefly revise the pertinent anatomical and physiological properties of the globe and to familiarize the audience with the imaging findings of different lesions with the focus on the role of conventional and advanced magnetic resonance imaging (MRI) sequences in the work-up of orbital lesions and the imaging findings in the most common orbital abnormalities and their differential diagnosis.

Learning Objectives:

1. To understand the embryology and imaging findings of the most common malformations of the orbit.
2. To learn about space occupying lesions and the differential diagnosis of tumours and inflammatory conditions.
3. To become familiar with the role of conventional and advanced MR sequences in the diagnostic approach of lesions in the orbit.

Author Disclosure:

P. C. Maly Sundgren: Board Member; ISMRM, ASNR. Consultant; ICON Medical Imaging.

A-073 09:00

B. The petrous bone

F. Veillon; Strasbourg/FR (Francis.Veillon@chru-strasbourg.fr)

CT (CB CT) and MRI provide very precise information about the pathology of the petrous bone. Minor malformations of the inner ear are extremely frequent and constitute a labyrinthine weakness which must be known by the otologist and patient. Chronic otitis media is very well documented by CT considering the ossicles particularly the stapes (with the footplate). MR is useful when the diagnostic is doubtful with CT before the surgery and in the follow-up of the postoperative middle ear knowing that diffusion is not totally specific. The evaluation of T1 is essential to avoid the false-positive diagnosis of cholesteatoma. CT allows a new classification of petrous traumatism (we separate the fractures of the middle ear, the inner ear

and both middle and inner ear) and of otosclerosis (a particular emphasis is put on the footplate which requires an excellent technic). MR opens a new way in the diagnostic of Meniere disease (the dilation of the saccule is nicely demonstrated with a 3 T MR unit) and in the analysis of the membranous labyrinth particularly in labyrinthitis. A new way of reading the inner ear is also provided by the 3 T machines. The foundation of the performance in imaging remains the knowledge of anatomy.

Learning Objectives:

1. To understand the normal imaging anatomy.
2. To learn about the role of CT and MRI in the evaluation of congenital malformations.
3. To become familiar with the most common acquired lesions of the middle and inner ear.

A-074 09:30

C. Sella and parasellar pathology

R. Gasparotti; Brescia/IT (gasparo@med.unibs.it)

The sellar region can be subdivided into three anatomical compartments, intrasellar, suprasellar and parasellar, each of which is characterised by different diseases. Although pituitary adenomas represent 90% of all sellar masses, a large spectrum of diseases can be encountered in such a small area, including congenital lesions, tumours, infectious and inflammatory conditions and vascular pathologies. The aim of neuroimaging is to characterise and to precisely define the anatomical relationships of the lesions, since a thorough understanding of the radiological anatomy is essential for the differential diagnosis and treatment planning. MRI has almost completely replaced CT in the study of the central skull base, because of its superior capability of tissue characterisation, although some tumours arising in this area may still take advantage from CT, which better identifies the extensive calcified components typical of craniopharyngiomas or giant partially thrombosed aneurysms. A reliable diagnosis of sellar or parasellar mass lesion can usually be obtained with conventional MRI based on T2W and pre/post-gadolinium T1W sequences, however, advanced MR techniques may be relevant for further characterising the lesions. DWI sequences may represent a useful adjunct for the preoperative assessment of macroadenomas; 3D SPACE sequences may be used to identify either microcystic or tiny solid components respectively into large solid or cystic lesions, whereas 3D T1W fatsat post-gadolinium sequences can better display dural enhancement and cavernous sinus invasion by intrasellar mass lesions. We present an overview of the relevant neuroimaging features of sellar and parasellar pathology, including the differential diagnoses with less common lesions.

Learning Objectives:

1. To consolidate knowledge about the normal anatomy and the age related patterns of the normal pituitary gland.
2. To learn how to evaluate congenital and acquired lesions of the sella and parasellar region.
3. To become familiar with imaging protocols.

08:30 - 10:00

Room F1

Multidisciplinary Session: Managing Patients with Cancer

MS 4

Hepatocellular carcinoma

A-075 08:30

Chairman's introduction

B. Sangro; Pamplona/ES (bsangro@unav.es)

A variety of options are available for the treatment of hepatocellular carcinoma (HCC) from liver transplantation or resection to percutaneous ablation by chemical or physical procedures, intraarterial injection of embolizing particles that may also serve as carriers of chemotherapeutic agents or radiation-emitting isotopes, or systemic delivery of molecularly targeted agents. Although large scale studies have identified groups of patients that may certainly benefit from some of these therapeutic tools, many areas of uncertainty still exist. Only by the coordinated action of HPB Oncology multidisciplinary teams may patients with HCC receive the best possible treatment.

Session Objectives:

1. To learn the current management of HCC as laid out in scientific guidelines.
2. To identify those areas of uncertainty, where multidisciplinary teams are needed most.
3. To understand the basis of personalised care for HCC patients and the need for multidisciplinary teams.

Author Disclosure:

B. Sangro: Advisory Board; Bayer Healthcare and Sirtex Medical. Speaker; Bayer Healthcare and Sirtex Medical.

A-076 08:35

Abdominal radiology

A. Benito; Pamplona/ES (albenitob@unav.es)

Worldwide accepted staging procedures for hepatocellular carcinoma include dynamic CT or MRI, both based on typical tumoural behaviour after contrast in arterial (hypervascular) and in portal-venous phases ("washout" appearance). However, some tumours may show ambiguous features that precludes staging. Recent advances such as perfusion for CT or diffusion and liver-specific contrast agents for MRI have demonstrated a potential role to solve disagreements in diagnosis, staging, or distinguishing the grade of malignancy. Imaging tumoural response after non-surgical treatments (ablation, chemoembolisation, radioembolisation or sorafenib), based on tumoural viability as estimated by the degree of hypervascularization in the arterial phase (modified-RECIST) seems to be more appropriate than conventional systems (WHO/RECIST). However, uncommon radiological patterns can be seen after sorafenib (gradual decrease in tumour hypervascularity before shrinkage) or after radioembolisation (heterogenous patchy hypervascular areas and/or fibrosis) leading to misinterpretation or late recognised responses if only morphologic changes are considered. Ethanol injection and RFA have been the two most employed local ablative techniques for the local control of HCC. However, other procedures could offer potential benefits. The use of microwave ablation is growing recently due to some presumed advantages such as larger ablations, shorter duration, less susceptibility to heat sink effect, or no requirement of grounding pads. Irreversible electroporation is also a new non-chemical, non-thermal technique (still under clinical investigation) that is based in the application of multiple direct pulses that result in an irreversible disruption of the cell membrane leading to cellular death.

Learning Objectives:

1. To learn which imaging procedures should be considered standard of care for staging HCC and which are potential improvements that await confirmation.
2. To understand the limitations of imaging in the diagnosis and evaluation of response to locoregional and antiangiogenic therapies.
3. To learn about the scientific evidence supporting the use of percutaneous ablation procedures other than radiofrequency.

A-077 08:50

Interventional radiology

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

The rationale to perform endovascular procedures for the treatment of patients with Hepatocellular Carcinoma (HCC) is based on the anatomical fact that liver neovascular networks are nourished exclusively by arteries. Thus, HCC may be selectively treated by delivering therapeutic agents through the afferent arteries. Ischaemia, provoked by the selective endovascular deployment of particles, may induce tumoural necrosis with high local control. The drawback is that ischaemia will also actively induce neoangiogenesis which may facilitate tumoural recurrence. Targeting of tumoural vessels is higher if smaller particles (or fluids like Lipiodol) are used and, for this reason, they could be loaded with anticancer agents. It has been widely reported the high local control rates obtained with the mixed effect given by ischaemia (macroembolisation) and the delivery of drugs (chemoembolisation, drug-eluted-embolisation). Since macroembolisation will provoke ischaemia in the embolized volume the procedure must be performed, as selective as possible trying to avoid any damage to the surrounding, usually cirrhotic, liver parenchyma. If not achievable the treatment should not be performed in patients with liver insufficiency or in the presence of thrombosis of the main portal branches. Endovascular treatments may, even, pursue the superselective deployment of an anticancer agent (drug, radionuclide, antibodies) avoiding any ischaemic effect (microembolisation). Taking into account these considerations, their indications are increasing in patients with HCC. Several reports demonstrated its usefulness as a palliative method improving both local control and patients' survival. But also tumours can be downstaged and then patients can receive curative treatments (surgery or ablation).

Learning Objectives:

1. To learn about locoregional intraarterial therapies currently being used for HCC and the rationale behind their use.
2. To become familiar with patient selection for embolising procedures prior to and after angiographic evaluation.
3. To learn some tips that may help reduce side effects and prevent complications of transarterial therapies.

4. To understand how IRs can help patients with unresectable tumours being evaluated for resection.

Author Disclosure:

J. Bilbao: Consultant; Sirtex, Terumo.

A-078 09:05

Surgery

F. Pardo; Pamplona/ES (fpardo@unav.es)

The goals of hepatocarcinoma (HCC) surgery are to achieve an R0 resection, to protect the liver remnant parenchyma and to prevent morbidity and mortality. Multiple factors have been associated with morbidity and mortality as remnant liver volume, age, comorbidities (cardiovascular disease, diabetes, renal function), liver functions tests, transfusion or the degree of portal hypertension. The requirements for safe resection are a sufficient remnant liver parenchyma and an adequate liver function. Contraindications for resection would be given by tumour size, preoperative staging and the degree of portal hypertension. Tumour size and location determines the type of surgery needed to perform oncological resection. Recent studies have shown that it is feasible to perform a major hepatectomy even in cirrhotic livers without increasing the risk considerably. Preoperative portal vein embolisation is a good strategy to increase the future liver remnant and reduce the morbi-mortality even in cirrhotic patients. Liver transplantation is the best option for patients with HCC and poor liver function. In 1996, Mazzaferro published excellent long term results of HCC transplantation when patients had a single nodule less than 5 cm in diameter or up to three nodules, none larger than 3 cm. These "Milan criteria" were adopted by most transplant teams in the world and confirmed by numerous series. Other groups also published good results with broader criteria (UCSF, Kyoto, Pamplona). Locoregional treatments such as TACE or SIRT are very useful for assessing the biological behaviour of HCC and also for achieve down staging, allowing the rescue of initially inoperable patients.

Learning Objectives:

1. To learn about the main factors behind the resectability of HCC.
2. To learn about the evolving criteria for liver transplantation.
3. To understand the potential role of radiologists in the intraoperative or post-operative management of HCC.
4. To learn about complications of locoregional therapies (percutaneous ablation or intraarterial therapies) that could complicate resection or transplantation.

A-079 09:20

Hepatology/oncology

B. Sangro; Pamplona/ES (bsangro@unav.es)

The scientific basis supporting the current treatment paradigm of hepatocellular carcinoma (HCC) is relatively weak due to the scarcity of large-scale randomised clinical trials. Several staging systems have been developed and most of them take into account not-only tumour burden but also liver function, since the frequently underlying cirrhosis may determine prognosis as much as tumour growth does. In Europe, the Barcelona Clinic Liver Cancer (BCLC) system has been endorsed by EASL and EORTC. Generally speaking, patients with small tumours are ablated surgically (resection or liver transplantation depending on the presence of cirrhosis) or percutaneously (radiofrequency or ethanol injection). Intraarterial procedures (bland embolisation, chemoembolisation or radioembolisation) are used for larger or multiple tumours not extended beyond the liver, while systemic therapy is used for patients with extrahepatic disease or a contraindication to transarterial therapy (mainly because of portal vein thrombosis). However, guidelines issued by different scientific societies worldwide diverge in the definition of patients that benefit the most from each treatment. Sorafenib (an oral agent with antiangiogenic properties) has been shown to prolong the survival of patients with unresectable, advanced disease and preserved liver function. After this proof of concept, a great number of clinical trials exploring agents with different molecular targets have been launched but so far none of this trial has yielded positive results. Sorafenib has failed to show any advantage in survival when given in combination with chemoembolisation and its role as an adjuvant therapy after resection or ablation is currently being studied.

Learning Objectives:

1. To learn the basis of tumour staging in HCC and the general treatment paradigm.
2. To learn about the discrepancies between different treatment guidelines and clinical practice.
3. To become familiar with systemic anticancer agents and their impact on locoregional and surgical treatment of HCC.

Author Disclosure:

B. Sangro: Advisory Board; Bayer Healthcare and Sirtex Medical. Speaker; Bayer Healthcare and Sirtex Medical.

Case presentation and discussion

09:35

08:30 - 10:00

Room F2

Special Focus Session

SF 4a

"MRI of the lung: to go?"

A-080 08:30

Chairman's introduction: "Apéritif"

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

MRI of the lung has experienced a series of groundbreaking technological developments in recent years. Most of them are related to imaging speed, gating and signal enhancement. It is now ready "to go" and to be used in clinical routine. Prerequisite is an easy-to-use standardised protocol off the shelf, which can be customized to clinical needs. Certainly, MRI rivals CT in many areas, however, the unique combination of structural and functional aspects in a single examination without using ionising radiation is an extraordinary asset. Patients suffering from vascular lung disease, e.g. pulmonary arterial hypertension and embolism, as well as neoplasms of the lung and mediastinum or inflammatory lung disease, especially, cystic fibrosis, pneumonia and pneumonitis will greatly benefit from the advantages of MRI. In patient population, such as children, younger subjects and pregnant women, MRI should clearly be preferred to CT for these indications. Therefore, when you return to your clinical environment consider and apply MRI of the lung more and more often: it is straightforward to do. Cheers!

Session Objectives:

1. To learn how to do MRI of the lung in clinical routine.
2. To understand the rationales and potential clinical applications of MRI of the lung.
3. To understand the prerequisites for acceptance of MRI of the lung by our clinical colleagues.

Author Disclosure:

H. -U. Kauczor: Advisory Board; Siemens. Investigator; Boehringer Ingelheim. Speaker; Siemens, Boehringer Ingelheim, Bayer, Bracco.

A-081 08:33

The sequence buffet

J.M. Wild; Sheffield/UK (j.m.wild@sheffield.ac.uk)

MRI of the lungs has evolved radically in the last ten years to the point that it is now becoming used routinely in clinical practice. This talk will focus on the technical challenges and solutions for imaging lung structure and function with MRI methods using both the endogeneous protons in the lungs and inhaled magnetic contrast agents. The low proton density in the lungs (~0.1 g/cm³) and the magnetic inhomogeneity between tissue and air (susceptibility difference ~8 ppm) make structural proton MRI of the lung micro-structure challenging, particularly at higher B0 fields. Short echo time pulse sequences, parallel imaging and respiratory gating can all help improve proton anatomical MRI. Signal from the major pulmonary vessels can be enhanced using paramagnetic contrast agents and T1-weighted ultrafast pulse sequences for volume coverage providing 3D pulmonary angiograms. Pulse sequence methods for pulmonary angiography and time resolved pulmonary perfusion mapping will be covered. The role of under sampled and view shared sequences with parallel imaging will be discussed within the constraints of tradeoffs between spatial and temporal resolution. Again the focus will be on technical challenges with a "how to do it" theme. Clinical images will be used as a means of highlighting the applications of the respective methodologies.

Learning Objectives:

1. To learn about the basic physics of MR imaging of protons in the lung.
2. To understand the role of different magnetic field strengths and parallel receiver coils.
3. To appreciate the potential of fast imaging sequences for imaging the lung.

A-082 08:48

Preparing your menu

J. Biederer; Heidelberg/DE (Juergen.Biederer@med.uni-heidelberg.de)

Compared to other lung imaging modalities, magnetic resonance imaging might be considered complex and difficult to use in clinical routine at first sight. However, in practice, the application is facilitated by dedicated, pre-set protocol trees customized for typical clinical questions. The procedures are simplified by avoiding ECG triggering or other time-consuming preparations for the examination. A basic protocol to be acquired within less than 15 min without administration of contrast material covers most clinical problems including infiltrates and lung nodules almost equally to CT. Excellent soft tissue contrast facilitates tumour staging, e.g. the differentiation of tumour and atelectasis or the diagnosis of mediastinal and chest wall masses. Visualisation of respiratory motion contributes functional information. Additional, contrast-enhanced series to be acquired within 5 more minutes increase the sensitivity of the examination for the detection of tumour necrosis and pleural reaction/carcinosis. A dedicated protocol for the diagnosis of pulmonary embolism can be acquired within 15 min. This comprises an initial, free breathing and non-contrast-enhanced examination for quick detection of severe embolism combined with dynamic contrast-enhanced perfusion imaging, a high-resolution angiogram and a final 3D breath-hold acquisition. These pre-set protocols offer solutions for tricky problems of daily routine, in the lungs and the chest wall as well as for imaging the mediastinum, or for cases in which radiation exposure or administration of CT contrast material should be strictly avoided, e. g. in paediatrics, pregnant women or for scientific studies.

Learning Objectives:

1. To learn how to combine MR sequences with a comprehensive imaging protocol.
2. To become familiar with the different diagnostic scopes of the protocol components.
3. To learn how to apply protocol variations for specific clinical questions.
4. To learn when to use IV contrast-enhanced series.

Author Disclosure:

J. Biederer: Speaker; Siemens.

A-083 09:03

Bon appétit! Starters": cystic fibrosis, pneumonia and pulmonary embolism

M.U. Puderbach; Heidelberg/DE (m.puderbach@dkfz.de)

CF: MRI is comparable to CT with regard to the detection of relevant morphological changes in the CF lung. Compared to CT, the strength of MRI is the additional assessment of „function“, i.e. perfusion, pulmonary haemodynamics and ventilation. In CF, regional ventilatory defects cause changes in regional lung perfusion due to the hypoxic vasoconstriction response or tissue destruction. Using dynamic contrast-enhanced MRI, these perfusion changes can be assessed. Pulmonary embolism: The current imaging reference technique in evaluation of acute pulmonary embolism is helical computed tomography. To be competitive with CT, an abbreviated MR protocol focusing on lung vessel imaging and lung perfusion may be accomplished within 15 min in-room time. As a first step, a steady-state GRE sequence acquired in two or three planes during free breathing enables a non-contrast-enhanced detection of large central emboli. As a second step, the protocol continues with the contrast-enhanced steps including first pass perfusion imaging, high spatial resolution contrast-enhanced (CE) MRA and a final acquisition with a volumetric interpolated 3D FLASH sequence in transverse orientation. Pneumonia: The potential of MRI to replace chest radiography, particularly in children, was already investigated several years ago. The experience from this work may be considered valid for the suggested protocols for 1.5-T scanners since image quality has significantly improved. Therefore, T2-weighted fat-suppressed as well as dynamic contrast-enhanced T1-GRE sequences are applied with a slice thickness between 5 and 6 mm. Disease entities encompassing community-acquired pneumonia, empyema, fungal infections and chronic bronchitis are detectable.

Learning Objectives:

1. To understand the application of MRI to morphological and functional imaging of airway diseases.
2. To appreciate the potential of MRI for imaging pulmonary embolisms using different morphological and functional MR-techniques.

A-084 09:23

Bon appétit! Main course": pulmonary and mediastinal neoplasms

E.J.R. van Beek; Edinburgh/UK (edwin-vanbeek@ed.ac.uk)

CT remains one of the main tools for the diagnosis of pulmonary and mediastinal neoplasms. In addition, PET imaging (with or without CT) plays an integral role in planning therapy due to its ability to enhance the staging requirements prior to treatment planning. However, MRI has made significant inroads into aiding treatment decisions and planning. MRI is the mainstay in the management of superior sulcus tumours, tumours where chest wall invasion is suspected and for characterisation of mediastinal tumours. It is now increasingly able to detect, assess and give additional (functional and often more detailed anatomical) information. The use of standard high-spatial resolution imaging in combination with the application of standard and dynamic contrast-enhanced imaging and the utility of ultrafast imaging demonstrating motion of organs and structures of the chest wall and diaphragm further enhance the capability of MRI. Thus, although still mainly reserved as a tool for "difficult cases", it is very likely that MRI will play an increasingly important role in the diagnosis and staging of chest tumours, ranging from lung cancer to mediastinal and pleural processes. This presentation will give examples of benign and malignant processes, linking this with the previously demonstrated menu of sequences now available.

Learning Objectives:

1. To understand the application of MRI sequences to the staging of lung cancer.
2. To become familiar with the role of MRI in lung cancer work-ups.
3. To learn about the limitations of MRI in chest tumours.

Author Disclosure:

E. J. R. van Beek: Advisory Board; Siemens Lung MRI. CEO; Quantitative Clinical Trials Imaging Services, Inc. Speaker; Toshiba Medical Systems, Vital Images.

Panel discussion:

"Bon appétit! Dessert": what are the benefits of MRI of the lung in clinical workflow and decision-making?

09:43

08:30 - 10:00

Room G/H

Neuro

RC 411

The paediatric brain: not just a small brain

Moderator:

C. Venstermans; Edegem/BE

A-085 08:30

A. Neurocutaneous syndromes: more than neurofibromatosis

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

Neurofibromatosis type 1 is the most common, but certainly not the only neurocutaneous syndrome. In children, white matter signal alterations ("myelin vacuoles") are a common neuroimaging finding. The incidences of optic gliomas and other gliomas are increased. Neurofibromas can occur in almost any body region. Plexiform neurofibromas show a diffuse and often locally destructive growth. Neurofibrosarcomas are malignant nerve sheath tumours. Neurofibromatosis type 2 is characterised by acoustic neuromas (vestibular schwannomas), which can be uni- or bilateral. Schwannomas can also affect other cranial nerves and spinal nerves. The incidences of meningiomas and to a lesser extent of gliomas are also increased. The hallmark feature of tuberous sclerosis is the combination of cortical or subcortical tubers and subependymal nodules. Tubers are hyperintense on T2w and FLAIR sequences. Other than heterotopia, subependymal nodules are NOT isointense to gray matter. Giant cell astrocytomas are located at the foramina of Monroi, increase in size over time and show a contrast enhancement. Sturge-Weber disease (encephalotrigeminal angiomas) is characterised by a leptomeningeal angioma and facial naevus flammeus. There is increased leptomeningeal enhancement and hypertrophy of the ipsilateral choroid plexus. Atrophy of the affected region and tramtrack calcifications typically ensue. Von Hippel-Lindau disease is not a neurocutaneous syndrome per se, but was classically considered a phakomatosis. Typical features include haemangioblastomas of the brain, spinal cord or retina, and papillary cystadenomas of the endolymphatic sac. Most neurocutaneous syndromes have manifestations outside the central and peripheral nervous systems as well. Moreover, there are multiple rare neurocutaneous syndromes.

Learning Objectives:

1. To become familiar with the typical clinical presentations of neurocutaneous syndromes.

2. To consolidate knowledge of the typical imaging patterns of the major neurocutaneous syndromes.
3. To become familiar with some less common features of neurocutaneous syndromes.

A-086 09:00

B. Patterns of white matter disease in children

A. Rossi; Genoa/IT (andrea.rossi@ospedale-gaslini.ge.it)

Paediatric inherited white matter disorders can be distinguished into well-defined leukoencephalopathies and undefined leukoencephalopathies. The first category may be subdivided into: (a) hypomyelinating disorders; (b) dysmyelinating disorders; (c) leukodystrophies; (d) disorders related to cystic degeneration of myelin; and (e) disorders secondary to axonal damage. The second category, representing up to 50% of leukoencephalopathies in childhood, requires a multidisciplinary approach in order to define novel homogeneous subgroups of patients, possibly representing "new genetic disorders". An integrated description of the clinical, neuroimaging, and pathophysiological features is crucial for categorizing myelin disorders and better understanding their genetic basis. A review of the MR imaging findings in the main genetic disorders affecting white matter in the paediatric age, including some novel entities, will be provided with a highlight on the concept of pattern recognition.

Learning Objectives:

1. To become familiar with the most common white matter diseases in children.
2. To learn how to differentiate between white matter diseases in children.
3. To consolidate knowledge of appropriate imaging protocols for MRI of children with white matter disease.

A-087 09:30

C. Paediatric brain tumours

C. Hoffmann; Tel Hashomer/IL (chen.hoffmann@sheba.health.gov.il)

In this short lecture, we will discuss the indications for imaging in the paediatric age group, the technique for imaging and the imaging characteristics of brain tumours in general, with examples of common and uncommon brain tumours. An emphasis will be given to new MR sequences, such as MR spectroscopy, perfusion sequences and diffusion tensor imaging. Brain tumours are the second most common type of paediatric cancer. The incidence of supratentorial and infratentorial tumours is equal, in the first two years of life, supra tentorial tumours are more frequent, and infratentorial tumours are more frequent at the 4-10 years age group. Over the 10th year of life there is equal incidence. The location of brain tumours is helping to predict the type of tumour. For example: tumours in the 4th ventricles are mainly medulloblastoma and ependymoma, in the cerebellar hemisphere pilocytic astrocytoma. Tumours of the 3rd ventricles can also be differentiated by the location in the ventricle. DWI sequences help in the diagnosis of the posterior fossa tumours. Tumours with high cellularity will present with low-ADC value (medulloblastoma), whereas tumours with lower cellularity will present with high ADC value (astrocytoma). MRS can also help: lactate and lipids are markers of malignant tumours. The combination of the characteristic location with the DWI and MRS appearance can lead to the accurate diagnosis in most of the cases before the pathology report is ready.

Learning Objectives:

1. To learn about the difference between paediatric and adult brain tumours.
2. To understand the imaging strategy for the paediatric population.
3. To recognise the most common paediatric brain tumours.

08:30 - 10:00

Room I/K

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

MC 428

Essentials in oncologic imaging: what radiologists need to know (part 1)

Moderator:

D.M. Panicek; New York, NY/US

A-088 08:30

A. Principles of oncologic imaging and reporting

D.M. Panicek; New York, NY/US (panicekd@mskcc.org)

Oncologic imaging examinations are often complex and specialized knowledge is required to interpret them in a clinically relevant manner. The radiologist needs to be

aware of the details of the staging system and pattern of spread for a given tumour; the strengths and limitations of available imaging modalities in specific oncologic applications, especially in assessing tumour response to different conventional and newer therapies and various pitfalls in the overall approach to interpretation and reporting of oncologic imaging examinations. Because a radiologic study is only a "snapshot" taken during a brief moment of a patient's medical timeline, meaningful interpretation (the radiologist's "added value") requires integration of current imaging findings with results from various prior radiologic studies and pertinent clinical information. The frequently numerous findings visible on an imaging study need to be distilled into a focused, clinically relevant report; otherwise, the radiologist functions simply as a "film reader" (rather than as a true consultant), and the resultant radiology report may be technically accurate but clinically unhelpful -- or even misleading. Better reports can be produced by using standardized report templates, integrated imaging summaries, and consistent lexicons.

Learning Objectives:

1. To review general principles of oncologic imaging.
2. To understand the critical importance of clinical context during interpretation of oncologic exams.
3. To evaluate ways to ensure that our reports provide added value and reflect the radiologist's role as consultant.

A-089 08:55

B. Lung cancers (primary, metastases)

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

Lung cancer is among the most common malignancies worldwide, and accounts for up to 30% of all lung cancer death annually. In the US, approximately 220,000 new cases are diagnosed every year. Accurate staging of non-small cell lung cancers (NSCLC) and small cell lung cancers (SCLC) is of utmost importance for selecting those patients, who benefit from attempted curative surgery versus those who may undergo palliative treatment. Recently, a new TNM staging system (7th edition) for lung cancer was introduced by the International Union against cancer and the American Joint Committee on Cancer and should now be uniformly used for lung cancer staging worldwide. This staging classification was based on the analysis of a large data base of approximately 70,000 cases of NSCLC and 13,000 cases of SCLC sampled in a multi-institutional effort containing detailed information from 46 institutions in 19 countries. The most important parameter for the developing of the subgroups was overall survival based on disease stage. The major changes involve the T and M categories, resulting in subgroups that would more accurately be associated with prognosis of a patient with defined descriptors. In this course, the new TNM-staging classification will be demonstrated, and case examples will be used to interactively enhance the learning experience of attendees. In addition, the role of imaging methods in evaluating standard and innovative therapy regimen will be discussed, and typical findings and pitfalls will be presented.

Learning Objectives:

1. To review the strengths and limitations of radiologic techniques suitable for detecting and characterising primary and metastatic lesions in the lungs.
2. To understand the imaging findings relevant for lung cancer T, N and M staging, and appraise the implications of the new IASLC lung cancer staging system.
3. To evaluate the imaging findings used to assess response to conventional and new therapies for lung cancers.

A-090 09:25

C. Colon cancer

R.M. Gore, R. Silvers; Evanston, IL/US (rgore@uchicago.edu)

The treatment of colorectal cancer has significantly changed over the last decade. Neoadjuvant chemotherapy and radiation therapy have become the standard of care for rectal cancer. New biologic agents are being used with increasing frequency leading to personalized colorectal cancer therapy. In this presentation, the staging of colorectal cancer is reviewed, the relative role of MDCT, PET-CT, MRI, TRUS in staging these neoplasms, and the applications of molecular imaging in the monitoring of tumour response to therapy is presented.

Learning Objectives:

1. To get an overview of current recommendations for the diagnosis of colorectal cancer.
2. To understand the specific role of MDCT, MR imaging, endoscopic ultrasound, and PET/CT in the staging of colorectal cancer in optimising patient management.
3. To learn the utility of imaging in assessing tumour response to therapy and in the general follow-up of patients with colorectal cancer.

Questions

09:50

08:30 - 10:00

Room L/M

Organs from A to Z: Heart

MC 422

Non-ischaemic heart disease

Moderator:

V.E. Sinitsyn; Moscow/RU

A-091 08:30

A. Congenital heart disease

M. Gutberlet; Leipzig/DE (matthias.gutberlet@herzzentrum-leipzig.de)

The numbers of newborns with congenital heart disease (CHD) is not rising but the number of infants with congenital heart disease who achieve adulthood is constantly increasing due to improved medical treatment especially in cardiac surgery and paediatric cardiology. The imaging modality of choice during infancy in patients with congenital heart disease is echocardiography. But in older patients, especially after cardiac surgery, it becomes very often more and more difficult to achieve an adequate acoustic window to assess important anatomical structures. In particular the visualisation of the right ventricle, which is involved in many CHD, becomes difficult. Therefore, all cross-sectional imaging modalities, especially magnetic resonance imaging but also computed tomography, and also the radiologist comes into play. The pros and cons of the different imaging modalities will be discussed as well as the possibilities in common diseases like coarctation, tetralogy of Fallot and Transposition of the Great Arteries.

Learning Objectives:

1. To understand the value of available imaging modalities in congenital heart disease.
2. To get an overview of common cases of congenital heart failure.
3. To learn how to read post-surgical cases in patients with congenital heart disease.

Author Disclosure:

M. Gutberlet: Research/Grant Support; BmBF (German Federal Ministry of Education and Research), Competence Network of Congenital Heart Defects. Speaker; Bayer, Bracco, Siemens, Philips and GE.

A-092 08:50

B. Valvular disease

J. Bogaert; Leuven/BE (Jan.Bogaert@uz.kuleuven.ac.be)

In recent years there has been an increased use of cardiac MRI and to a lesser extent also cardiac computed tomography (CT) to assess valvular heart disease. Both techniques have shown to provide complementary often unique information compared with conventional techniques such as echocardiography and cardiac catheterization (x-ray angiography). When investigating cardiac valves, the information is required on 1. clarification of the affected valve after auscultation of the heart; 2. definition of the valvular anatomy; 3. assessment of valvular function and 4. definition of the effect of the valvular dysfunction on other cardiac structures and function. These questions can be addressed by combining echocardiography with x-ray angiography. However, MRI can provide the required information in a single investigation that is safe, non-invasive and without exposure to x-rays. Moreover, both MRI and CT are increasingly used as pre-procedural imaging in patients scheduled for transcatheter, percutaneous treatment, ensuring optimal patient selection and safe implantation. Furthermore, with the increasing acceptance of cardiac MRI for the assessment of valvular heart disease, there has been an increase in the amount of follow-up and outcome data that enables MRI to be used to define when patients should undergo treatment of their valve disease. In this presentation, an overview of the MRI and CT techniques that are currently used in the assessment of valvular heart disease, discussing the advantages and limitations of these techniques with reference to more conventional imaging modalities for investigating valvular heart disease.

Learning Objectives:

1. To learn about various imaging modalities available for imaging the cardiac valves.
2. To get an overview of various types of valvular diseases.
3. To understand myocardial changes caused by valvular pathologies.

A-093 09:10

C. Cardiomyopathies

P. Sipola; Kuopio/FI (petri.sipola@kuh.fi)

Cardiac magnetic resonance imaging (CMRI) is highly valuable in the differential diagnosis of cardiomyopathies. MRI diagnosis is based on cine imaging of cardiac function, T2-weighted imaging of oedema and late gadolinium-enhanced (LGE) patterns of scar tissue. Hypertrophic cardiomyopathy (HCM). Left ventricular hypertrophy (LVH) is typically located in basal septum and anterior wall but has variable expression (diffuse, localised). Associated abnormalities include left ventricular (LV) high-ejection fraction (EF), mitral valve abnormalities, apical aneurysm, and right ventricular (RV) hypertrophy. Scattered intramyocardial LGE may occur in various patterns. The differential diagnoses in patient with hypertrophic phenotype include pressure overload hypertrophy, amyloidosis, sarcoidosis, and Fabry's disease. LGE patterns are useful in differentiation. Dilated cardiomyopathy (DCM): Dilated LV end-systolic volume and impaired EF% are characteristics. Non-ischaemic DCM typically shows no LGE (in contrast to ischaemic cardiomyopathy). Sometimes faint midwall enhancement can be observed, which has prognostic value. Presence of extensive non-compacted myocardium indicates non-compaction cardiomyopathy. Arrhythmogenic right ventricular cardiomyopathy (ARVC): The RV volume is enlarged and akinetic RV segments can be seen. Local bulging or dyskinesia in conjunction with fatty infiltration and LGE is typical. Restrictive cardiomyopathy (RCM): Enlarged atria and normal sized ventricles with preserved EF% and no LGE are characteristics. Myocarditis: LV systolic function is typically lowered but may be normal. T2 images may show increased signal. LGE limited to the subepicardial myocardium is highly suggestive of myocarditis. Iron overload cardiomyopathy: Cine imaging is used to assess LV global function and T2*-weighted imaging to quantitate ventricular iron deposition.

Learning Objectives:

1. To get an overview of different types of cardiomyopathies.
2. To differentiate typical imaging findings in various cardiomyopathies.

A-094 09:30

Interactive case discussion

V.E. Sinitsyn; Moscow/RU (vsini@mail.ru)

Clinical cases of congenital heart disease, valvular disease and cardiomyopathy have been presented. Combined use of cardiac MRI and CT give both morphological and functional information about heart structure, function, myocardial perfusion and myocardial viability. Cardiac CTA is superior in depicting general cardiac and extracardiac congenital abnormalities, such as anomalies of coronary vessels, systemic and pulmonary veins, bronchi, pulmonary collaterals, etc. Cardiac CT can be used for diagnosis of valve abnormalities, especially in cases of aortic valve diseases. Cardiac MRI provides quantitative and qualitative information about intracardiac blood flow (shunts), cardiac valve function, structure of myocardium. Late enhancement pattern in patients with cardiomyopathies has both diagnostic and prognostic value. Rationales for selection of different protocols for cardiac CT and MRI in patients with non-ischaemic heart diseases are discussed.

08:30 - 10:00

Room N/O

EIBIR/EORTC Joint Workshop

A radiologist with a ruler in his hand is a dangerous person: seeking standardisation in multicenter imaging trials

Moderators:

P. Brader; Vienna/AT

Y. Liu; Brussels/BE

A-095 08:30

Introduction: imaging and the future of cancer therapy

P. Brader¹, Y. Liu²; ¹Vienna/AT, ²Brussels/BE (peter@brader.md)

The use of imaging biomarkers will become more important in clinical trials in the future. Non-invasive imaging enables associations between therapy and effect, providing morphologic but also functional information. Assessment of tumour burden and time to the development of disease progression is of importance in clinical evaluation of cancer therapy, however, with increasing use of cytostatic over cytotoxic targeted agents, response evaluation using conventional morphologic assessment is limited and usually takes longer to detect response compared to functional and molecular imaging techniques. Therefore, the question is raised whether it is time to move from anatomic assessment of tumour burden to functional and molecular

assessment. Imaging biomarkers like apparent diffusion coefficient (ADC) reflect cell density/death/apoptosis, contrast enhanced magnetic resonance imaging (CE-MRI) or computer tomography (CE-CT) detect early changes of micro-vascularisation and perfusion in tumours, and magnetic resonance (MR) spectroscopy shows biochemical changes in the tumour tissue. Undoubtedly, these advanced functional 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. In this session, a road map for future collaboration between EORTC and EIBIR will emerge with the aim of seeking standardisation of advanced MR technology in multicenter cancer clinical trials.

Learning Objectives:

1. To seek standardisation of imaging biomarkers in multicenter cancer clinical trials.
2. To demonstrate examples of imaging implementation in optimised study design.
3. To explore future collaboration between EORTC and EIBIR.

A-096 08:40

Setting up clinical trials with functional imaging end-points: trials and tribulations

N.M. [deSouza](#); Sutton/UK (Nandita.Desouza@icr.ac.uk)

The standard imaging assessment of tumour response relies on size measurements, which, with predominantly cytostatic targeted agents, may not reflect the drug effect. Functional imaging biomarkers have the potential to quantify biological characteristics of tumours and measure on-target and off-target effects that indicate early likelihood of response to a specific therapy, which can then be used to guide the optimal biological dose and drug schedule. Serial, non-invasive assessments of whole tumour are possible. This is particularly important in the context of inter and intra-patient tumour heterogeneity as different parts of the tumour and primary vs metastatic lesions may be biologically different and these characteristics may change with treatment. However, functional imaging end-points suffer from variability, which can be very significant in a multicentre setting. Strict Quality Assurance and Quality Control measures need to be implemented at the start of a trial and the variability across centres documented. Data acquisition protocols need to take account of equipment variations. Data analysis methodology needs standardisation of software, central review and preferably double reading of scans. Automation may not always prove the most robust and reliable option. This presentation will focus on the factors that are crucial in determining the compatibility of data in multicentre trials with functional imaging end-points.

Learning Objective:

1. To understand the processes involved in incorporating functional imaging end-points into clinical trials and appreciate the limitations.

Author Disclosure:

N. M. deSouza: Research/Grant Support; Cancer Research UK, Medical Research Council UK, Engineering and Physical Sciences Research Council UK, National Institute for Health Research (NIHR) UK.

A-097 09:00

Challenges, problems on key imaging techniques

B. [Van Beers](#); Clichy/FR (bernard.van-beers@bjn.aphp.fr)

Imaging methods used in clinical trials of new drugs should be able to objectively assess the early response to treatment. Therefore, the imaging biomarkers should be validated and standardised and quality control should be performed. The amount of validation depends on the type of clinical trials. In phase 1 and 2 clinical trials, pharmacokinetic/dynamic biomarkers may be sufficient for taking "go/no go" decisions. In phase 3 trials, surrogate imaging markers of hard endpoints, such as survival or time to progression, are required. The reproducibility of the imaging biomarker is an important factor that should be taken into account. Standardisation should concern both the image acquisition and analysis methods. Quality control may require repeated phantom measurements and central reading. Finally, the cost benefit of the imaging biomarkers should be considered relative to that of non-imaging biomarkers.

A-098 09:20

Advanced MR neuroimaging in multicentre trials: experience from the EORTC Brain Tumour Group

M. [Smits](#); Rotterdam/NL (marion.smits@erasmusmc.nl)

Anaplastic gliomas constitute a group of brain tumours with heterogeneous clinical behaviour, and the optimal treatment strategy is still a matter of debate. Conventional MR imaging, including T2w/T2-FLAIR and contrast enhanced T1w sequences,

has only modest diagnostic value for the assessment of such tumours. 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 (anaplastic) 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 4 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.

A-099 09:40

Presentation of LUNG study: from the beginning until today

U. [Nestle](#); Freiburg/DE (ursula.nestle@uniklinik-freiburg.de)

The LungTech trial will be a European multicenter study addressing the challenge of stereotactic radiotherapy for small centrally located lung tumours. High precision radiotherapy poses special needs on pre-treatment assessment and target volume definition. Post treatment, radiation induced normal tissue alterations may lead to diagnostic problems and misinterpretations. Therefore, imaging research will play a major role in the study concept. Beyond pre-treatment staging, 3D and 4D imaging will be used for target volume delineation, positioning and follow-up concerning tumour control and toxicity. Several translational imaging research projects will or may be attached to this study. These involve 4D FDG PET/CT for target volume delineation, serial FDG PET/CT for evaluation of local control, DCE CT, and chest MRI. Besides insights in high precision radiotherapy for lung tumours, the concepts and methods of the related imaging studies will be discussed, obstacles and challenges will be discussed.

08:30 - 10:00

Room P

Professional Challenges Session

PC 4

The visibility of the radiologist

A-100 08:30

Chairman's introduction

J.A. [Reekers](#); Amsterdam/NL (jimreekers@xs4all.nl)

For decades, radiology practise was located in the basement of the hospital, no daylight and no natural relation to the rest of the hospital. This was more or less the natural habitat. The radiologist was "the person" taking the pictures, he was not perceived as a doctor whose opinion would value the patient directly. During the last decade, the radiologist has come to the light, changing from light box to computer screen, and has started to become more involved in clinical decision taking. However, there is still a lot, which can be improved before the radiologist is a fulltime member of the clinical multidisciplinary treatment team. Reporting and at the same time, combining this with knowledge about treatment will contribute to this role and increase the visibility of the radiologist. The guidance of radiology in cancer treatment is a good example of this. Clinical involvement in combination with delivering care and treatment, like in interventional radiology, will also improve the visibility of the radiologist within the hospital. The radiologist should learn how to make alliances with other medical specialists. To achieve these goals, it is also crucial to understand the importance of having a prominent place for radiology in the medical curriculum. In modern medicine, radiology needs to play a central role in diagnosis and treatment. The visible radiologist should be a clinical doctor, a conductor and a Webmaster in one. This special session will give suggestions and information how to achieve this.

Session Objectives:

1. To learn how the visibility of the radiologist can be increased.
2. To understand that radiology needs to play a central role in diagnosis and treatment.
3. To learn from the experts and increase understanding through Q & A.

A-101 08:33

How to optimise the visibility of the radiology department

J.A. Reekers; Amsterdam/NL (jimreekers@xs4all.nl)

For decades, the radiology department was located in the basement of a hospital. Radiation was the main reason for this stuffy and airless environment. A clinician did not go to a radiology department, the pictures were sent to him, sometimes with a note describing what could be seen on the pictures. Imaging was easy and most medical specialists could read the film related to their own specialty. This has now changed dramatically, reading diagnostic images has become very complicated with the new imaging modalities and consultation on which imaging technique fits best with a clinical question is now the domain of the radiologist. With this new position also a new department has to be structured as a service-centre. First of all, out of the basement and centrally located in the hospital. All medical conferences where imaging plays an important role should take place at the radiology department. This means that smaller and larger conference rooms with state-of-the-art projection and access to a PACS should be build. As all reading is done from a computer screen, workspaces should be able to facilitate interactive medical specialist discussions. Radiology departments should be organised around medical subspecialties with fixed stations to make it easy for specialist to find there diagnostic partner. Natural light is important but if this is not possible daylight systems will improve the well being and ambiance at a department. In this session some important details will be discussed about how to increase the radiologist's visibility by building an open department.

Learning Objectives:

1. To learn how to organise a radiology department within a hospital.
2. To learn how to optimise contact with clinical partners.
3. To learn how to create an open radiology department.

A-102 08:45

Start early with radiological visibility

M. Maas; Amsterdam/NL (m.maas@amc.nl)

The future of radiology depends on what current medical students think of radiology and how they are attracted into the field. There is a high responsibility for academic radiologists to increase awareness amongst medical students considering the pivotal role of radiology as clinical specialty and of the opportunities in the field of radiological research. Radiology has got very powerful selling points: Radiology has got images (one image is more than 1000 words), Radiologists are used to perform (in clinical meetings), Radiology is the most Computer Integrated Specialty, Students nowadays are computer centered learners (digital natives, Homo Zappiens). Possible strategies to reach the goals are: 1. Teaching (Radiological Anatomy, in combination with department of Anatomy, Computer-based learning programs, Moderating small group learning); 2. Faculty development (Clinical rotations, Mentoring medical students); 3. Curriculum development (Board Medical school, National Advisory Boards). Some steps need to be taken, to be successful in this track. Head of the Department strategically needs to reserve time and money for some staff to pursue this goal. The individual Radiologist needs training in the field of education, attends courses on curriculum building and faculty development, as well as on preparation of exams and on class room performing. CME credits in the field of Medical Education need to be obtained. Furthermore, the person needs to be willing, creative and flexible, while skills in mentoring and providing feedback on students also are important to develop. IT IS GREAT FUN!

Learning Objectives:

1. To learn how to set up an undergraduate teaching programme for radiology.
2. To learn how to overcome the barriers of a traditional curriculum.
3. To learn about the results of an undergraduate teaching programme for radiology.

A-103 09:05

Clinical radiology puts you in the spotlight: taking over the clinical responsibility

E. de Kerviler; Paris/FR (eric.de-kerviler@sls.aphp.fr)

Clinical radiology is the use of imaging to diagnose, treat and monitor various disease processes. Radiology is somewhat different from most other clinical practices because there is in theory a relatively weak connection to the individual patient. However, there are subspecialties of Radiology, which include a lot of patient interaction. Unfortunately, the volume and complexity of imaging work has driven many radiologists underground. There are many other factors that influence a radiologist's clinical implication such as administrative, managerial, teaching or research duties. The radiologist must however recover his place in patients' management, from imaging workup to therapeutic decision. This begins in guiding

physicians in the appropriate use of diagnostic imaging studies. The radiologist's participation in clinical meetings is also mandatory, but this takes time and necessitates speaking the same language as clinicians, reading the same journals. As an example, clinicians rely more than ever on imaging studies to assess tumour response to various treatments. This hidden and time-consuming work is often not well recognised and rewarded. Lastly, answering clinicians' questions needs adequate reporting, avoiding disorganized and imprecise document that can rarely be taken seriously by colleagues.

Learning Objectives:

1. To learn how to become more clinically involved.
2. To learn about the requirements of clinical radiology.
3. To learn how to manage the clinical problems of others.

A-104 09:25

Radiology in the 21st century: time to come out of the dark?

A. Adam; London/UK (andy.adam@kcl.ac.uk)

In a few years, we are likely to see 3D images generated instantly, and with comparable resolution to today's 2D views. The detail on these images will make them increasingly relevant as detailed diagnostic and presurgical planning tools. Inclusion of functional information, possibly at the molecular level, could also assist in clinical decision-making. Specialist surgeons and physicians with intimate knowledge of their field of interest are likely to have a better understanding of the anatomy and physiology of an organ system than a general radiologist. So given that the images will be presented in a more familiar format, why should clinicians and surgeons wait for a general radiologist to read them? If radiologists wish to retain their role as the experts in image interpretation, they will not only need a thorough understanding of imaging, but also a detailed understanding of anatomy and pathophysiology and they will need to subspecialize. In addition to subspecialization, radiologists will need to play an important role in the determination of patient pathways. The way radiology is used at present is inefficient, as it is driven by requests for investigations by physicians who are not equipped to use imaging efficiently. Radiologists should be proactive, and should communicate with referring physicians and with patients when significant abnormalities are detected, planning further investigations rather than simply responding to requests. This will help to arrive at a diagnosis at an earlier stage, will save money and will improve clinical outcomes.

Learning Objectives:

1. To learn about the role of the radiologist as quality controller.
2. To learn how to become proactive and drive patient pathways rather than simply responding to requests.
3. To learn about improved visibility through improved service.

Panel discussion:

Should we improve the visibility of the radiologist? And if yes, how? 09:45

08:30 - 10:00

Room Q

Special Focus Session

SF 4b

Justifying CT in paediatric radiology

A-105 08:30

Chairman's introduction

C. Owens; London/UK (owensc@gosh.nhs.uk)

This session will provide a vitally important opportunity to listen to experts discussing the core issues which we face in a world with increasing expectations and demands on the imaging world. That is to provide the best quality images in the most challenging group of patients, i.e. children. The sensitivity of organs to radiation and the expectations of longer survival with state of the art treatment (for diseases which were previously lethal) dictates that we must act with prudence when choosing the best and most appropriate imaging modality to answer the relevant diagnostic question. The attendee will have an opportunity to indulge in the opinions and expertise of the speakers from various relevant subspecialties.

Session Objectives:

1. To become familiar with the importance of CT justification and optimisation.
2. To understand the evidence base for concern.
3. To become familiar with realistic alternatives to CT.

A-106 08:34

How should CT be optimised?

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

In general, optimisation aims at maximising the benefit of a procedure while at the same time minimising potential risks or side effects. In paediatric radiology, this means that dose should be kept to the minimum necessary for adequate image quality. The aim of this lecture is to focus on dose issues and on options for reducing patient's dose without impairing image quality. Dose levels today are typically quoted at 1 to 15 mSv as effective dose per CT scan and will depend on the examination and on the anatomic range examined. The underlying dosimetry issues will be discussed briefly. Modern CT scanners offer a variety of means for reducing dose without a detriment in image quality. The availability of voltage values below the standard 120 kV setting is one of the most important steps. Model-based iterative image reconstruction, dedicated filtration, tube current modulation and automated exposure control are further examples which will be discussed. These measures have to be complemented by proper assessment of dose and by providing the respective information to the user on the console. Respective tools will be presented. The current trend is to bring doses in paediatric CT down to the sub-mSv range and thereby to increase the benefit-to-risk ratio further. „As high as reasonably achievable“ or AHARA is the goal regarding this ratio.

Learning Objectives:

1. To become familiar with the dose levels currently encountered in paediatric CT.
2. To become familiar with new developments towards dose reduction in CT.
3. To learn about tools for assessing organ dose and effective dose values.

Author Disclosure:

W. A. Kalender: CEO; CT Imaging GmbH, Erlangen, DE. Consultant; Siemens Healthcare, Erlangen, DE. Founder; CT Imaging GmbH, Erlangen, DE. Owner; CT Imaging GmbH, Erlangen, DE. Research/Grant Support; Siemens Healthcare, Erlangen, DE; CT Imaging GmbH, Erlangen, DE.

A-107 08:56

When, how, and why I perform CT

C. Owens; London/UK (owensc@gosh.nhs.uk)

This presentation will help the attendee to understand how CT must be used with caution in children, and appropriate justification will be discussed in detail. We will give recommendations for appropriate use of in children, with examples of weight-based protocols, used in house, for paediatric body imaging. Various tips and tricks for enhancing images with different acquisition techniques and post-processing will be shown using cardiothoracic models. Relative strengths and weaknesses of the various modes of CT acquisition which can be prescribed by the attending radiologist will be discussed, and analysed.

Learning Objectives:

1. To become familiar with the concept of CT 'fit for purpose'.
2. To appreciate the role of CT in paediatric body imaging.
3. To become familiar with suggested parameters for use of CT in cardiothoracic imaging, describing risks and benefits.

A-108 09:18

Why and when CT does not need to be performed

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

While CT examination provides major clinical information in many cases, two other modalities which do not entail ionising radiation exposure have to be considered as appropriate methods and/or substitutes to CT in children and adolescents, in respect to an ALARA approach. Ultrasound (US) is a well assessed, low-cost and non-invasive modality, widely used for a large spectrum of diseases. It has to be considered as the first imaging modality in the emergency room and intensive care unit (ICU). New applications also include chest US, musculoskeletal US and flow imaging. Recent advances allow encompassing previous technical limitations, including high-frequency probes, fast imaging, elastography and volume imaging. Contrast-enhanced sonography is still waiting for approval in the paediatric population. Paediatric US requires appropriate experience and sufficient allocation of technical and human resources to ensure high-quality performance. MRI offers another interesting alternative to CT. High-resolution images with various spontaneous contrast patterns are useful for morphological evaluation, and in some cases for characterisation of lesions. However, long exam times, sedation, motion artefacts, and cost are barriers to expand the use of MRI. This may be partly reduced by technical improvements, such as high-field systems, acceleration and navigation processes. The place of US and MRI in diagnostic strategies will be discussed in abdominal imaging, including in emergency and ICU, renal

and chest imaging, in comparison with CT. Moreover, functional applications of MRI represent a promising field, challenging for example scintigraphy, an ionising modality, in measurement of renal function.

Learning Objectives:

1. To become familiar with alternative imaging methods to replace CT.
2. To appreciate the advantages and disadvantages of these alternative methods of imaging.
3. To become familiar with a practical model for CEUS and MRI in body imaging.

Panel discussion:

Do we have guidelines for paediatric CT? Do we have alternatives? 09:40

10:30 - 12:00

Room A

Interactive Teaching Session

E³ 520a

Pitfalls in abdominal imaging

A-109 10:30

A. Liver

V. Vilgrain, M. Ronot, A. Kerbaol, O. Bruno; Clichy/FR (valerie.vilgrain@bjn.aphp.fr)

The purpose of this lecture is to emphasize some pitfalls in liver imaging. Morphologic changes in the liver are usually attributed to chronic liver disease where liver cirrhosis represents the most important cause. However, non-cirrhotic diseases may also induce atropho-hypertrophic changes of the liver. The most common mechanisms are related to venous obstruction (either portal or hepatic venous) and biliary obstruction. Multidetector CT and MR imaging are essential to highlight these abnormalities. When dealing with liver tumours, the most important question that has to be solved is tumour characterisation. Yet, it is often difficult to assess whether a large tumour is intra- or extrahepatic. Imaging findings that might be helpful will be shown. Last, some liver lesions can mimic liver tumours. Vascular disorders and focal fatty changes or focal fatty sparing are the most common causes. Some other conditions can be also mimickers and such cases will be shown.

Learning Objectives:

1. To learn about morphologic changes in the liver observed in non-cirrhotic diseases.
2. To understand imaging features enabling distinction between intra and extra-hepatic tumours.
3. To become familiar with liver lesions mimicking liver tumours.

A-110 11:15

B. Pancreas and bile ducts

R. Manfredi; Verona/IT (riccardo.manfredi@univr.it)

The technique and the anatomy of the bile duct and pancreatic duct will be described. Anatomical variants of the biliary duct and the pancreatic duct system will be analyzed and their possible role in generating diagnostic imaging pitfalls, will be described. Strategies to avoid pitfalls in diagnostic imaging of the bile duct and the pancreatic duct system will be illustrated, considering the possible source of pitfalls. Diagnostic imaging findings of different diseases involving the biliary ducts and pancreatic duct system will be illustrated, as well as the diagnostic imaging criteria useful for the differential diagnosis.

Learning Objectives:

1. To understand the MRI technique for evaluating the pancreatic parenchyma, the pancreatic duct system and the biliary tree, the functional assessment following secretin stimulation.
2. To appreciate the signs in MR imaging of the pancreas and bile ducts.
3. To understand the diagnostic imaging criteria useful for differential diagnosis.

10:30 - 12:00

Room B

ESR meets Spain

EM 1

Imaging: essential tool from diagnosis to treatment

Welcome by the ESR President:
G.P. Krestin; Rotterdam/NL

Presiding:
C. Ayuso; Barcelona/ES
J.I. Bilbao; Pamplona/ES

A-111 10:30

Introduction

C. Ayuso; Barcelona/ES (cayuso@clinic.ub.es)

Radiology had been continuously improving since x-rays were discovered by C. Roentgen in 1895, until nowadays. The technological developments had been dramatically followed and new tools and complex procedures guided by means of imaging techniques had been developed. These facts had been crucial for the clinical approach of Radiology in the recent decades. The organ-system organization of Radiology conducted us to focus in more specific scenarios, allowing us to acquire deep knowledge on specific fields. Knowledge on Radiology is based on evidence nowadays. This has been the basis of the tremendous impact of including Radiology in the task of multidisciplinary teams where radiologists have an interesting role in the decision making process. The session will include three particular scenarios where radiologists have a crucial role from the diagnosis of the disease, to the treatment and the follow-up of the patients.

Session Objectives:

1. To discuss the role of imaging techniques in different clinical scenarios where radiologists are key, from diagnosis to treatment.
2. To present technical imaging innovations that assist the diagnosis, treatment and follow-up in three different clinical scenarios: ischaemic stroke, aortic aneurism and hepatocellular carcinoma.
3. To present specific clinical advantages and results of the multimodality approach.

A-112 10:35

Ischaemic stroke

J. Macho; Barcelona/ES (jmmacho@clinic.ub.es)

Interventional neuroradiology (INR) has become an essential tool during the last decades in the management of hemorrhagic stroke as well as in the diagnosis and treatment of the different vascular lesions that may lead to them (aneurysms, AVM's, Dural Fistulas, etc). However, the role of INR in the treatment and prevention of ischemic stroke has been controversial, with carotid stenting, intracranial stenting and intraarterial techniques in acute stroke, being frequently under debate. Lately, new devices and technology specifically designed for intracranial thrombectomy in acute stroke have shown their effectiveness in revascularization with better reperfusion rates than those achieved with intravenous lytics or previous thrombectomy devices. However, these good revascularization rates were not always correlated with good clinical outcomes. Advanced multimodal imaging techniques have been advocated as essential in the decision-making algorithm in order to achieve better long-term clinical outcomes. Morphological (angioMR - angioCT) and especially perfusion imaging techniques (perfusion computed tomography and diffusion and perfusion weighted magnetic resonance) have proved to be effective in the identification of cerebral penumbra in acute stroke and thus in the selection of patients for thrombolytic therapy, being both techniques equivalent in this task. Multidisciplinary stroke teams in which diagnostic and therapeutic neuroradiology plays a significant role are achieving excellent rates of clinical recovery in this otherwise devastating disease. We will show algorithm protocols and stroke unit designs specifically addressed to improve clinical outcomes in those patients selected for Intraarterial treatment and with the aim to increase the number of patients eligible for revascularization.

Learning Objectives:

1. To discuss the clinical and neuroradiologic implications of an early diagnosis. Evaluation of CT and MR diffusion/perfusion in patient selection for endoarterial treatment.
2. To understand the rationale behind mechanical endoarterial reperfusion of acute vascular occlusion.
3. To analyse the short and medium term results of a regional programme for acute stroke treatment after three years.

Author Disclosure:

J. Macho: Consultant; STRYKER, eV3.

A-113 10:55

Interlude: Spanish radiologists: open to the world

E. Fraile Moreno; Madrid/ES (eduardo.fraile@salud.madrid.org)

Founded on February 11, 1917, SERAM, "Sociedad Española de Radiología Médica" is the Scientific Society that groups more than 4,700 members among Spanish radiologist. It is a professional scientific organization dedicated to promoting education, research and development of all diagnostic and therapeutic aspects in relation to diagnostic images. As a society, the main challenges for us are to promote the education of radiologists and courses sponsored and run by SERAM are available for radiologists throughout all of their training. We also hold courses for senior radiologists in specific areas of interest such as oncology, molecular imaging or vascular diseases. SERAM also provides grants to attend different meetings like the ECR in Vienna or RSNA in Chicago and grants in research in collaboration with different companies involved in radiology. Another of SERAM's contributions include promoting the sharing of knowledge creating and releasing different types of publication. Our official journal is called "Radiología." it is the only Spanish radiological publication in PubMed, and is also included in the GORAD portal of radiology magazines. The english version is also available online on our website www.seram.es. Other contribution that SERAM makes are available on our website is the virtual library. In 2009, with the support of SERAM, the book "Radiología Esencial" was published. Establishing standards and references is another of SERAM's contributions, since the year 2000, we have published the reference book of current procedural terminology.

A-114 11:00

Aortic aneurisms

J.J. Martínez Rodrigo; Valencia/ES (martinez.jjo@gmail.com)

Aortic aneurisms are a potentially devastating condition if misdiagnosed or not early detected and corrected. Aortic aneurism rupture prevention with a proper imaging follow-up and treatment indication are essential to provide a standard of care to these patients. Screening programs among elderly and risk patients have been addressed to detect patients with aortic aneurysms amenable to follow-up or treatment. Multidisciplinary teams focused on early detection and treatments of these pathologies have improved the outcomes of this disease. We will describe strategies to develop a multidisciplinary approach to early detection and diagnosis of aortic aneurisms and will describe our experience. Stent graft devices allowed interventional radiologists and other specialists a less-invasive approach to treat aortic patients but new challenges derived from this new treatment related to endovascular treatment complications. The simple bifurcated technique has evolved to treat complex abdominal and thoracic aneurisms by means of fenestrated grafts and branched devices. The totally percutaneous approach with the new low-profile devices and percutaneous suture techniques is a fact. Imaging again is the leading tool allowing us to improve outcomes. We will discuss imaging role in increasing security in performing and guiding these interventions especially in 3D guiding imaging. Radiologists play also a major role in the follow-up of stent grafts to detect endoleaks and other complications. Finding the right approach to solve these problems is mainly dependant on imaging techniques that provide interventional radiologists the tools to plan the adequate treatment strategies.

Learning Objectives:

1. To understand the role of imaging modalities in diagnosis and endovascular treatment of aortic aneurisms.
2. To learn about the role of 3D imaging techniques to assist the endovascular treatment of aortic aneurisms.
3. To appreciate the role of imaging modalities in evaluating the complications of endovascular aortic repair.

A-115 11:20

Interlude: Radiologists and Spanish wines

L. Martí-Bonmati; Valencia/ES (marti_lui@gva.es)

Why are wines different? Which is the influence of the country, the climate and the situation. Why is the soil (and by extension terroir) so important? A wine from a particular patch of ground expresses characteristics related to the physical environment in which the grapes are grown. A combination of certain vineyard sites and grape varieties creates unique wines that faithfully express their geographical origins. But, how do soils affect wine quality? Is it a direct or indirect relationship? What are the scientific explanations for terroir effects? How many soils are present in wine-producing regions? The miracle of the plant kingdom is that these complex

organisms build themselves from virtually nothing: all a plant needs to grow is some water, sunlight, air and a mix of trace elements and nutrients. Many viticultural interventions aim at encouraging the vine to partition nutrients to the grapes so that they ripen properly, rather than concentrating on growing more leaves and stems. Spain is a peninsula with so many different rivers, mountains, seas and climates. Even more, the soil composition of vineyards, one of the most important viticultural considerations when planting grape vines, is so different that a clear explanation has to be done. This will be the focus of this interlude.

Learning Objectives:

1. To understand the influence of the country, the climate and the situation in the quality of wines.
2. To learn about Spain's characteristics that influence the wine quality.
3. To appreciate why the soil (and by extension the terroir) is so important.

A-116 11:25

Hepatocellular carcinoma: the BCLC approach

M. [Burrel](#); Barcelona/ES (marta_burrel@yahoo.com)

Hepatocellular carcinoma is recognised as one of the major cancer causes of death, its incidence has increased in several Western countries, and it is the leading cause of death in patients with cirrhosis. Screening allows detection at an early stage and there is a large range of therapeutic options to be considered while taking into consideration tumour burden and liver function. Imaging techniques are a key tool for clinical decision making in the evaluation of patients with liver tumours. The development of ultrasound, computed tomography and magnetic resonance imaging has allowed the detection and diagnosis of liver tumours at an asymptomatic stage, which has modified their diagnostic approach and treatment. Moreover, assessment of treatment efficacy and follow-up is done through imaging. Imaging techniques and radiologists executing them have also a major impact in a variety of image-guided therapeutic interventions. The capacity to identify the tumour site in real time allows percutaneous tumour ablation; several cohort studies and randomised trials have shown the value of ablation in patients with HCC at an early stage; currently, radiofrequency ablation and ethanol injection are established therapies in conventional clinical practice. Transarterial chemoembolisation has also shown to be effective in terms of burden reduction and has proved to positively affect patient survival in patients with multinodular HCC confined to the liver.

Learning Objectives:

1. To understand the clinical implications of an early diagnosis, when the lesion is small and asymptomatic.
2. To learn about the rationale behind the current guidelines for model treatment options.
3. To appreciate the spectrum of locoregional therapies for HCC from percutaneous to intravascular approaches.

Panel discussion:

Is the multidisciplinary environment the natural way to develop excellence and leadership in clinical imaging?

11:45

10:30 - 12:00

Room C

Interactive Teaching Sessions

E³ 520b

Pitfalls in head and neck imaging

A-117 10:30

A. Pitfalls in neck imaging

F.A. [Pameijer](#); Utrecht/NL (f.a.pameijer@umcutrecht.nl)

Pitfall: „a hidden or unexpected danger or difficulty“. 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. Pitfalls in the head and neck may present in various ways: normal variants may look like disease, incidental findings are frequently encountered, suboptimal technique may obscure important findings. Moreover, many pitfalls are directly related to technical errors. In this potential „minefield“, the post-treatment patient presents a major challenge to the imaging specialist. Ablative surgery usually results in distortion of the anatomy, especially when combined with flap reconstruction. When adequate preoperative and/or baseline postoperative imaging is lacking, determination of recurrence on a single postoperative examination may well be impossible. PET CT (MR) and advanced MR-techniques; e.g. Diffusion Weighted Imaging (DWI)

or Dynamic Contrast Enhanced Magnetic Resonance Imaging (DCE-MRI) can be helpful in this setting. The presentation aims to familiarize general radiologists, who have an interest in head and neck imaging, with common pitfalls encountered on CT and MR studies focussing on the neck. Both the pre-therapeutic, as well as the post-treatment setting, will be discussed using examples from daily practice.

Learning Objectives:

1. To understand the variations of normal anatomy in the neck that should not be interpreted as abnormal.
2. To become familiar with the incidental findings that are frequently encountered when searching for neck disease.
3. To recognise suboptimal neck studies, or technique related problems and understand how these may influence interpretation.

A-118 11:15

B. Pitfalls in maxillofacial and skull base imaging

R. [Hermans](#); Leuven/BE (Robert.Hermans@uzleuven.be)

Imaging of the skull base and maxillofacial skeleton requires a meticulous imaging technique and a good knowledge of normal anatomy and possible anatomical variants. Asymmetry in the pneumatization of the paranasal sinuses, skull base or temporal bone is a common reason for misinterpretation. For example, hypoplasia of the maxillary sinus may be misinterpreted on conventional radiography as maxillary sinusitis or an orbital blow out fracture, depending on the context; asymmetric pneumatization of the petrous apex or mastoid bone may mimic, respectively, a cholesterol granuloma and fluid effusion in the non-pneumatized side on MRI. Vascular variants may also cause interpretation problems. For example, turbulent flow in a large jugular bulb may mimic a jugular foramen tumour on MRI. Variants in the vascular plexus surrounding the facial nerve or branches of the trigeminal nerve may occur, and cause asymmetric findings on MRI, possibly mimicking neuritis or perineural tumour spread. Incomplete maturation or arrested development of skull base structures may also cause confusion. Examples are the cochlear cleft, not be confused with otosclerosis, or arrested pneumatization of the sphenoid sinus, possibly mimicking a tumoural lesion in the central skull base. To avoid problems, one should keep in mind the existence of such variants, while correlating the imaging findings with the clinical problem; in some cases, an additional imaging study may be needed to exclude a pathological process more confidently.

Learning Objectives:

1. To understand the basic requirements for an optimal imaging study of the skull base and maxillofacial region.
2. To become familiar with anatomical variants, potentially mimicking disease.
3. To learn to appreciate incidental findings, avoiding unnecessary concern while recognising relevant pathology.

10:30 - 12:00

Room E2

Foundation Course: Neuroimaging

E³ 520c

Paediatric

Moderator:

D. [Prayer](#); Vienna/AT

A-119 10:30

A. Neonatal hypoxic-ischaemic brain injury

M.I. [Argyropoulou](#); Ioannina/GR (margyrop@cc.uoi.gr)

The pattern of neonatal brain lesions associated with hypoxia-ischaemia depends on the severity of the event and gestational age at birth. The immature brain of preterm babies reacts to hypoxia-ischaemia differently than the brain of full-term babies. Imaging plays an important role in the diagnostic work up of these patients, with brain ultrasound being the first line examination performed at bedside, followed by brain Magnetic Resonance Imaging. Germinal Matrix Haemorrhage appearing as an ovoid lesion anterior to the caudothalamic groove, Intraventricular Haemorrhage, Parenchymal Venous Haemorrhagic Infarction appearing as a paraventricular frontoparietal triangular lesion pointing towards the lateral ventricle, Post-haemorrhagic Hydrocephalus, Periventricular Leukomalacia with a focal necrotic form (fPVL) appearing with multiple coalescent periventricular cysts, irregular outlines of the lateral ventricles and white matter loss and a diffuse form (dPVL) appearing with regular outlines of the lateral ventricles and white matter loss represent the spectrum of lesions responsible for the encephalopathy of prematurity. Parasagittal Watershed Infarcts affecting the cortex and the subcortical white matter, Diffuse lesions of Macrocytic Encephalomalacia, due to partial prolonged asphyxia (1-3

h) and Lesions of the basal ganglia, the perirolandic cortex and the brain stem due to acute total asphyxia (10-15 min) comprise the spectrum of lesions following hypoxia ischaemia in the full-term baby. Stroke is an important cause of mortality and morbidity in the neonatal period. Neonatal stroke is less common than adult stroke but more common than that in childhood and the carotid artery territory is most commonly affected.

Learning Objectives:

1. To understand gestational age-related patterns of brain injury.
2. To understand the role of ultrasound and MRI for the initial diagnosis and follow-up of these patients.
3. To understand when and how to use advanced MRI techniques for delineation of lesions and for prognosis.

A-120 11:00

B. Spine and spinal cord malformations

A. Rossi; Genoa/IT (andrearossi@ospedale-gaslini.ge.it)

Spinal and spinal cord malformations are collectively named spinal dysraphisms. They arise from defects occurring in the early embryological stages of gastrulation (weeks 2-3), primary neurulation (weeks 3-4), and secondary neurulation (weeks 5-6). They are categorized into open spinal dysraphisms, in which there is exposure of abnormal nervous tissues through a skin defect, and closed spinal dysraphisms, in which there is a continuous skin coverage to the underlying malformation. Open spinal dysraphisms basically include myelomeningocele and other rare abnormalities such as myelocele and hemimyo (meningo)cele. Closed spinal dysraphisms are further categorized based on the association with low-back subcutaneous masses. Closed spinal dysraphisms with mass are represented by lipomyelocele, lipomyelomeningocele, meningocele, and myelocystocele. Closed spinal dysraphisms without mass comprise simple dysraphic states (tight filum terminale, filar and intradural lipomas, persistent terminal ventricle, and dermal sinuses) and complex dysraphic states. The latter category further comprises defects of midline notochordal integration (basically represented by diastematomyelia) and defects of segmental notochordal formation (represented by caudal agenesis and spinal segmental dysgenesis). Magnetic resonance imaging is the preferred modality for imaging these complex abnormalities. The use of the aforementioned classification scheme is greatly helpful to make the diagnosis.

Learning Objectives:

1. To understand the embryology underlying the different categories of malformations.
2. To learn the key morphological features.
3. To learn how to use a simplified diagnostic imaging approach.

A-121 11:30

C. Imaging of the foetal brain

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

The foetal brain undergoes changes throughout pregnancy according to a specific timing. Hence, the changing appearance of the cerebral parenchyma over time, the development of the different sulci and the structures of the posterior fossa must be well known in order to provide an accurate analysis of the fetal brain. Ultrasonography (US) is the imaging modality of choice for routine evaluation of the fetal brain. In favourable conditions, it enables detection of most cerebral abnormalities. The acquisition of images in the three planes of the space is mandatory. When available, the use of high-frequency probes enhances spatial resolution and may provide important details regarding brain anatomy. The different structures of the brain must be systematically analysed. Magnetic Resonance Imaging (MRI) provides excellent images whatever the foetal position and the thickness of the maternal wall but may be hampered by foetal motion. It is important to be aware of the contribution of the different sequences. The contrast resolution is better with MRI than with US. Imaging findings of the most common cerebral abnormalities will be displayed with emphasis on respective contribution, limitations and indications for both imaging modalities. For instance, certain lesions, such as focal parenchymal calcifications, may be overlooked by MRI. Conversely, other lesions such as focal haemorrhage or subependymal tubers may be missed by US. Awareness of these limitations is of utmost importance.

Learning Objectives:

1. To become familiar with the normal appearance of the developing brain.
2. To learn about the protocols and the limitations of foetal imaging.
3. To gain knowledge about the imaging findings of the most common brain abnormalities.

10:30 - 12:00

Room I/K

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

MC 528

Essentials in oncologic imaging: what radiologists need to know (part 2)

Moderator:

H. Hricak; New York, NY/US

A-122 10:30

A. Pancreatic cancer

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

Despite advances in cross-sectional techniques, imaging has still difficulties on assessing pancreatic tumours 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. After reviewing current concepts in the classification of pancreatic tumours including the role of molecular biomarkers, the lecture will address the strategies that may be used to maximize tumour conspicuity in a multi-modality perspective that also encompasses uprisng 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 as the key points for image interpretation in the setting of clinical decisions for patient management. In addition, the current role of adjuvant or neoadjuvant therapy will be shortly addressed especially concerning its imaging implications, as well as the new concepts on pancreatic adenocarcinoma oncogenesis and possible imaging strategies that may be used for earlier detection.

Learning Objectives:

1. To understand current pathologic concepts for the classification of pancreatic tumours.
2. To learn about imaging findings used for tumour detection, staging, and restaging after adjuvant therapy.
3. To understand the role of functional and molecular information provided by PET/CT, DWI and perfusion imaging when assessing pancreatic tumours.

A-123 10:55

B. Kidney cancer

E.K. Fishman; Baltimore, MD/US (efishman@jhmi.edu)

Carcinoma of the kidney is responsible for over 100,000 deaths worldwide each year. With advances in radiologic imaging up to two-thirds of renal cancers are picked up as serendipitous findings. Despite multiple advances in imaging challenges in lesion classification remain and may result in up to one fourth of lesions under 3 cm being resected being benign lesions. In this presentation we will focus on the role of CT in the detection, staging and management of the patient with renal cell carcinoma discussing both renal cell carcinoma (clear cell and papillary) and transitional cell carcinoma. The importance of proper protocol design, the use of multiphase acquisition and the value of 3D mapping will be discussed. The role of CT in staging tumours and its role in surgical planning will also be addressed. New understanding of how CT findings on arterial phase imaging closely correlate with the genetic findings is also addressed. The pitfalls in lesion detection and classification are also addressed and case examples of some of the pitfalls are provided. Protocols for the use of imaging as well as the use of dose reduction techniques including iterative reconstruction are addressed.

Learning Objectives:

1. To understand the diagnostic implications of minimally invasive treatments of renal cancer.
2. To review the genetic causes of renal cancer and the radiologic appearances of specific histologic subtypes.
3. To review the potential role of molecular imaging in the management of advanced renal cancer.

Author Disclosure:

E. K. Fishman: Advisory Board; GE, Siemens. Board Member; HipGraphics Inc. Founder; HipGraphics Inc. Research/Grant Support; GE, Siemens.

A-124 11:20

C. Ovarian cancer

H. Hricak; New York, NY/US

In the developed world, ovarian cancer continues to have the highest mortality rate among gynaecologic cancers. At diagnosis, more than 62% of patients have advanced disease. The mainstay of treatment is comprehensive staging laparotomy (including transabdominal hysterectomy, bilateral salpingo-oophorectomy, omentectomy, retroperitoneal lymph node sampling, peritoneal and diaphragmatic biopsies and cytology of peritoneal washings), usually followed by adjuvant chemotherapy. Patients with advanced non-resectable disease benefit from neoadjuvant (preoperative) chemotherapy. This lecture will review the key imaging findings in the management of ovarian cancer and will briefly consider how advances in molecular imaging may improve outcomes in the future. In ovarian cancer management, cross-sectional imaging is essential in (1) tumour characterisation; (2) treatment selection and planning (identifying difficult-to-reach tumour deposits or inoperable disease for which neoadjuvant chemotherapy is indicated); (3) monitoring treatment response; (4) detecting recurrent disease. Ultrasound is the primary modality for detecting and characterising adnexal masses. MRI is used for characterising sonographically indeterminate lesions. CT is the modality of choice for preoperative staging. FDG-PET-CT is valuable for detecting recurrent disease, particularly in the mesentery, bowel serosa and normal-sized lymph nodes. In recurrent disease, tumour size and standardised uptake values are also powerful prognostic biomarkers. The development of sensitive molecular imaging (MI) biomarkers could improve ovarian cancer management by allowing detection of the disease before symptoms arise and, in high risk patients, enabling repeat MI to substitute for preventative oophorectomy. In treatment selection and response assessment, MI may provide more powerful predictive biomarkers. Intraoperative MI may facilitate more complete tumour resection.

Learning Objectives:

1. To get an overview of the essential imaging findings in characterisation and staging of ovarian cancer.
2. To learn the key imaging findings that affect management of ovarian cancer.
3. To understand the changes in imaging armamentarium in ovarian cancer, and learn the best practice in proper image utilisation.

Questions

11:50

12:30 - 13:30

Room P

The Beauty of Basic Knowledge: Musculoskeletal Imaging

MC 25B

Degenerative disorders

A-125 12:30

Degenerative disorders

T.M. Link; San Francisco, CA/US (tmlink@radiology.ucsf.edu)

Degenerative disease is related to abnormal loading and/or tissue-related deficiencies. Chronic and acute trauma, excessive physical activity and obesity are among the conditions that promote degenerative disease. In addition, dysplastic morphology, inflammatory and metabolic disorders may eventually lead to degeneration. While cartilage and intervertebral disc are the target tissues, it should be noted that multiple structures are involved in the degenerative process. This includes the adjacent bone and bone marrow, ligaments, menisci and labrum. While standard radiographs have been the standard technique to diagnose and score osteoarthritis for many years, MR imaging has an increasing role in identifying early degenerative changes and determining the disease burden. Using molecular imaging techniques such as T1rho and T2 relaxation time measurements, the biochemical abnormalities of the cartilage and disc can be detected before macro-morphological damage. Subsequently, focal and diffuse defects of cartilage are shown with adjacent bone marrow abnormalities, such as subchondral cysts and bone marrow edema pattern. Mucoid degeneration with swelling and tears of ligaments are typical findings, so are degenerative meniscal and labral tissue transformation with signal abnormalities and tears. The typical radiographic findings include joint space narrowing and osteophytes. Frequently, secondary degenerative disease is observed related to conditions such as previous infection, inflammatory arthropathies, trauma and metabolic disorders, which lead to deformity of the joint with altered biomechanical loading. Underlying conditions and differential diagnoses of degenerative joint disease were need to be correctly identified. Sometimes differentiation between degenerative and inflammatory joint disorders can be challenging.

Learning Objectives:

1. To understand the basic pathophysiology of degenerative processes in peripheral joints and in the spine.
2. To become familiar with typical imaging findings of osteoarthritis and degenerative changes in the spine.
3. To learn about the differential diagnosis of degenerative disorders.

12:30 - 13:30

Room Q

The Beauty of Basic Knowledge: Head and Neck

MC 24B

The infrahyoid neck and lymph nodes

A-126 12:30

The infrahyoid neck and lymph nodes

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

The CT and MRI analysis of the anatomic compartments of the infrahyoid neck, and the signal intensity or the density of the different lesions correlated to the clinical history enable a precise assessment of the neck masses with a high degree of accuracy. The infrahyoid neck can be divided into a posterior or nuchal region and an anterior or cervical region. The nuchal region is composed primarily of muscular structures, but also of fat tissue and bone. The anterior region is almost entirely occupied by glands, nerves, muscles and vessels (arterial, venous and lymphatic) and can be further divided in one median and two lateral areas. The infrahyoid compartment is containing trachea, larynx, oesophagus, thyroid and parathyroid glands. Nodal classification is essential to accurately discuss the location of cervical nodes. About 300 of the 800 lymph nodes in the body are located in the head and neck. A simplified level nomenclature is used since 1984 cervical lymph nodes in seven levels. Lymphnode size is one of the most frequently used criteria for discrimination of metastatic lymph nodes from benign reactive nodes. Furthermore, the shape of the node, abnormality of internal architecture, including necrosis, and extracapsular tumour spread have been demonstrated as additional morphological criteria which lead to a diagnostic In the childhood, tumours and tumour-like lesions of the neck are rare and they tend to be benign. However, most of the soft tissue neck masses in the adult over the age of 40 are metastatic nodal lesions.

Learning Objectives:

1. To become familiar with the different anatomic compartments of the infrahyoid neck.
2. To understand lymph node classification and level system.
3. To learn about the best imaging approach to an IHN mass.
4. To be able to localise and provide a useful differential diagnosis.

12:45 - 13:15

Room A

Plenary Session

HL 1

Josef Lissner Honorary Lecture

Presiding:

J.I. Bilbao; Pamplona/ES

A-127 12:45

MR guided focused ultrasound: a new string to the radiologist's bow

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

In the recent past, minimally invasive therapies have greatly benefited of the continuous developments of imaging modalities. In fact, it has become feasible to perform minimally invasive therapies with high precision in the routine clinical practice under imaging guidance. MR-guided Focused Ultrasound is a new non-invasive method of treatment that allows, under continuous MR guidance, precise thermal ablation. MRI is used for target definition, planning of treatment and continuous control of thermal effect at the target and in the surrounding tissues. High-intensity focused ultrasound is an efficacious means of extracorporeal thermal ablation. For guidance and monitoring, MRI provides several advantages over any other imaging modality; in fact, it allows to identify the target, it defines excellent three-dimensional planning, and with MR thermometry, it provides continuous thermal mapping at the target and the surrounding tissues. MR-guided Focused Ultrasound has been approved for uterine fibroids treatment and bone metastasis palliation; several are the ongoing clinical trials in breast, liver, pancreas, prostate, brain tumours and in

other benign tumours and neurologic functional disorders. Furthermore, it appears to be an exceptional research tool, as it may temporarily modify cell membrane permeability and release or activate compounds for targeted drug delivery or gene therapy. There is no doubt that MR-guided Focused Ultrasound represents a new extremely powerful tool with already well defined clinical fields of applications and enormous potentials of research.

Learning Objectives:

1. To learn about the technical and physical principles of MR guided focused ultrasound.
2. To understand the advantages of MR guidance.
3. To become familiar with the approved clinical applications and the ongoing clinical trials.
4. To learn the research activities and the possible future applications in the fields of drug delivery and gene therapy.

14:00 - 15:30

Room D1

Controversies in Breast Imaging

MC 623

Preoperative MRI in newly diagnosed breast cancer: to do or not to do?

Moderator:

F. Sardanelli; Milan/IT

Teaser:

N. Houssami; Sydney/AU

A-128 14:00

A. Why we should do preoperative MRI

W.A. Kaiser; Jena/DE (Werner.Kaiser@med.uni-jena.de)

MR-Mammography (MRM) has been used in clinical research and in routine since 30 years now. It is now accepted that the sensitivity is extremely high for invasive cancers in a size of more than 3 mm (between 95 and 100%) and - using important morphological and kinetic signs in combination - the specificity is also much higher than previously published (above 90%). The positive arguments to use MR-Mammography preoperatively are the following: it is always important to know the truth (multifocality, multicentricity, bilaterality of breast cancers); both lumpectomy+radiation as well as mastectomy are equally effective, but not able to stop the continuous drop in long-term survival curves. The aim should be permanent healing; knowing the precise staging is helpful for an exact surgical planning; knowing the precise staging is helpful for the inclusion or avoidance of radiation; knowing the precise staging is helpful for the avoidance of legal problems; the previous publications about the use of preoperative MRI are controversial and partially misleading.

A-129 14:25

B. Reasons not to do preoperative MRI

M.G. Wallis; Cambridge/UK (matthew.wallis@addenbrookes.nhs.uk)

Pre-operative MRI staging undoubtedly finds additional disease with retrospective and prospective studies showing that this changes surgical practice. To date, there is no good prospective evidence that this change in surgery affects patient outcome in terms of reduction in re operation rates or improved disease free or overall survival. In fact, the 2 prospective studies show no or detrimental effects on care and there is evidence of increasing mastectomy rates. Conservation surgery plus radiotherapy was shown to be equivalent to mastectomy many years ago and surgery plus modern adjuvant treatment is associated with increasing survival and very low local surgical failure. Therefore, there are good reasons to suggest that the majority of the additional disease picked up by MRI is biologically and clinically irrelevant and only serves to increase the surgical burden on our patients. I will contend that by merely demonstrating that our bigger/better (more expensive) kit finds more disease in not enough. We the radiological research community and those that fund our research have failed the profession, our patients and the community as a whole. We should be obliged to take the next step and demonstrate we can improve our patient's outcomes, both survival and well being, before introducing new technology. Pre-operative MR staging is a classical example, after all if we had done a proper trial 10 years ago we would be standing here demonstrating 5-year disease free survival rather than entertaining you with an unanswerable debate.

A-130 14:50

Discussion

F. Sardanelli¹, N. Houssami²; ¹Milan/IT, ²Sydney/AU

The discussion will address the following issues:

1. How come there are divergent views on the evidence from randomised controlled trials?
2. Is the device for MR-guided procedures absolutely necessary?
3. How to manage additional findings?
4. How to reduce false positives?
5. How to reduce overtreatment?
6. How to translate MRI information from radiology to the operating theatre?

14:00 - 15:30

Room E2

Foundation Course: Neuroimaging

E³ 620

Trauma and vascularity

Moderator:

A. Molyneux; Oxford/UK

A-131 14:00

A. CNS trauma

P.M. Parizel, C. Venstermans, F. De Belder, T. Van der Zijden, L. van den Hauwe, M. Voormolen, J. Van Goethem; Antwerp/BE (paul.parizel@ua.ac.be)

Neuroimaging techniques constitute an essential part of the diagnostic work-up of patients with traumatic brain injury (TBI). In the acute setting, imaging findings determine patient management and influence clinical course. CT remains the first choice technique to determine the presence and extent of injury, and to guide surgical planning. Multi-detector CT allows simultaneous assessment of head and cervical spine, obviating the need for plain radiographs. From a clinical point of view, it is important to understand the difference between primary and secondary TBI. Primary injuries occur as a direct result of the impact with damage to brain tissue. Examples include fractures, different types of traumatic haemorrhage (epidural, subdural, intracerebral, subarachnoid), cerebral contusion, diffuse axonal injury (DAI). CT-angiography is useful to document traumatic blood vessel injury. Whenever there is a discrepancy between the patient's clinical status and imaging findings, MRI is indicated. Secondary injuries are caused by systemic factors such as increased intracranial pressure, oedema, brain herniation, decreased cerebral blood flow, excitotoxic damage. These lesions can be documented with multiparametric MRI including diffusion, perfusion, and susceptibility weighted imaging. Diffusion tensor imaging with fractional anisotropy mapping may show microstructural abnormalities in patients with mild TBI, even when traditional MRI sequences appear normal. Neuroimaging also plays a role in the chronic stage of TBI, identifying sequelae, determining prognosis, and guiding rehabilitation. In conclusion, advances in neuroimaging improve our understanding of the pathophysiology of craniocerebral trauma and allow us to detect abnormalities, even in patients with mild TBI, when routine imaging studies appear normal.

Learning Objectives:

1. To become familiar with the different types of intracranial injury and the appropriate imaging patterns.
2. To learn about the imaging characteristics of intracranial haemorrhage by CT and MR.
3. To be able to recognise imaging findings that are critical for the patient's prognosis.

A-132 14:30

B. Cerebral ischaemia and infarction

L. Pierot; Reims/FR (lpierot@gmail.com)

Ischaemic stroke is a diagnostic and therapeutic emergency. The diagnostic has to be established as rapidly as possible in order to be able to offer to the patient the best therapeutic approach. At the acute phase of stroke, the diagnostic is usually based on CT or MRI. CT will eliminate any haemorrhagic stroke, but will be normal in approximately 50% of cases. Precocious signs of ischaemia are sometimes visible including decreased density of lentiform nuclei, loss of gray-white matter interfaces, sulcal effacement, and hyperattenuating artery (indicating acute thrombus). CTA will show the occluded artery. MRI has an increased sensitivity compared with CT. At the hyperacute stage, diffusion will show hyperintensity in the

ischaemic area with reduced apparent diffusion coefficient. At this stage, T2 and FLAIR images are usually normal and hyperintensity will appear after few hours. Occluded vessels are easily detected by MRA. Perfusion imaging will permit an evaluation of the mismatch (penumbra). At the acute phase of stroke, treatment is based on IV administration of thrombolytics (rtPA), or mechanical thrombectomy. Only IV administration of rtPA has been validated in large randomised studies. It can be performed in the first 4.5 h of ischaemia. Mechanical thrombectomy can be performed after failure of the IV treatment or as a first line treatment. Precocious follow-up imaging (CT or MRI) is performed to detect any haemorrhagic transformation of the ischaemic zone.

Learning Objectives:

1. To consolidate knowledge of CT findings and conventional MRI findings.
2. To become familiar with the imaging findings and diagnostic role of diffusion and perfusion MRI.
3. To be informed of the indications and techniques for endovascular stroke treatment.

Author Disclosure:

L. Pierot: Consultant; EV3, Codman.

A-133 15:00

C. Vascular malformations of the spinal cord

D.A. Rüfenacht, I. Wanke; Zurich/CH (danielrufenacht@gmail.com)

Vascular malformations of the spinal cord are rare, present with variable clinical symptoms and exhibit a variety of distinct oedema pattern in the spinal cord and distinct vascular pattern in- and outside the spinal cord. Accordingly, vascular lesions of the spinal cord are best evaluated by a combination of MRI and catheter-based angiography. In addition, current treatment options relay for the majority of conditions on endovascular, image-guided methods. The lecture will include explanation and illustration of the criteria used to assess and classify lesions based on imaging. Imaging elements interesting to consider for lesion assessment, disease evolution, and success and risk prediction will be provided in form of a query. Spinal cord oedema being the most frequent form of changes that become visible along evolution of vascular malformations of the spinal cord is the reason to provide pathophysiological explanations and imaging examples to the variable oedema pattern. Examples of each type of vascular malformation will be given. Knowledge of such information may be useful to radiologist performing spinal MRI in the interest of avoiding to ignore subclinical lesions that may be readily detected with current MR imaging methods, and should not be missed. Early and correct identification of vascular spinal lesions may avoid progression into clinical potentially non-reversible damage of the spinal cord. Knowledge about current methods of diagnostic imaging and about endovascular treatment options allows for providing expert advice to referring physicians, something that should be in part possible after this medical education.

Learning Objectives:

1. To understand the pathophysiology of vascular anomalies.
2. To become familiar with imaging protocols.
3. To be informed of the indications of interventional therapeutic procedures.

14:00 - 15:30

Room I/K

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

MC 628

Essentials in oncologic imaging: what radiologists need to know (part 3)

Moderator:

Y. Menu; Paris/FR

A-134 14:00

A. Oncologic imaging: terminology, definitions and buzzwords

Y. Menu; Paris/FR (yves.menu@sat.aphp.fr)

The routine practice of oncologic imaging requires standardisation, which means that we need to harmonise technical protocols and agree on the meaning of selected words for the radiological report. The words "Response", "Progression" and "Stable disease" are precisely defined according to internationally accepted thresholds and criteria. Although the rules are quite simple and rather easy to apply, they are very efficient in the classification of the response to treatment, and therefore for the medical decisions. However, the role of the radiologist is not limited to measurements and calculation. The detection of new lesions may be challenging and requires

experience. The differential between cancer progression and complications of the treatment might be very difficult and requires an adequate communication with the referring clinician. Overall, most of the decisions taken by the clinician will be related to imaging results, stressing the importance of adequate protocols and reports.

Learning Objectives:

1. To get an overview and precise explanation of current cancer-related terminology, definitions and "buzz" words used in everyday practice.
2. To understand why and how this terminology should ensure and simplify communication with all specialists involved in cancer management, including clinicians, researchers as well as other radiologists.
3. To learn common tricks and traps in providing a radiology report, illustrated with clinical cases.

A-135 14:20

B. Liver cancers (primary, metastases)

R.L. Baron; Chicago, IL/US (rbaron@uchicago.edu)

Hepatocellular carcinoma (HCC) is the most common primary tumour with cholangiocarcinoma comprising 5-10% and only rare other primary tumours. HCC is commonly associated with chronic liver with hepatitis or cirrhosis. Nodular and fibrotic changes inherent in cirrhosis both simulate and obscure tumours and particular emphasis will be placed on characterising small nodular changes in cirrhosis that are often diagnostic dilemmas. Contrast enhancement characteristics and MR signal intensity changes play a critical role in these evaluations resulting in nonbiopsy imaging criteria for HCC diagnosis as the standard of care for management. Staging and treatment for HCC are based on lesion size and number (TNM staging system). False positive diagnoses in cirrhosis will be discussed. Cholangiocarcinoma has a varied imaging appearance based on the underlying histologic stroma (from glandular mucin producing to dense fibrous). The contrast enhancement characteristics that vary with the stroma is a key to detect and to characterise these lesions. There is no effective chemotherapy or interventional cure, and treatment options are limited to aggressive surgical approaches and the imaging assessment of extent of disease is critical in planning. Metastatic liver disease most often has very nonspecific imaging features that preclude diagnosis on imaging characteristics alone. Certain contrast enhancement characteristics, however, allow for characterisation and more importantly, assessment of response to treatment, particularly in vascular metastatic lesions such as GIST tumours. Detection of small lesions that can be critical for detection, characterisation and staging can be optimised with MR liver-specific imaging agents and with diffusion-weighted imaging.

Learning Objectives:

1. To get an overview of the AASLD/EASL imaging criteria for noninvasive diagnosis of hepatocellular carcinoma.
2. To learn about best practice CT/MR/US imaging techniques that optimise characterisation, detection and staging of primary and metastatic liver tumours.
3. To understand the key role specific findings reported by radiologists have in determining patient treatment options for hepatocellular carcinoma.

A-136 14:55

C. Prostate cancer

J.O. Barentsz; Nijmegen/NL (J.Barentsz@rad.umcn.nl)

This presentation provides guidelines for how to be successful in prostate MRI and convince urologists to use MRI. It is important that radiologists performing prostate MRI speak the same language as their referring physicians. They should know as to what is important for the patient. Therefore, this presentation provides guidelines for prostate MRI, assessed by prostate MRI experts from the European Society of Urogenital Radiology (ESUR). The proposed MRI protocols for "detection", "staging" and "node and bone" will be shown. The use of endorectal coil versus pelvic phased array coil and 1.5 versus 3 T will be discussed. And most importantly, clinical indications are provided. Finally, the ESUR PiRADS classification and a reporting system will be presented.

Learning Objectives:

1. To learn the key clinical indications for MR imaging in prostate cancer.
2. To get an overview of essential MR imaging techniques in detection, characterisation, localisation and staging of prostate cancer.
3. To understand how MR imaging influences therapeutic decisions and how best to provide a value added MR report.

Questions

15:20

16:00 - 17:30

Room A

Interactive Teaching Session

E³ 720a

Neurological emergencies

A-142 16:00

A. Non-traumatic

C. Ozdoba; Berne/CH (christoph.ozdoba@insel.ch)

Neurological emergencies, i.e. the sudden loss of motor, sensory, or cognitive functions up to coma, have numerous causes. The probably most important neurological emergency in absolute number of patients and in socio-economic impact is stroke. With recent advances in devices and techniques for interventional neuroradiology, neuroendovascular surgery is playing an increasing role in the treatment of acute stroke. Early diagnosis with a complete imaging work-up by CT or MRI is mandatory before these therapies can be applied, and although the time span for a successful therapy has increased to 4.5 h for i.v.-thrombolysis and up to 8 h for intraarterial therapy, an efficient time-saving algorithm in the management of stroke patients remains crucial. Other causes besides stroke, however, must not be forgotten. This talk focuses on CNS pathology; conditions like coma due to metabolic causes or intoxication will not be covered. A wide range of possible aetiologies remains, ranging from vascular pathology (e.g. cervical artery dissection or venous sinus thrombosis) to epilepsy, metastatic disease, and inflammation. As in stroke, imaging studies today are an essential component of early diagnosis. MRI is the method of choice for nearly all of the above-mentioned conditions; at least in tertiary care centers, indications for MR in a neurological emergency should be seen generously - around the clock (24/7). In an emergency situation, structural imaging should routinely be complemented by special techniques like diffusion- and susceptibility-weighted imaging and perfusion studies. Examples will be shown and recommendations for optimised emergency study protocols are given.

Learning Objectives:

1. To learn which imaging modality to use.
2. To understand how to identify early ischaemia.
3. To be able to select patients for treatment.

Author Disclosure:

C. Ozdoba: Consultant; Siemens Healthcare. Investigator; Bayer. Speaker; Bayer.

A-143 16:45

B. Traumatic

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

Traumatic brain injury (TBI) is a significant cause of mortality and morbidity in Europe. TBI encompasses a wide, heterogeneous group of intracranial injuries that include acute primary insults occurred at the time of impact and secondary ones such as cerebral swelling or herniation. Non-contrast CT is still the "gold standard" imaging modality in acute setting. Epidural, subdural and subarachnoid haemorrhage (extra-axial) as well as cortical contusion, intraparenchymal hematoma, diffuse axonal injury (intra-axial haemorrhage) will be discussed. Conventional MRI sequences are less-sensitive than CT in detection of hyperacute intracranial bleeding. However, FLAIR technique are capable to detect even small amount of extravasated blood. Susceptibility-weighted imaging (SWI) is mandatory in evaluation of microhemorrhages, together with DWI they play an important role in diagnosis of axonal injury. Traumatic injury of spinal cord (SCI) in majority of cases results with devastating consequences. MR examination is the imaging modality of choice in such patients. It enables the clear assessment of lesion morphology, extent and severity of trauma. For optimal characterisation of SCI, one has to start with estimation of canal compromise and the degree of spinal cord compression. Then qualitative intramedullary changes like cord swelling, oedema, contusive haemorrhage, haematomyelia, partial or complete laceration should be evaluated. Protocols for routine MRI of the patients SCI are proposed and discussed.

Learning Objectives:

1. To understand the proper imaging protocols for trauma patients.
2. To become familiar with imaging findings in acute head trauma.
3. To learn about the imaging findings in spinal cord trauma.

16:00 - 17:30

Room B

ESR meets E-AHPBA

EM 2

Pancreatic cystic neoplasms 2013

Welcome by the ESR President:

G.P. Krestin; Rotterdam/NL

Presiding:

J.I. Bilbao; Pamplona/ES

P.-A. Clavien; Zurich/CH

A-144 16:00

Introduction

P.-A. Clavien¹, K. Conlon²; ¹Zurich/CH, ²Dublin/IE (clavien@access.uzh.ch)

Primary pancreatic cysts are being seen more commonly in clinical practice in part to increased awareness and improved diagnostic modalities. This timely symposium that the European-African Hepato-Pancreato-Biliary Association is pleased to co-sponsor with the European Society of Radiology will explore our understanding of the current pathological classification, illustrate and define the "state-of-the-art" imaging modalities available, describe the role of Endoscopic Ultrasonography in contemporary diagnostic algorithms and establish the role for surgical resection for these conditions.

Session Objectives:

1. To understand the importance of the recent WHO classification and its relevance to therapy.
2. To become familiar with the radiological work-up for patients with pancreatic cystic tumours.
3. To appreciate the current role of endoscopic ultrasonography in diagnosis and management.
4. To become familiar with the indications for surgical intervention and the role of organ-sparing therapies.

A-145 16:03

Classification/pathology

C. Verbeke; Stockholm/SE (caroline.verbeke@ki.se)

The increasing use of imaging has led to a more frequent detection of cystic lesions in the pancreas. Such lesions can be of a various nature, i.e. they may be neoplastic or non-neoplastic, benign, potentially or overtly malignant, epithelial or mesenchymal, congenital or degenerative. As these cystic entities obviously differ in terms of treatment, prognosis and need for follow-up, it is important that they are correctly diagnosed. The current morphological classification of pancreatic cystic lesions is based on the distinction between neoplastic/non-neoplastic and epithelial/non-epithelial cysts. In view of this significant histogenetic diversity, it is not surprising that pancreatic cystic lesions also differ in their gross appearance. Because the latter is the pathology correlate of findings on imaging, it is important to become familiar with the key distinctive macroscopic features of the various cyst entities and to understand the basic microscopic diagnostic features. It should be appreciated, however, that significant variation in macroscopic appearances can occur within single entities, whilst there can also be a considerable overlap in features between various entities. Therefore, in the individual case, the morphological diagnosis of pancreatic cystic lesions can be problematic. The identification of malignant transformation within primarily benign cystic lesions represents a further diagnostic challenge. While this important diagnosis is ultimately based on unequivocal microscopic findings, there are certain macroscopic features that may suggest invasive malignancy and find their correlate in radiological imaging.

Learning Objectives:

1. To understand the morphological classification of pancreatic cystic lesions based on the distinction between neoplastic/non-neoplastic and epithelial/non-epithelial cysts.
2. To become familiar with the key distinctive macroscopic features of the various cyst entities and to understand the basic microscopic diagnostic features.
3. To appreciate the considerable variation in macroscopic appearances and the potential overlap between certain entities.
4. To become familiar with the macroscopic features of malignant transformation within primarily benign cystic lesions.

A-146 16:21

Radiological diagnosis

S. Skehan; Dublin/IE (s.skehan@st-vincent.ie)

Pancreatic cysts are recognised increasingly commonly in symptomatic and asymptomatic individuals. The challenge of imaging is to differentiate cysts that need to be resected from those that can be safely left alone or kept under observation. While CT and ultrasound are often the initial modality that identifies a pancreatic cyst, MRI and endoscopic US typically provide the most useful diagnostic information. MR can accurately demonstrate the size of any cystic components of a lesion in addition to showing septations, mural nodules and areas of enhancement. MRI is also the optimal technique for imaging surveillance of pancreatic cysts. Pancreatic cystic lesions include pseudocyst, serous cystadenoma, mucinous cystadenoma and cystadenocarcinoma, intraductal papillary mucinous neoplasm, solid and papillary epithelial neoplasm and cystic neuroendocrine tumour. In classical cases, imaging features combined with knowledge of patient demographics can allow a confident non-invasive diagnosis. However, imaging features often overlap and in these cases the results of fine needle aspiration at the time of endoscopic ultrasound are critical in arriving at a diagnosis.

Learning Objectives:

1. To become familiar with the optimal imaging modalities for cystic pancreatic lesions.
2. To learn about the characteristic imaging features of cystic pancreatic lesions and to describe how imaging can contribute to preoperative diagnosis.
3. To discuss the appropriate imaging surveillance of selected cystic pancreatic lesions.

A-147 16:39

Current role of endoscopic ultrasonography

P. Bauerfeind; Zurich/CH (peter.bauerfeind@usz.ch)

With the increasing use of abdominal imaging (CT-scan and MRI) more and more pancreatic cystic lesions are incidentally detected. Pancreatic cystic neoplasms (PCN) represent 2/3 of all pancreatic cystic lesions. After initial detection it is crucial to distinguish between benign, malignant or potentially malignant pancreatic cystic lesions. EUS allows morphologic analysis, guides fine-needle aspiration, and provides fluid for cytology, CEA, Amylase and DNA analysis. In future, EUS may play a role in the treatment of some PCN, e.g. intracystic injection of ethanol or ethanol/paclitaxel for intraductal papillary mucinous neoplasm (IPNM). Cross-sectional imaging and medical history allow in a large portion of patients to differentiate PCN from pseudocyst and to determine the type of PCN. In unclear cases, endoscopic ultrasonography (EUS) with CEA measurement in aspirated fluid can be used to discriminate between mucinous and benign serous cysts. A cut-off CEA level of 192 ng/mL has the sensitivity of 73%, specificity of 84%, and accuracy of 79% for differentiating mucinous from non-mucinous pancreatic cystic lesions (Brugge Gastroenterology 2004;126:1330). In case of mucinous lesions larger than 2 cm the primary question is whether the cyst is malignant or benign. Fluid cytology allows with 80% sensitivity and specificity to identify malignant IPNM. Amylase in aspirated fluid may allow to distinguish between IPNM and mucinous cystic neoplasms, the latter is usually without communication with the pancreatic duct. In summary, EUS with cyst fluid analysis increase the diagnostic certainty in patients with pancreatic cystic lesions.

Learning Objectives:

1. To appreciate the technical aspects, performance characteristics and limitations of EUS and EUS-FNA in PCNs.
2. To understand how EUS and EUS-guided FNA help to establish a diagnosis in PCNs.
3. To appreciate the added information that EUS brings in staging pre-malignant and malignant PCNs and in orientating surgical decision-making.

A-148 16:57

How aggressive should the surgeon be?

K. Conlon; Dublin/IE (Kevin.Conlon1@amnmh.ie)

Primary pancreatic cysts are more prevalent in surgical practice due to improvements and availability of sophisticated cross-sectional imaging techniques. They are identified in approximately 1% of patients undergoing abdominal CT scanning. Historically, surgical resection was recommended for all pancreatic cystic neoplasms. This philosophy resulted partly from limited understanding of the natural history, poor sensitivity and specificity of investigations and improved safety of pancreatic surgical resections. An aggressive surgical algorithm results in resection of numerous benign lesions; frequently in asymptomatic patients with incidentally detected lesions. A consensus has now emerged towards a more conservative and tailored

approach. In general, symptomatic patients with low surgical risk should undergo resection unless the lesion is considered to be a serous cystadenoma on imaging. Patients with moderate surgical risk are more challenging and risk of resection versus risk of malignancy should be carefully taken into account. These patients require careful investigation tailored at grading the true malignant potential of their lesion. Of patients with a high operative risk, resection should be confined only to patients with confirmed malignant disease. Specific conditions require a tailored approach. Decisions regarding resection should be based on assessment of malignant potential of a lesion, size of lesion (≥ 3 cm) and the patient's surgical risk factors.

Learning Objectives:

1. To understand the clinical indications for surgical intervention.
2. To appreciate the rationale for deciding on a particular procedure.
3. To discuss the outcomes of observation versus surgery.

Panel discussion:

The multidisciplinary assessment and management of pancreatic cystic neoplasia

17:15

16:00 - 17:30

Room C

New Horizons Session

NH 7

Cartilage imaging

A-149 16:00

Chairman's introduction

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

In this New Horizon session dedicated to cartilage imaging, the audience will learn of new advances in imaging the normal and abnormal cartilage matrix and understand the basic techniques used in this assessment. It is hoped that these new techniques which are currently in the research field would very soon be translated into clinical application. Early detection of cartilage disease may lead to novel therapies which can help reverse and repair the degenerative process.

Session Objectives:

1. To review the basics of articular cartilage physiology.
2. To introduce the quantitative MR tools used to assess collagen and proteoglycan depletion.
3. To learn about the problems arising from the avascular nature of articular cartilage.

A-150 16:03

Sodium imaging

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

The major advantage of sodium MRI in musculo-skeletal applications is that it is highly specific to glycosaminoglycan content. The recent proliferation of 7 T whole-body MRI offers a significant impact on sodium MRI and its potential for clinical use. Since SNR scales linearly with increasing field strength and the lack of B1 penetration and B0 susceptibility problems sodium MRI can be particularly advantageous at higher fields. The low-gyromagnetic ratio of sodium also means lower power deposition, thus reducing SAR problems at 7 T. Although sodium MRI has high specificity and does not require any exogenous contrast agent, it does require special hardware capabilities (multinuclear) and specialized RF coils. With the application of a 7T whole body system and a modified 3D GRE optimised for sodium imaging and dedicated multi-element sodium coils, we performed a series of clinical studies: in a small group of 12 patients after matrix-associated autologous chondrocyte transplantation (MACT) sodium imaging allowed to differentiate between sodium content and hence GAG in the transplants compared to native, healthy cartilage. In all patients, the sodium SNR was lower in the repair tissue compared to healthy cartilage. In another study, 18 patients after different cartilage repair surgery sodium SNR was significantly lower in BMS and MACT repair tissue, compared to reference cartilage, but sodium SNR was significantly higher in MACT repair tissue. In addition to cartilage sodium imaging, preliminary clinical studies have shown the potential of sodium imaging in the quantification of glycosaminoglycans in the intervertebral disc and Achilles tendon.

Learning Objectives:

1. To get familiar with the basic principles of sodium imaging.
2. To understand technical challenges of sodium imaging and how to handle them.
3. To learn about clinical applications of sodium imaging in cartilage, cartilage repair and other MSK structures.

A-151 16:21

dGEMRIC (delayed gadolinium-enhanced MR imaging of cartilage)

G. Welsch¹, S. Trattnig²; ¹Erlangen/DE, ²Vienna/AT (welsch@bwh.harvard.edu)

Acute and chronic articular cartilage lesions are a common pathology and many patients could benefit from cartilage treatment which needs high sophisticated follow-up. Whereas standard morphological approaches can demonstrate the constitution of cartilage, quantitative/biochemical MR approaches are able to provide a specific measure of the composition of cartilage. One of the biochemical MRI techniques most often reported to visualise cartilage ultra-structure is delayed Gadolinium-Enhanced MRI of Cartilage (dGEMRIC). Using dGEMRIC, biochemical MRI has the ability to quantify functionally relevant macromolecules within articular cartilage such as glycosaminoglycans (GAG). GAG are the main source of fixed charge density in cartilage, which are often decreased in the early stages of cartilage degeneration and are considered as a key factor in the progression of cartilage damage. The role of GAG is comparably important in the follow-up after cartilage repair procedures where hyaline-like repair tissue with a normal or nearly normal amount of proteoglycans has been described to have a positive predictive value. The technical requirements and possible applications of dGEMRIC are presented in this „New Horizon session (NH 7) Cartilage imaging“.

Learning Objectives:

1. To learn the basic principles of dGEMRIC and the current used techniques for clinical imaging.
2. To learn about the current clinical applications of dGEMRIC.
3. To get an overview of future uses of dGEMRIC in therapeutic studies.

A-152 16:39

Diffusion tensor imaging

C. Glaser; Munich/DE (glaser@rzmm.de)

DTI aims to monitor water proton diffusion as modified by a tissue's macromolecular structure. This implies to apply (and register) at least 6 diffusion sensitizing gradient directions in order to obtain an adequate diffusion tensor data matrix. From the data metrics, commonly the apparent diffusion coefficient (ADC), fractional anisotropy (FA) and the principal eigenvector (EV1), are derived to characterise architectural tissue properties. This approach has been demonstrated to be feasible and applicable to articular cartilage in an experimental setting, and promising first in vivo data of human cartilage have been published. ADC appears to correlate to proteoglycan (PG) and water content and an increase of ADC (both bulk and depth dependent) has been shown to correlate to (local / bulk) PG depletion. FA reflects depth dependent anisotropy in the collagenous fibre architecture and is independent of PG content. EV1 has the potential to define cartilage zonal height but is the most SNR-demanding parameter of the three. A first in vivo study has shown very good accuracy for bulk ADC and FA to differentiate healthy volunteers from early OA patients and reproducibility data are comparable to dGEMRIC and T2. Most recently, an ex vivo study has obtained an excellent predictive value of DTI for the diagnosis of early cartilage degeneration and a good ability to grade early stages of cartilage degeneration - confirming the potential of DTI as a non-invasive non-CM-dependent biomarker for (early) OA. Current challenges are to implement and standardize robust acquisition protocols for in vivo human and animal imaging.

Learning Objectives:

1. To discuss basic principles of diffusion imaging in MSK.
2. To review technical challenges and current achievements.
3. To look into potential future directions.

A-153 16:57

CEST (chemical exchange saturation transfer)

B. Schmitt; Vienna/AT (benjamin.schmitt@meduniwien.ac.at)

CEST imaging in principle relies on the chemical exchange of protons bound to solute molecules and surrounding bulk water molecules. The effect can be used for MRI because the magnetization of each solute proton, is also transferred to bulk water, and can thus be visualized via the MR signal. CEST effects can be evaluated for specific molecular groups due to their characteristic proton resonance frequencies, which provides the technique with a high intrinsic sensitivity to these groups. In healthy cartilage tissue, strong CEST effects from exchangeable protons of glycosaminoglycan (GAG) molecules can be observed. The magnitude of these effects decreases when concentration ratio between bulk water protons and GAG protons decreases, e.g. in the early stages of osteoarthritis (OA). Initial studies on patients after cartilage repair surgery with GAG-dependent CEST (gagCEST) imaging have demonstrated that it is feasible to visualize GAG loss in vivo at 7.0 Tesla. Initial reports also claim that the technique might be transitioned to the clinical field strength of 3 T. Although CEST imaging can be performed with standard

clinical equipment and protocols can easily be implemented in a routine clinical workflow, the signal analysis in gagCEST imaging and the reading of gagCEST images are technically complex. For example, effects, which alter the T2 relaxation time of tissue such as high relative water concentration, can affect the magnitude of gagCEST effects although the absolute concentration of GAG is unchanged. Unless confounding effects are automatically corrected, careful analysis of images is necessary for proper interpretation of results.

Learning Objectives:

1. To understand basic principles of CEST imaging.
2. To learn about the current status of gagCEST imaging.
3. To become aware of technical pitfalls and future approaches.

Author Disclosure:

B. Schmitt: Research/Grant Support; Siemens Healthcare.

Panel discussion:

What are the envisaged future advances in these cartilage imaging techniques and can we expect to introduce them into clinical practice?

17:15

16:00 - 17:30

Room D1

Controversies in Breast Imaging

MC 723

Should we add ultrasound to mammographic screening of dense breasts?

Moderator:

F.J. Gilbert; Cambridge/UK

Teaser:

A. Tardivon; Paris/FR

A-154 16:00

A. We can reduce the interval cancer rate

W.A. Berg; Pittsburgh, PA/US (wendieberg@gmail.com)

Greater rates of interval cancers (detected clinically in the interval between screenings), and even greater mortality, have been observed in women with dense breast tissue (heterogeneously dense or extremely dense mammographically) compared to those in women whose breasts are fatty or show minimal scattered fibroglandular density. Importantly, breast density itself is a strong risk factor for the development of non-hereditary breast cancer, with relative risk from extremely dense breast tissue 4- to 5-fold higher than for women with fatty breast tissue. Ultrasound (US) has been considered for supplemental screening of women with dense breasts. Across 8 single-center studies, and three prospective multicenter trials, encompassing over 64,000 examinations, supplemental cancer detection rate of US has consistently been 3 to 4 per 1000. Over 90% of cancers seen only on ultrasound are invasive, with median size of 10 mm. Over 85% of invasive cancers seen only on ultrasound are node negative. Interval cancer rate (ICR) after three years of programmatic screening with mammography plus ultrasound was only 8% after three years of screening mammography and ultrasound in the ACRIN 6666 study (which evaluated women with dense breasts and at least one other risk factor). In the Italian multicenter trial, after adding US to mammography in women with dense breasts, the ICR was not different than for women with nondense breasts. US carries a substantial risk of false positives, with from 2 to 7% of women biopsied because of screening US, and only 10% of additional biopsies prompted only by US showing cancer.

Author Disclosure:

W. A. Berg: Advisory Board; Philips Healthcare. Consultant; Naviscan, Inc. Equipment Support Recipient; Gamma Medica, Inc. Grant Recipient; Hologic, Inc. Research/Grant Support; Gamma Medica, Inc. Speaker; SuperSonic, Imagine.

A-155 16:25

B. Do we have enough radiologists to do it? Alternatives to ultrasound to reduce interval cancers

A. Frigerio; Turin/IT (alfonso.frigerio@gmail.com)

Mammography screening (MS), i.e. screening with mammography only, is an effective and efficient means of significantly reducing breast cancer mortality. However, many European countries fail short of complete population coverage. This is largely due to the costs involved and mainly to a shortage in dedicated radiologists. Moreover, some countries already started, and others are considering,

to extend the age target of MS to 45-75. This expanded target would obviously enhance the relevance of any staffing problems. It has been estimated that adding traditional, hand-held ultrasound to MS - aiming to decrease interval cancers (IC) - might increase the need for radiologists by 40-100% depending on different estimates and especially on the criteria for the selection of women to be studied by ultrasound (age, breast density, different thresholds). This is simply not feasible, even not considering other relevant drawbacks of such a policy, as the increase in percutaneous biopsies and surgical procedures with a benign outcome. Alternative to ultrasound to reduce IC might include: 1. to employ only well trained, dedicated radiologists: this alone has been shown to reduce false negative IC rates from 40% to below 10%. 2. consider new technologies, the most promising being at this moment (2a) digital breast tomosynthesis, while a complementary option could be (2b) automated whole breast ultrasound. These two options require proper validation in a screening setting. Indeed, both would also imply an increased demand in radiological personnel, mostly related to reading times. These could be tackled by the development of dedicated CAD systems.

A-156 16:50

Discussion

F.J. Gilbert¹, A. Tardivon²; ¹Cambridge/UK, ²Paris/FR

The discussion will address the following issues:

1. How to define breast density?
2. Additional cancer detection rate using ultrasound.
3. The level of evidence for routine use of ultrasound as an adjunct to mammography.
4. How many more breast radiologists do we need to carry out ultrasound screening in Europe?

16:00 - 17:30

Room D2

Oncologic Imaging: Follow-up of Systemic and Local Therapies

CC 719

Imaging after systemic therapies: the standards

Moderator:

E.L. van Persijn van Meerten; Leiden/NL

A-157 16:00

A. RECIST criteria

Y. Menu; Paris/FR (yves.menu@sat.aphp.fr)

RECIST is a universal standard in tumour response evaluation. Therefore, it is of utmost importance that imaging technique and radiological reports are compliant with the recommendation. Advantages of standardization comprise the comparability of different examinations in the same patient, and responses in a cohort. Precise definition of response or progression makes possible to evaluate the accuracy of a specific treatment. Another advantage is that structured reporting is easier to perform, improving efficiency and communication. Technical requirements are important though easily achievable: slice thickness of 5 mm or less reconstructed in the axial plane, contiguous slices (on CT, minimal gap on MRI), robust and reproducible contrast injection with similar delay and injection rate, similar coverage ensure proper comparison of images and clear basis for decision making. Thinner slices, alternative planes, specific contrast media and/or customized MRI sequences are optional, and should not replace basic techniques. Interpretation of baseline images requires a perfect knowledge of the method for measurement of the largest diameter, identification of targets and non targets. Interpretation of evaluation examinations needs iterative comparison with Baseline and Nadir examinations, and identification of unequivocal new lesions. Obviously, a universal standard does not fit all oncology cases. It appears that some tumours like GIST or HCC may need adapted criteria in addition to RECIST. PET is only mildly included among the criteria, although it proves to be an important method for evaluation. Finally, morphology does not summarize tumour biology. Besides RECIST, the addition of structural, metabolic and/or functional information would be desirable.

Learning Objectives:

1. To consolidate knowledge of evaluation of solid tumour response.
2. To learn about tips and tricks to help bring RECIST to everyday practice.
3. To understand advantages and limitations of RECIST.

A-158 16:30

B. PERCIST: evolving considerations for PET response criteria in solid tumours

T.F. Hany; Zurich/CH (thomas.hany@gmail.com)

In solid as well as non-solid tumours, PET/CT imaging using 18-Fluoro-Deoxyglucose (FDG) has demonstrated the ability to a) correctly stage disease, b) demonstrate therapy response and c) predict therapy outcome. FDG-uptake can be measured objectively, however several factors in the standardization processes of tracer application, image acquisition and post-processing are needed for reproducibility. The term standard uptake value (SUV) measurement is used for compensating the influence of injected dose, decay time, body mass and represents FDG-uptake in any selected pixel of the image. For therapy assessment, drop in FDG-uptake represents tumour cell kill, notably a negative PET scan does not exclude viable tumour cells but overall has a better outcome. PET response criteria in solid tumours (PERCIST 1.0) have been introduced to refine previously established PET response criteria by EORTC. Major changes concern the use of lean-body-mass based SUV (SUL), SULpeak measurement in a fixed ROI, use of only a single target lesion and normalisation to liver uptake. Metric measurements in CT component of the PET/CT as an intrinsic asset like in RECIST 1.1 have not yet been introduced but might be crucial in the future. The proposed PERCIST 1.0 criteria are not yet standard since several limitations hamper its general use but may improve metabolic tumour response assessment.

Learning Objectives:

1. To learn about the evaluation of solid tumours through metabolic imaging.
2. To understand the benefits of metabolic imaging.

A-159 17:00

C. Evaluation of brain tumours

C. Majós; L'Hospitalet de Llobregat/ES (cmajos@bellvitgehospital.cat)

Malignant gliomas (WHO grade III and IV) are the most common primary tumours in the brain. Consensus guidelines consider that the standard of care for malignant gliomas include maximal surgical resection followed by combined treatment with chemoradiotherapy including temozolomide. Radiological assessment is critical in the follow-up and should be done by MRI at three different times: (1) in the early postsurgical period, (2) 2 to 6 weeks after completing treatment with radiotherapy, and then (3) every 2 to 4 months. (1) Early postsurgical MR must be done within 72 h after surgery to evaluate residual tumour and to be used as baseline for follow-up. (2) A new MR exam is recommended 2 to 6 weeks after completing RT to evaluate response to treatment. According to the Macdonald criteria, the response can be classified as Complete Response, Partial Response, Stability or Progressive Disease. The evaluation of this first exam after RT is challenging, and the pseudoprogression phenomenon can appear. Advanced MR imaging techniques can be of help. Recently, the Macdonald criteria of response have been updated by the Response Assessment in Neuro-Oncology Working Group, being the RANO criteria those to be preferentially used. (3) Additional follow-up with MR should be done every 2 to 4 months. When Progressive Disease is detected, several options can be offered, including antiangiogenic drugs. Evaluation of response to antiangiogenic drugs is challenging too, and the pseudoresponse phenomenon can appear. Management of these tumours in the context of multidisciplinary teams including neuroradiologists is recommended due to its complexity.

Learning Objectives:

1. To learn about evaluation criteria for brain tumours.
2. To become familiar with the evaluation of brain tumours after treatment with various therapies.

16:00 - 17:30

Room E1

Musculoskeletal

RC 710

Peripheral nerve imaging: MRI and US

A-160 16:00

Chairman's introduction

J. Renoux; Paris/FR (jeromerenoux@hotmail.com)

Thanks to their excellent tissue contrast, ultrasonography and MRI can perfectly visualize peripheral nerves. Nevertheless, knowledge of their anatomic relationship remains necessary. The pathologic state can affect the nerve surrounding area or the nerve itself; therefore, good comprehension of these conditions is necessary to

perform diagnostic imaging. Most of the time, clinical examination or electrophysiological study come before imaging and help to orientate the exploration. The first part of this course will address brachial plexus anatomy and pathology. The two following parts will give an understanding on nerve anatomy and pathology of the upper and the lower limbs. Strengths and weaknesses of the two techniques will be discussed.

A-161 16:05

A. Applied radiological anatomy and pathology of the brachial plexus
S. Gerevini; Milan/IT (gerevini.simonetta@hsr.it)

The Brachial Plexus (BP) originates from the ventral branches of the cervical nerve roots from C5 to T1. It comprises roots, trunks, divisions, cords, and branches, topographically divided into supraclavicular (roots and trunks), retroclavicular (divisions), and infraclavicular sections (cords and branches). The various divisions of the brachial plexus appear as linear structures with low signal intensity on MR images obtained with all sequences and in all planes (especially sagittal and coronal). The T1-weighted images optimally delineate normal nerve tracts from the musculature and blood vessels, and show the size of the nerve. The nerves appear as elongated fibers that are isointense to the scalene muscle in T1 weighted images, posteriorly and superiorly to the curvilinear flow void of the subclavian artery. The general abnormal findings include: loss of fat planes around BP components, diffuse or focal enlargement of the nerves, hyperintensity of nerve signal on T2-weighted images, focal or extensive Gadolinium uptake of the nerves on T1 fat-saturated images. Pathology of brachial plexus can be divided into non-traumatic and traumatic brachial plexopathies. Post-actinic fibrosis is the most commonly reported non-traumatic cause of brachial plexopathies, accounting for about 30% of cases, followed by metastatic breast cancer (20%) and primary or metastatic lung cancer (20%). Together, these three processes represent almost 70% of the explainable causes of brachial plexopathies. The remaining cases are caused by a variety of situations ranging from benign and malignant tumours to inflammatory disease and Thoracic Outlet Disease.

Learning Objectives:

1. To understand the anatomy of the brachial plexus as demonstrated with MRI.
2. To appreciate the range of pathology seen at the brachial plexus.
3. To become familiar with the MRI findings of brachial plexus pathology.

A-162 16:28

B. Upper limb nerve entrapment

D. Weishaupt; Zurich/CH (dominik.weishaupt@triemli.zuerich.ch)

The peripheral nerves of the upper limb are affected by a number of entrapment and compression neuropathies. These syndromes involve the brachial plexus as well as the musculocutaneous, axillary, suprascapular, ulnar, radial and median nerves. Clinical examination and electrophysiological studies are traditionally the mainstay of diagnostic work-up. However, ultrasonography and magnetic resonance imaging (MRI) may provide key information about the exact anatomic location of the lesion or may help to narrow the differential diagnosis. In certain patients with the diagnosis of a peripheral neuropathy, imaging using either ultrasonography or MRI may help establish the cause of the condition and provide information crucial for conservative management or surgical planning. In addition, imaging is particularly valuable in complex cases with discrepant nerve function test results.

Learning Objectives:

1. To become familiar with the strengths and weaknesses of US and MRI for assessing upper limb nerves.
2. To appreciate the imaging findings of upper limb nerve entrapment.

A-163 16:51

C. Lower limb nerve entrapment

C. Martinoli, A. Tagliafico; Genoa/IT (carlo.martinoli@libero.it)

A variety of peripheral neuropathies can be encountered in the lower limb. Most are entrapment syndromes affecting many nerves, such as the sciatic, gluteal, femoral, lateral femoral cutaneous, obturator and pudendal around the hip, the peroneal and its branches and the saphenous at the knee, the superficial peroneal at the lateral leg, the tibial with its plantar and calcaneal branches at the ankle, the deep peroneal and the interdigital nerves in the foot. Although clinical examination and nerve conduction studies are the mainstays of the diagnostic work-up of peripheral neuropathies, ultrasound (US) and magnetic resonance (MR) imaging may provide key information about the exact anatomic location of a lesion and the nature of the constricting finding or may help narrow the differential diagnosis. In patients with peripheral neuropathies of the lower extremity, US and MR imaging may provide critical information for planning an adequate treatment strategy. Although US and

MR imaging have followed parallel paths for nerve imaging with little comparison of the two modalities, US seems to have some advantages over MR imaging, including higher spatial resolution, time effectiveness, the ability to explore long nerve segments in a single study and to examine tissues in both static and dynamic states.

Learning Objectives:

1. To become familiar with the strengths and weaknesses of US and MRI for assessing lower limb nerves.
2. To appreciate the imaging findings of lower limb nerve entrapment.

Panel discussion:

Which on-going technological advances in MRI and US could influence the way we image peripheral nerves in the future?

17:14

16:00 - 17:30

Room E2

Foundation Course: Neuroimaging

E³ 720b

Infection and inflammation

Moderator:

A. Gouliamos; Athens/GR

A-164 16:00

A. Infection

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

Cerebral infections can be caused by bacteria, fungi, parasites, viruses and prions. Radiological evaluation plays an important role in the diagnosis, subsequent treatment and treatment monitoring. Cerebritis is characterised by poorly localised perivascular inflammatory infiltrations with scattered necrosis, oedema, and petechial haemorrhage. Radiological findings vary according to the stage of the infection from oedema, mass effect, mild/patchy/heterogeneous enhancement of cerebritis to ring-like lesions, with the capsule hypointense on T2WI, hyperintense on T1WI, heterogeneous enhancement, central necrotic area, surrounding oedema of abscesses. DWI shows high-signal intensity while ADC map shows low-signal intensity of the central necrotic area of the abscesses. MRS shows elevated lactate and amino acid peaks. Cystic lesions isointense to CSF are also seen with the parasitic infestations. Treatment can also be monitored mainly by MRI; decrease in oedema, in mass effect, and in the degree of enhancement, decreasing signal on DWI, increasing signal on ADC maps, gliosis, occasionally focal calcifications, turning of lactate and amino acid peaks to normal at MRS are the indicators of successful treatment. Imaging findings vary according to the causative fungus; from granuloma with hypointense signal on T2, abscess with rim enhancement, diffuse cerebritis with signal change and haemorrhages, haemorrhage, infarcts, enlarged perivascular space to gelatinous pseudocyst. Acute encephalitis are diffuse brain parenchymal inflammatory diseases mainly caused by viruses. They can also involve meninges. Pathologically the primary features of viral encephalitis include neuronal degeneration and inflammation with or without mass effect.

Learning Objectives:

1. To understand the concept of 'leaky vessels' in the infectious meningeal, parenchymal and ventricular involvement.
2. To learn how to proceed with imaging when 'time is of the essence'.
3. To become familiar with the specific imaging patterns of bacterial, viral, fungal, parasitic and prion infections.

A-165 16:30

B. Multiple sclerosis

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

MRI is often being used to demonstrate dissemination of lesions in the CNS in patients with multiple sclerosis (MS). In the McDonald diagnostic criteria for MS that rely more heavily on MRI than previously, a high specificity is warranted in demonstrating dissemination in space (DIS) and dissemination in time (DIT). In the 2010 updated criteria, DIS can be demonstrated by the presence of one or more asymptomatic T2 lesions in minimally 2 of 4 crucial anatomical locations: juxtacortical, periventricular, infratentorial or in the spinal cord. Simultaneous presence of asymptomatic gadolinium-enhancing and non-enhancing lesions at any time is sufficient for demonstration of DIT, or any new lesion at follow-up. MRI is also used to initiate and monitor treatment efficacy and its side-effects (like PML). In addition, neurodegenerative features such as atrophy and black holes can be determined. The most common differential diagnosis of WM lesions in patients suspected of MS are hypoxic-ischaemic white matter changes due to small vessel disease (SVD). They are usually asymptomatic but can also present with migraine,

transient ischaemic attacks, stroke or subcortical arteriosclerotic encephalopathy. Several MRI features help distinguish between MS and SVD such as the presence of micro-bleeds in the basal ganglia and deep white matter regions, borderzone or watershed lesions and lacunes. The vascular distribution of lesions may differ between MS and SVD; perivenular versus arterial respectively. Spinal cord imaging may aid in the differentiation between MS and SVD, since cord lesions are never found in the latter.

Learning Objectives:

1. To learn about the role of MRI in detecting focal and diffuse multiple sclerosis pathology.
2. To consolidate knowledge of lesion distribution, signal intensity characteristics and patterns of contrast enhancement.
3. To be able to apply the 2010 McDonald criteria to the diagnosis of MS.

A-166 17:00

C. Mimics of multiple sclerosis

V. Dousset; Bordeaux/FR (vincent.dousset@chu-bordeaux.fr)

Although the misdiagnosis of MS is very low due to the constant improvement of MS diagnostic criteria, there is no single biomarker to establish a definite MS diagnosis, and MRI lacks of specificity despite the use of new sequences or tedious post-processing methods! In addition, MS diagnostic criteria have a high-positive predictive value but they lack of sensitivity making numerous patients in suspense for the definite diagnosis. Since there are many diseases, very frequent or very rare which manifest symptoms similar to MS, an attentive inspection of clinical presentation, biological (both blood serum and CSF) and imaging markers may help in tracking mimics of MS and other differential diagnoses: immune-related disorders (ADEM, SLE, Sjögren's Sd, Clippers Sd, thyroiditis, sarcoidosis, immune reconstitution inflammatory Sd, etc.), microvessels diseases (diffuse small vessel occlusions, primary CNS angitis, etc.), infections (Lyme disease, HTLV1, etc.), primary CNS tumours, metabolic disorders (Biermer's disease) and inherited myelinopathies. During the presentation we will review MRI and MRS signs that help in targeting diseases that may mix-up with MS: white matter lesions number, location, shape, signal intensity, enhancement and duration of enhancement, associated signs such as grey matter abnormalities, meninges involvement, T2* sensitive findings, changes in MRS biomarkers, etc.

Learning Objectives:

1. To be aware of the top ten mimics of multiple sclerosis.
2. To become familiar with the imaging findings suggestive of other disorders.
3. To be informed of the importance of imaging the spinal cord for the differential diagnosis of MS/MS mimics.

16:00 - 17:30

Room F1

Special Focus Session

SF 7a

Radiographers and ultrasonography in Europe

A-167 16:00

Chairmen's introduction

D. Pekarovic¹, V. Vilgrain²; ¹Ljubljana/SI, ²Clichy/FR (dean.pekarovic@kclj.si)

In the recent years, US became a new field for radiographers in some countries across Europe. Radiographers are now performing and reporting US examinations. Accordingly, a new role for radiographers in US performance and reporting has to be established. New emphasis on clinical knowledge and pathological correlation has to be implemented during radiographers educational curricula. In addition, regulations in some countries has to be adjusted accordingly. This session will also include Portuguese model with additional facts about the role of radiographers in the context of a professional framework and about the benefits and duties of radiographers in US management team. Dutch model of education will focus on US module curriculum in the first level of education. Guidelines and models will be available framework for those embracing the idea of US radiographer. The question: What are the challenges and barriers for role extension for radiographers role in US will be discussed during the debate including an overview of educational models across the Europe.

Session Objectives:

1. To understand why ultrasound continues to be a growth area in diagnostic imaging.
2. To identify the challenges posed by the growth of this field.
3. To understand the challenges faced by radiographers carrying out US across Europe.

A-168 16:05

Levels of training and competencies across Europe

M.T. Stanton; Dublin/IE (marie.stanton@ucd.ie)

The aim of this presentation is to add to the knowledge we have of education and clinical practice of ultrasound by radiographers in Europe. Data collected via a survey of professional bodies and centres offering ultrasound education in Europe form the basis of the discussion. The aims of European ultrasound programmes are compared, and regulations guiding training and clinical practice are reviewed. Teaching and learning activities employed in the development of competent ultrasonographers are deliberated. Formative and summative assessment strategies are debated. The session finishes with some proposals for the development of ultrasound education for European Radiographers.

Learning Objectives:

1. To appreciate the similarities between radiographer competencies across Europe.
2. To become familiar with the regulations for radiographers to train and practice in Europe.
3. To understand an expert-derived consensus of educational standards for radiographer in Europe.

A-169 16:28

The role and impact of the radiographer conducted US in Portugal

R.T. Ribeiro; Lisbon/PT (ricardo.ribeiro@estesl.ipl.pt)

Radiographers have a role in ultrasound (US) within their professional boundaries. With the proper strategy, US have an unconditional value towards professional development. Abstract knowledge controlled by a group is the characteristic that best defines a profession, since abstraction gives survivability in a competitive system of professions. Radiographers exist integrated in the Portuguese health system, so their professional development should consider the interdependence system that characterises the relationship between the professional groups. The focus of this professional framework should not only be on the cognitive knowledge, but also in the translation of it to the clinical practice. Radiographers can play an important role in the response time for diagnosis and therapeutic monitoring. The role of radiographers in US should be organized in an organ-oriented workflow division, profoundly related with the clinical problems that emerge from each medical specialty. The basic principle is that the incorporation of US as a routine extension of the clinical examination will lead to a considerable contribution to the understanding of the natural history of disease and to improve/optimize the follow-up. In this framework, the radiographer assumes the complex coordination probe-eye and special navigation while the clinician is focused on the clinical analysis of the normal/abnormal findings of the exam. In conclusion, the inclusion of a radiographer in clinical routines leads to a less patient waiting time, a more dynamic workflow and improved clinical services.

Learning Objectives:

1. To become familiar with the radiographers' role in the context of a professional progression framework.
2. To understand the synergies at play in interprofessional relationships and team-work.
3. To learn the benefits of having radiographers in the management and optimisation of health systems.

A-170 16:51

Evolution of radiography education for US in the Netherlands since 1990, and its influence on their role

G. Plug; Haarlem/NL (Geert.plugin@inholland.nl)

This presentation will provide an overview of the past, present and future role of radiographers working in the field of ultrasound in the Netherlands. At the implementation of ultrasound in radiography practice in the 1970s, examinations were solely done by radiologists. The workload for the radiologists expanded quickly and already in 1980, a vocational one year course in ultrasound started in Haarlem to meet with the growing need for trained radiographers to work in ultrasound. Because the number of radiographers working in ultrasound was rising, ultrasound education became part of a four-year bachelor programme including radiography, radiotherapy and nuclear medicine (MIRT) from 1989. The initial one year course became a post-graduate course for diploma holders and later part of the Master course medical imaging and radiation oncology. The ultrasound education in the bachelor programme focuses on basis ultrasound physics and examination skills in abdominal ultrasound, as were the post-graduate course focuses on advanced practice. In present day, ultrasound is performed by radiographers in almost 75% of the hospitals in the Netherlands. Because of a growing availability of MIRT

bachelors, it is to be expected that related work fields, such as echocardiography, gynaecology and obstetrics, vascular ultrasound, musculoskeletal ultrasound and ultrasound in private practice will be performed by radiographers in the near future. A continuous adjustment of ultrasound education is therefore essential.

Learning Objectives:

1. To learn about US education over an entire four year bachelor programme.
2. To understand the role of the radiographers as a result of this bachelor programme.
3. To appreciate changes in the education programme following changes in the role of the radiographers.

Panel discussion:

What are the challenges and barriers facing role extension? 17:14

16:00 - 17:30

Room F2

Special Focus Session

SF 7b

Imaging and radiotherapy: all you need to know

A-171 16:00

Chairman's introduction

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

In this session, "Imaging and radiotherapy: all you need to know" the audience will have a comprehensive overview of the rationale for radiotherapy in cancer, current state-of-the-art planning and delivery of radiotherapy in cancer patients, and evaluation of the treatment response and radiotherapy effects. Following this session, the audience have insight into how developments in imaging may have contributed to improved outcomes in radiotherapy.

Session Objectives:

1. To understand the principles of modern radiotherapy.
2. To learn how functional and metabolic imaging have been integrated into radiotherapy planning, adaptation and response evaluation.
3. To become familiar with imaging findings after radiotherapy.
4. To understand how imaging affects radiotherapy outcomes.

Author Disclosure:

V. J. Goh: Research/Grant Support; Siemens.

A-172 16:05

Modern radiotherapy: what are the new technologies?

V. Valentini; Rome/IT (vvalentini@rm.unicatt.it)

Modern radiation oncology offers to cancer patients a safe, organ sparing, cost-effective, well-validated treatment. Nowadays, radiation can be modulated in the four dimensions of space and time, and the dose can be precisely defined to produce a specified local effect of a given magnitude. The administration of non-uniform intensity-modulated radiotherapy (IMRT) to patients as a way to create a specified, non-uniform absorbed dose distribution that provides better conformity around the tumours and increasing the amount of spared surrounding organs. The optimal implementation of IMRT requires effective control of the tumour's location as well as of the changes in tumour volume during the daily treatment. Image-guided radiation therapy (IGRT) aims at in-room imaging guiding the radiation delivery based on instant knowledge of the target location. The combination of diagnostic tools and radiation intensity modulated technology is providing new generation of hybrid machine, suitable to offer this new service. The effectiveness and convenience for the patient to practice high dose delivery in few fractions through stereotactic body radiotherapy (SBRT) implies optimal reduction of treatment margins, practical implementation of sharp dose gradients and interactive adaptation of the treatment based on IGRT modalities. Its efficacy and feasibility enlarged the offer of SBRT to different clinical conditions, where small volumes have to be treated in primary or also in oligometastatic setting. The conformity and reliability of dose delivery provided by new technology and imaging integration promoted new onset of clinical benefit and more affordability of cure to address the aging of cancer patient population.

Learning Objectives:

1. To become familiar with 3D conformal radiotherapy and intensity modulated radiation therapy (IMRT) and intensity modulated radiosurgery (IMRS).
2. To learn about brachytherapy and intraoperative radiotherapy (IORT) and its indications.
3. To understand how IMRT contributes to better treatment outcomes as compared with conventional radiotherapy.

A-173 16:23

PET/CT for radiotherapy planning: how does it assist IMRT?

A. Loft; Copenhagen/DK (annika.loft@rh.regionh.dk)

In Radiotherapy, the use of PET/CT scans for dose planning is increasing. On the PET images, the viable tumour can be delineated as a support for the delineation performed on the corresponding CT. Small malignant foci are detected and can increase the Gross Tumour Volume- oppositely, non-malignant but on CT pathological structures can be left out- of course at the discretion of the oncologist! Especially for IMRT, the tumour delineation must be very precise. This demands that the patient is prepared for therapy planning with use of fixation equipment for correct positioning and that the staff is well trained and collaborate with the staff from Radiotherapy when PET/CT scanning these patients. The collaboration across specialities, the technical issues, the tumour delineation process and the clinical impact are discussed.

Learning Objectives:

1. To learn about anatomical imaging risk compartments that define gross tumour volume (GTV).
2. To understand how PET/CT assists in delineating the GTV.
3. To understand the role of PET/CT guided IMRT and how it can lead to treatment adaptation.

A-174 16:41

Response evaluation and treatment adaptation

K. Haustermans; Leuven/BE (karin.haustermans@uzleuven.be)

Multimodal imaging is becoming more important in radiotherapy planning and delivery especially in the curative setting. Typically, before the start of a radiation treatment, a CT scan in the treatment position is taken. On this CT scan, the clinical target volume, the gross target volume and the organs at risk are delineated. However, soft tissue contrast on CT scan is low, that is why MRI is often used as well. MR images are then registered to the CT scan as the HU are needed to calculate the dose distribution. Also PET with different tracers and DW MR are under evaluation in the radiation treatment preparation process. These functional imaging modalities allow to depict more radioresistant areas within the tumour. Theoretically, a dose escalation to radioresistant subregions within the tumour becomes possible also thanks to the evolution in the technology to deliver the radiation. Several Phase II studies are ongoing to evaluate the benefits of an inhomogeneous dose distribution. Reimaging during a course of treatment allows to adapt the dose distribution, and this is called adaptive radiotherapy. Moreover, the changes measured on functional imaging performed during treatment, for example, changes in ADC values and/or SUV max are often predictive for treatment outcome. Overall, there is a rapid evolution in the integration of multimodal imaging in the radiation treatment process which will lead to a more personalized radiation treatment and to better patient outcome with higher chances of local control and less side effects.

Learning Objectives:

1. To understand the molecular tumour microenvironment (tumour hypoxia, -apoptosis and -proliferation) that may impact response to radiation treatment.
2. To learn how tumour heterogeneity, reflecting tumour microenvironment, influences dose distribution in IMRT.
3. To learn how response assessment during IMRT leads to adaptation and tailoring of radiation treatment.

A-175 16:59

MR imaging biomarkers for response evaluation

R.G.H. Beets-Tan; Maastricht/NL (r.beets.tan@mumc.nl)

Imaging plays a pivotal role in cancer diagnostics and therapy monitoring. Magnetic resonance imaging (MRI) stands out from other imaging modalities as a high-spatial resolution technique with superior soft-tissue contrast, which enables anatomic, functional as well as metabolic characterisation of the lesions. Anatomical information on itself is invaluable but not sufficient to understand the biological profile of the tumour. With nowadays cancer specific treatment, non-invasive assessment of tumour biomarkers is highly desired to predict outcome of anti-cancer treatment. The most widespread method of non-invasive assessment of imaging biomarkers is functional imaging: perfusion dynamic contrast-enhanced MRI and diffusion weighted MRI. This lecture will elaborate on the value of perfusion and diffusion MR imaging for assessment of response after radiation treatment and for predicting of response during radiation treatment. The audience will learn whether the imaging biomarkers derived from such MR techniques enable a reliable stratification of treatment and patient specific adjustment of radiation treatment.

Learning Objectives:

1. To learn about the range of MR imaging biomarkers that can be used for markers of tumour microenvironment and heterogeneity.
2. To understand the role and accuracy of diffusion and perfusion (MR) imaging for evaluation of response during and after radiotherapy.
3. To become familiar with the MR imaging findings after radiotherapy and understand the pitfalls and interpretation difficulties.

Panel discussion:

How can imaging improve outcomes in radiotherapy?

17:17

16:00 - 17:30

Room G/H

Genitourinary

RC 707

Diagnosis and management of GU tract trauma

Moderator:

A. Magnusson; Uppsala/SE

A-176 16:00

A. Imaging the kidney and ureter

M.-F. Bellin; Le Kremlin-Bicêtre/FR (marie-france.bellin@bct.aphp.fr)

Urinary tract injuries occur in approximately 10% of all abdominal trauma patients, the kidney being the most commonly injured organ. The spectrum of renal injuries ranges from minor trauma requiring no treatment to major life-threatening renal injuries that require surgical intervention. There is a growing trend toward conservative management of renal trauma. To help predict the outcome and to guide management of renal trauma, the American Association for Surgery of Trauma has created a renal injury grading system, which is based on the appearance of the kidney at surgery. Indications for renal imaging include: penetrating trauma and haematuria; blunt trauma, shock, and haematuria; and gross haematuria. Contrast-enhanced MDCT is currently the test of choice for assessing renal injury, since it provides, with short examination times, both anatomic and functional data. It is helpful to assess the type and extent of parenchymal injuries. It can help in detecting active extravasation of contrast and is of great help in guiding transcatheter embolisation. It may demonstrate vascular injuries including dissection, thrombosis, laceration, pseudoaneurysm, or arteriovenous fistula. It may also show urine leakage, pre-existing abnormalities with increased risk of injury from blunt trauma, and associated abdominal and retroperitoneal injuries. The volumetric data acquired can be used to obtain high-resolution MPR, MIP, and 3D images that help display complex injuries. The wide availability of MDCT in major trauma patients has reduced the use of other imaging modalities: IVU in unstable patients already in the operative room, and ultrasonography.

Learning Objectives:

1. To learn the indications, advantages and disadvantages of imaging modalities after trauma.
2. To learn the appropriate diagnostic imaging studies and imaging findings of different types of trauma.
3. To be able to identify a kidney that is in danger after trauma.

A-177 16:30

B. Imaging the bladder and urethra

U.G. Mueller-Lisse; Munich/DE

Trauma to the bladder and urethra may be caused by blunt force or by penetrating objects in the course of accidents, or by invasive surgical measures, such as catheterization, prostatectomy, sling operations for urinary obstruction or urinary continence or by foreign bodies introduced into the urethra. Diagnostic clarification of the exact location and nature of urethral injury requires high-quality imaging studies. In patients who have suffered either blunt or penetrating abdominal or pelvic trauma, or polytrauma, multiorgan injury is common and frequently involves the genitourinary tract. Contrast-enhanced CT is currently considered to be the primary imaging technique to evaluate trauma patients. In trauma affecting the pelvis, urethral injury is a common complication which may lead to significant long-term morbidity if remaining undiagnosed. The posterior urethra, which is close to the pubic rami and the puboprostatic ligaments, is particularly vulnerable in pelvic trauma. Certain types of pelvic fractures are associated with an increased risk of urethral injury, such that timely radiologic recognition facilitates the early diagnosis of urethral injury and ensures that serious long-term sequelae are minimized. Urethral injury may be better assessed and classified by means of urethrography than by CT. Thus, the traditional imaging modalities of RUG, VCUG, and cystography

remain useful both in the initial evaluation and in the follow-up of trauma to the urinary bladder and urethra.

Learning Objectives:

1. To be able to identify patients requiring urgent cysto-urethrography.
2. To learn to identify bladder and urethral injury.
3. To learn the imaging techniques necessary for accurate initial evaluation of the urethra in cases of complicated pelvic trauma.

A-178 17:00

C. Interventional radiology for GU trauma

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

GU trauma can easily being missed when associated with other abdominal/pelvic injuries. The type/mechanism of the trauma is the key for both imaging and treatment. Iatrogenic injuries of the GU tract are getting more and more common as a result of increasing numbers of percutaneous procedures (e.g. nephrolithotomies, biopsies). In general, renals are the most common injured part of the tract, however, by increasing numbers of renal transplantation, ureteral injuries are now common as well. Timing of the intervention is as important as taking the decision of percutaneous approach for optimal management of injury. Multiphasic CT imaging with contrast injection via both IV line and trans-urethral catheter (if possible) can demonstrate most of the injured sites with high sensitivity. CT is also useful in predicting which hemodynamically stable patients may benefit from percutaneous (non-operative) management. Vascular injury of the GU tract almost always involves renals, and bleeding and/or ischaemia is the problem. Unless the patient is at unresponsive haemodynamic shock, or has complete vascular avulsion, endovascular treatment may always be the choice. The American Association for the Surgery of Trauma's system for grading injury to the kidney is also helpful in making a decision whether surgical or endovascular intervention. Embolisation of a bleeding artery/pseudoaneurysm or stenting of an intimal dissection are the most common cases. Although the vascular injuries of the GU results with retroperitoneal hemorrhages, non-vascular injuries leading urine leaks may present with intra or extra-peritoneal urinomas. Non-vascular percutaneous intervention may be applied to urinoma, urine leak, ureteral laceration and transection injuries. These interventions include percutaneous nephrostomy for urine diversion, ureteral stent placement for ureteral injuries, and drainage tube placement for urinoma formation.

Learning Objectives:

1. To be able to determine which cases deserve management by interventional radiology.
2. To understand the techniques to manage fistulas and ruptures of the ureter and urethra.
3. To appreciate the vascular and non-vascular interventional techniques in kidney trauma.

16:00 - 17:30

Room I/K

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

MC 728

Essentials in oncologic imaging: what radiologists need to know (part 4)

Moderator:

M.F. Reiser; Munich/DE

A-179 16:00

A. Lymphoma

H. Schoder; New York, NY/US

This presentation will emphasize the important contributions of FDG PET imaging in staging and management of lymphoma, with particular emphasis on response assessment and response adapted therapy. The role of surveillance imaging, imaging in the setting of stem cell transplant, as well as the potential utility of alternate radiotracers and DWI will also be discussed briefly.

Learning Objectives:

1. To get a practical, clinically relevant summary of key imaging issues in Hodgkin and non-Hodgkin lymphoma.
2. To learn how imaging, especially PET and PET-CT can optimally assess and measure tumour treatment response, providing a value-added radiology report.

A-180 16:30

B. Musculoskeletal neoplasms

M.F. Reiser; Munich/DE

Diagnosis, staging and follow-up of musculoskeletal tumours are most important for selection of adequate therapeutic measures and prognosis of patients. Modern imaging technologies have greatly contributed to improvement. With modern MRI systems high contrast of neoplastic tissue versus normal uninvolved structures is achieved. This allows for adequate delineation of intraosseous and soft tissue extension and thereby facilitating high precision in staging. Compartmental infiltration is readily detected. Dynamic, contrast-enhanced studies allow for assessment of vascularity and perfusion, which provides valuable information concerning malignancy and benign character of a particular tumour. With diffusion-weighted imaging and diffusion-tensor imaging, microstructural information can be obtained, which correlates with response to chemotherapy and viability of the tissue. Malignant bone tumours may spread within the bone or to distant organs. Therefore, whole body imaging modalities hold great potential for comprehensive assessment. In computer tomography, major advances have been achieved recently. The combination of CT and PET in hybrid systems allows to assess function and morphology within one session. With FDG-PET, the metabolic activity of a particular lesion can be analyzed. The standard uptake value (SUV) can be utilised for differentiation of benign malignant lesions. However, there are various benign lesions, such as NOF, fibrous dysplasia, eosinophilic granuloma and aneurysmal bone cysts as well as inflammation and infection. False-negative results in FDG-PET may be found in low-grade chondrosarcoma, multiple myeloma, low-grade osteosarcoma, Ewing's sarcoma and low-grade soft tissue sarcomas.

Learning Objectives:

1. To become familiar with the imaging modalities which enable to detect and differentiate benign and malignant bone neoplasms.
2. To consolidate knowledge of radiographic, CT and MRI findings which enable to classify and stage bone tumours.
3. To understand the potential role of PET-CT and whole body MRI.
4. To learn the signs indicative of favourable and poor response to preoperative chemotherapy and for recurrence of malignant bone tumours.

A-181 16:55

C. Chemo- and radiation therapy-induced toxicity

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

Multimodal cancer therapy, including chemotherapy, biologicals and radiotherapy, is frequently associated with adverse toxic effects. Depending on the specific agent, different organs, such as brain, lung, liver, bowel, bone, heart might be affected. „Inflammatory“ reactions will occur. These will be detected on imaging as white matter lesions in the brain, reticular changes and consolidations in the lung (fibrosis, cryptogenic organizing pneumonia), diffuse liver disease, colitis, bone necrosis, or cardiomyopathy. These direct toxic effects have to be differentiated from infectious complications due to chemotherapy-induced neutropenia. These infections mainly affect the lung and are caused by fungi or viruses. Angioinvasive aspergillosis of the lung is the most frequent, but sinusitis, abscesses in brain and liver as well as sepsis with haematogenous foci are also encountered. Toxic effects of radiotherapy will mainly occur within the planned target volume and result from application of high doses to radiosensitive normal tissue leading to inflammation, fibrosis and necrosis. As imaging is routinely performed for therapy response monitoring or surveillance in patients suffering from cancer, toxic effects have to be differentiated from infectious complications, postsurgical or postradiation scar tissue or tumour recurrence. Specific patterns of toxic effects of cancer therapy in brain, lung, liver, pelvis and their differential diagnoses will be reviewed.

Learning Objectives:

1. To get an overview of organ-specific toxicity and other adverse effects of chemo- and radiotherapy.
2. To review the key imaging findings of therapy-induced organ toxicity and adverse effects.
3. To understand how to differentiate inflammatory, infectious, fibrotic, and necrotic changes from tumour recurrence.

Author Disclosure:

H. -U. Kauczor: Advisory Board; Siemens. Investigator; Boehringer Ingelheim. Speaker; Siemens, Boehringer, Bayer, Bracco.

Questions

17:20

16:00 - 17:30

Room L/M

Organs from A to Z: Heart

MC 722

Ischaemic heart disease

Moderator:

C. Catalano; Rome/IT

A-182 16:00

A. Imaging of the coronary arteries: the Holy Grail

G. Roditi; Glasgow/UK (Giles.Roditi@ggc.scot.nhs.uk)

Small critical structures in the human body require high spatial resolution imaging. Coronary artery disease carries a high disease burden regarding morbidity and mortality. The coronary arteries are not only small but also move rapidly and in a complex manner predicated on movements of the beating heart with superimposed asynchronous respiratory motion. Conventional angiography has high temporal fidelity and spatial resolution, however, this lumenogram does not fully evaluate coronary disease, a process affecting the vessel wall. The non-invasive acquisition of three-dimensional data combining high spatial and temporal resolution for coronary visualisation has proven challenging, hence the description as the 'Holy Grail'. The Holy Grail was sought not as an object but for what it could do. In similar fashion not only are the heart and related great vessels now reliably imaged in unprecedented detail but the heart can be reincorporated into a holistic evaluation of the whole patient and the advances in technology allowing coronary CT to enter clinical routine have benefited many other CT techniques. Advances in temporal resolution, broad detector arrays and dual energy imaging spurred by cardiac CT have expanded the opportunities in other areas such as whole organ CT perfusion. Perhaps more importantly the high radiation doses delivered by the initial schema for cardiac CT have led to development of dose reduction techniques with profound benefits in all CT applications as the risk:benefit changes compared to plain film radiography become compelling to allow CT as a first line modality in many situations.

Learning Objectives:

1. To learn about the meaning of CT coronary calcium screening for risk assessment.
2. To identify suitable modalities and challenges for non-invasive coronary angiography.
3. To understand the potential of coronary plaque imaging beyond calcium.

Author Disclosure:

G. Roditi: Advisory Board; Bayer Advisory Board member 2012. Consultant; past consulting for Toshiba Medical Visualisation Systems Europe. Speaker; In the past 5 years I have undertaken speaking engagements for the following: Bayer, Bracco, Guerbet, GE Healthcare & Toshiba Medical Systems.

A-183 16:20

B. The ischaemic myocardium: what to do?

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

In case of ischaemic heart disease, the assessment of myocardial viability is crucial for treatment decision making. Simply, patients with viable tissue left will improve by revascularization therapy, whereas treatment of non-viable tissue by revascularization could be fatal. Assessment of myocardial viability by imaging is dedicated to and follows different distinct pathophysiological mechanisms. It includes the assessment of regional wall motion abnormalities, regional perfusion deficits, abnormal metabolism or the direct demonstration of myocardial scars. Different methods have been established so far for demonstration of the different abnormalities including SPECT (perfusion), PET (metabolism), PET/CT (metabolism) and cardiac MR (perfusion, function, scar). Recently, even cardiac CT was introduced as comparative method for the assessment of myocardial viability and function of ischaemic myocardium combined with the possibility of direct demonstration of the coronary pathologies. Given the number of different modalities and their different approaches, knowledge about the specific strengths of each method is crucial for adequate management of patients with ischaemic heart disease. In this presentation, the importance of careful assessment of myocardium in ischaemic heart disease for adequate treatment decision making and planning will be underlined. The different methods with their different approaches to myocardial assessment should be presented together with possible advantages and disadvantages. Based on this, potential imaging algorithm will be proposed. In addition, possibilities of careful assessment of contractile reserve will be presented. Finally, therapeutic consequences of different imaging results will be demonstrated based on clinical cases, and the most important differentials should be shown.

Learning Objectives:

1. To learn how to evaluate the function of the ischaemic myocardium.
2. To identify methods of assessing the viability of the ischaemic myocardium.
3. To get an overview of the therapeutic consequences depending on imaging findings.

Author Disclosure:

C. Loewe: Board Member; member of the steering committee B/S (Apixaban studies). Investigator; investigator for different multicenter trials sponsored by Bayer, Guerbet, BMS, GE Healthcare. Speaker; speaker for Siemens, Bracco, GE Healthcare, Bayer, Guerbet, Covidien.

A-184 16:40

C. The ischaemic heart after treatment: still alive?

G. Bastarrika; Toronto, ON/CA (bastarrika@unav.es)

Non-invasive cardiac imaging modalities have shown to possess diagnostic and prognostic value in patients with coronary artery disease. Moreover, non-invasive imaging-guided therapy has gained significant importance in the last decades. In particular, computed tomography (CT) and cardiac magnetic resonance (CMR) imaging have emerged as primary imaging modalities useful to evaluate the status of coronary vasculature and myocardium before and after coronary artery revascularization. CT is particularly helpful to assess patency/stenosis of coronary artery bypass grafts or stents, to detect atherosclerosis progression in non-revascularized vessels and to plan new interventions. CMR is exceptionally effective in risk stratification after coronary revascularization, differentiating angina and non-cardiac chest pain, assessing periintervention myocardial damage and determining long term prognosis. Therefore, the assessment of the ischaemic heart after treatment may benefit from both, anatomical and functional imaging modalities. Appropriate knowledge of the added clinical value of each imaging modality will enable to choose the more adequate diagnostic test for a given patient. This lecture will introduce and enhance knowledge about how to analyse cardiac images following stent implantation and bypass grafting, will determine the appropriateness of CT after coronary intervention and will introduce the value of MRI in the follow-up of patients undergoing coronary revascularization therapy. Importance of conventional as well as stress-based CMR protocols will be emphasized, within the context of available state of the art non-invasive cardiac imaging modalities.

Learning Objectives:

1. To learn how to analyse cardiac images following bypass grafting.
2. To understand the value of cardiac imaging after coronary interventions (PTA and stenting).
3. To assess potential therapeutic consequences.

Author Disclosure:

G. Bastarrika: Speaker; Bayer, General Electric, Medrad, Siemens.

A-185 17:00

Interactive case discussion

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

During the presentation, cases on ischaemic heart disease will be shown in an interactive fashion. Cases will be selected in order to strengthen the concept that the speakers during the session have gone through. In particular, CT angiography cases of coronary arteries will be shown as well as examples on the ischaemic myocardium providing morphological and functional information. Eventually, cases of the ischaemic heart after treatment will also be shown, demonstrating the importance of cardiac imaging, especially in the clinical suspect of recurrency.

16:00 - 17:30

Room N/O

Interventional Radiology

RC 709

Expanding the role of interventional radiology in hepatocellular carcinoma

A-186 16:00

Chairman's introduction

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

Poor prognosis of HCC has shown some improvement during the last years. Targeted therapy with radiofrequency ablation (RFA) and transcatheter arterial chemoembolisation (TACE) seems to have an influence on this development. RFA is recommended as a technique for the treatment of early stage (Child A or

B, solitary HCC or up to 3 nodules < 3 cm in size) HCC. The best outcomes have been reported in Child-Pugh A patients with small single tumour, commonly less than 2 cm in diameter. When the patient is considered inoperable, RFA can be indicated also in huge tumours, even in combination with other procedures. After correctly indicated and performed RFA, we can expect a 5-year survival in 40 - 70% and curative treatments in 30% patients. RFA also plays an important role in the multidisciplinary treatment of HCC. Substantial number of HCC patients has undergone TACE as the first-line treatment for tumour control and survival prolongation. TACE (transcatheter arterial chemoembolisation) is recommended as first line non-curative therapy for non-surgical patients with large-multifocal HCC who do not have vascular invasion or extrahepatic spread. The choice of the treatment modality depends on the size and the number of tumours, the stage and the cause of cirrhosis and finally on the availability of various modalities in each centre.

A-187 16:05

A. RF ablation

J. del Cura; Bilbao/ES (joseluis.delcurarodriguez@osakidetza.net)

RF ablation is currently indicated in HCC as curative treatment in Child-Pugh A-B patients with: single < 2 cm nodule and not candidates for transplantation, 1-3 nodules < 3 cm and not candidates for resection or transplantation. RF can be also performed in patients waiting for liver transplantation. Some studies suggest that survival does not differ between RF ablation and resection in 5 cm because of the high possibility of recurrence. Different types of electrodes can be used: internally cooled, cluster, expandable, with saline instillation. Although results can be good with any of them, every type of device requires a different technique of ablation. Obtaining a margin of at least 0.5 cm of ablated tissue around the tumour is key to avoid recurrences. Combined treatments like combining chemoembolisation or PEI with RFA can be useful to increase the ablation volume. Published data show a pooled 5-year survival of 48-55%, with better outcomes in Child-Pugh A patients. In candidates for surgery, 5-year survival is similar to resection: 76%. RFA is safe: major complications appear in 10% and reported mortality is 0.15%. Tumours located subcapsular or near major vessels, biliary tree or bowel are more prone to complications. Laparoscopic ablation can be an alternative in these cases. Imaging follow-up with CT, MRI or CEUS is performed to assess the outcome and detect recurrences, new lesions or complications. Although not well established, most protocols include an immediate post-procedure imaging, 1-month follow-up and explorations every 3 or 6 months for 2-3 years.

Learning Objectives:

1. To understand the indications for RF ablation.
2. To learn about the technique and devices for RF ablation.
3. To learn about results, complications and follow-up strategies.

A-188 16:28

B. Intra-arterial procedures

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

Liver resection and ablation are the standard of care for early stage HCC, but majority of patients are not candidate because of a more advanced stage. Several intra-arterial procedures are now available for treating advanced HCC. There is no consensus on the best intra-arterial local therapy; however, it represents a great rationale of care, based upon the premise that HCC is almost exclusively supplied by arteries. Embolisation, chemoembolisation and radioembolisation are some of the local treatments for advanced HCC and several embolics were developed for that purpose. Both TACE and TAE may shut-down the arterial blood flow, leading for tumour ischaemia and tumour cell death. Association of local chemotherapy to the embolic effect represents the rationale for TACE. For this purpose, new embolic particles, which may precisely elute drugs, were introduced (Drug Eluting Beads). For radioembolisation, micro-particles are injected into the feeding arteries as vehicles for delivering interstitial sources of radiation. When disease is widely spread into the liver, a whole hepatic liver distribution of antitumour drug may be indicated. It may be obtained with intraarterial chemotherapy or with the newer technique, called percutaneous liver chemoperfusion. Because hepatic tumours are supplied by several feeders, complete tumour death may be obtained only if the entire vascular network is treated. If small feeding arteries are missed, tumour will be not completely treated and it will relapse. For this reason, the knowledge of vascular abnormalities is mandatory for a better outcome.

Learning Objectives:

1. To become familiar with the indications for intra-arterial treatment of HCC.
2. To learn the techniques of intra-arterial treatment.
3. To learn about results, complications and follow-up strategies.

Author Disclosure:

F. Orsi: Research/Grant Support; CELONOVA. Other; PROCTOR FOR DELCATH SYSTEM.

A-189 16:51

C. Portal vein embolisation before surgery

A. Denys, P. Bize; Lausanne/CH (Alban.Denys@chuv.ch)

Portal vein embolisation (PVE) is performed before hepatectomy. Portal branches of segments that will ultimately be resected are embolized. This embolisation produces local per-portal inflammation and reroutes the portal flow towards segments that will be left in place by the surgeon inducing liver regeneration of these segments. Indications are mainly hepatectomies removing more than 70-80% of the functional liver in healthy liver of more than 50-60% when the liver has been harmed either by a chronic liver disease or cirrhosis or by chemotherapy or steatosis. The procedure is done percutaneously and different embolic agents can be used for PVE, such as embolic particles, coils and plugs. Results from experimental works suggest that PVE is more efficient when embolic agent occludes small portal branches and produces significant periportal inflammation. PVE indications as well as results are evaluated by CT volumetry of the liver either manually or automatized by dedicated algorithms.

Learning Objectives:

1. To become familiar with imaging strategies and indications for embolisation.
2. To understand embolisation methods.
3. To learn about results, complications and follow-up strategies.

Author Disclosure:

A. Denys: Advisory Board; Bayer. Grant Recipient; Biocompatibles, Cook, Terumo. **P. Bize:** Advisory Board; Bayer. Grant Recipient; Biocompatibles, Cook, Terumo.

Panel discussion:

How to allow for more patients with HCC to be treated? 17:14

16:00 - 17:30

Room P

Radiographers

RC 714

Clinical audit: from EURATOM to the clinical environment

Moderators:

E.J. Adam; London/UK
D. Pronk-Larive; Middelburg/NL

A-190 16:00

A. Clinical audit: from the EURATOM treaty to EU guidelines: clinical audit RP 159

P. Wood; Helsinki/FI (paivi.wood@suomenrontgenhoitajaliitto.fi)

The EC directive 97/43/EURATOM introduced the concept of Clinical Audit for the assessment of radiological practices. The Member States were required to implement clinical audits in accordance with national procedures. This concept is of high importance for the improvement of the quality of imaging practices. In the past years, the implementation of clinical audits has been commenced in a number of varying "national procedures". Need for guidance was obvious to achieve meaningful results. In 2007-2008, the EC conducted a project to prepare guidance on clinical audit. The purpose of the project was to provide clear and comprehensive information on existing procedures and criteria for clinical audits in radiological practices. The final European Guidelines were published in June 2009. The EC guideline is to provide guidance on clinical auditing in order to improve implementation of Article 6.4 of Council Directive 97/43/ EURATOM. The guideline provides comprehensive information on existing procedures and criteria for clinical audit in radiological practices: diagnostic radiology, nuclear medicine and radiotherapy. Clinical audit is not research, quality system audits nor regulatory inspections and it is systematic and planned activity. Clinical audit is a systematic review of medical radiological procedures which seeks to improve the quality and the outcome of patient care through structured review. Clinical audit should be a multi-disciplinary, multi-professional activity. Follow general accepted rules and standards which are based on international, national or local legal regulations, or on guidelines developed by international, national or local medical and clinical professional societies.

Learning Objectives:

1. To understand the background to the publication of RP 159 along with its purpose and scope.
2. To become familiar with the principles and prerequisites of clinical audit as outlined by RP 159.
3. To become familiar with the relationship between clinical audit and regulatory controls.
4. To gain an insight into potential national, regional and international issues associated with clinical audit.

Author Disclosure:

P. Wood: Advisory Board; European Commission project 2007-2008 Contract N TREN/07/NUCL/S07. 71512, Panel of Experts Member. CEO; Society of Radiographers in Finland. Consultant; Qulitor Ltd, clinical audits.

A-191 16:30

B. Implementation in practice: a comparison of different models

S. Geers-van Gemenen; Utrecht/NL (s.geers@nvmb.nl)

The Dutch Society of Medical Imaging and Radiotherapy (NVMBR) has implemented clinical audit in 1999 for the fields radiology, nuclear medicine and radiotherapy. In the Netherlands, clinical audit is since 2010 obligatory for healthcare professions, regulated by law, to be able to practice. With clinical audit the quality of the provision of care by professionals is assessed by peers. In 1999, the NVMBR started with clinical audit. The NVMBR audit radiographers working in the Radiology and Nuclear Medicine departments every five years on request. For the radiotherapy, a multidisciplinary audit is developed since 2003. Pilots of multidisciplinary audits have been performed for radiology in 2004 and for nuclear medicine in 2010 and 2012. The evaluation of the pilots shows a benefit for the department and for the professional groups. Implementation: in 2008, the NVMBR started with a web-based tool ADAS (General Digital Audit System) to support the audit. The use of ADAS is evaluated amongst the members of the audit team and the departments. 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 understand the key components required to allow clinical audit to be implemented in practice.
2. To gain an insight into different implementation models.
3. To be informed about the key considerations that must be made prior to implementing an audit model: organisation, auditors, process, financing, the roles of professional bodies, and outcomes.

A-192 17:00

C. A perspective on the impact and benefits of clinical audit

S. O'Connor; Dublin/IE (s.oconnor@globaldiagnostics.ie)

The purpose of this lecture is to demonstrate how systematic clinical audit can be embedded in a radiology department and to provide practical insight and advice on audit selection and implementation and how to achieve critical buy in from a multi-disciplinary team to ensure that clinical audit remains an integral and self-sustaining component of a modern radiology service. The importance of appropriate resources and training will be discussed in tandem with review of current literature and guidelines available in this field. The findings, actions and outcomes will be evaluated to demonstrate the tangible and beneficial impact audits can have on patients, the team and the service delivery. Clinical Audit remains one of most important ways we have to ensure the quality of the service we provide. When implemented properly, it will result in an effective and efficient quality-assured and safe radiology service. The service must be delivered by a committed team of informed clinicians and will underpin an optimised patient journey.

Learning Objectives:

1. To gain an insight into the use of clinical audit from the perspective of a clinical audit lead in an international diagnostic imaging service provider.
2. To become familiar with the challenges that may be encountered when undertaking clinical audit.
3. To understand the significant impact that clinical audit can have from the perspective of the patient, the healthcare team and on service delivery.

16:00 - 17:30

Room Q

Special Focus Session

SF 7c

Imaging in intensive care patients

A-193 16:00

Chairman's introduction

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

Intensive care units are special places where everything happens very fast and most decisions taken are influencing not only the healing but also the survival of the patient; while the amount of available information supporting these decisions is frequently rather limited. Results of imaging examinations are therefore of very high importance, however, the extraordinary circumstances both in terms of technical conditions and in state of the patients challenge the expertise of the radiology department. Radiologists cooperating with intensive care specialists must understand the unique constraints in this environment and be aware of the clinical significance of their reports. Imaging diagnostic algorithms and examination techniques are to be flexibly adapted to the clinical situation and a fast and close communication of and consultation about the imaging findings is a basic requirement. Speakers of this session will address these general topics through the most challenging specific areas of imaging the intensive care patients.

Session Objectives:

1. To understand the importance of imaging diagnostics in the unique and challenging clinical setting of the intensive care units.
2. To learn about the technical and methodological considerations to be taken into account with this patient group.
3. To learn more about the most important conditions and the imaging findings as well as the diagnostic imaging algorithms to be used in the intensive care environment.

Author Disclosure:

A. Palkó: Advisory Board; Euromedic Intl. Consultant; Covidien.

A-194 16:05

Value of MRI for intensive care coma patients with unclear brain pathology

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

Evaluation of the degree of severity of injury, coma duration, and prediction of outcome are integral parts of the management of patients in coma at the intensive care unit. Advanced magnetic resonance imaging techniques with special focus on MR spectroscopy (MRS) and diffusion (DWI) but also of the cerebral vascularity in form of different perfusion measurements have shown to be a valuable tool in the work-up or both patients with known as well as unknown cause for coma. The causes for coma are many including infections, metabolic, traumatic and can also be seen secondary to space occupying brain lesions. The present lecture will focus the value of different MR imaging techniques and sequences in the work-up of possible cause, monitor treatment and predict outcome in coma patients at the intensive care unit.

Learning Objectives:

1. To understand the importance of magnetic resonance imaging in cases of unclear brain pathology causing severe dysfunction of the central nervous system.
2. To understand the significance of imaging in the evaluation of brain function and potential outcome following anesthesia, injuries and hypoxia.
3. To become familiar with the imaging signs and their predictive value and accuracy regarding brain death, and future role of imaging in decisions concerning the termination of intensive treatment.

Author Disclosure:

P. C. Maly Sundgren: Board Member; ISMRM, ASNR. Consultant; ICON Medial Imaging.

A-195 16:23

Computed tomography of pathologic lung conditions complicating intensive care treatment

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

Method of choice for imaging the lung of an intensive care patient is the bedside chest radiograph. CT is only done if complications are anticipated or radiographic findings are equivocal. One focus of the presentation is, therefore, to outline which diagnostic information is added by CT compared to the bedside radiograph. The

second focus will be to outline key features helpful for differential diagnosis because CT of the lung - similarly as radiography - frequently suffers from the fact that the pattern of lung reaction to inflammatory/infectious noxa is quite nonspecific. Taking these two goals into consideration, the following four pathologic situations will be discussed: pneumonia and complications, ARDS staging and signs of barotrauma, oedema and its differential diagnosis, and post-surgical conditions: normal versus pathologic findings.

Learning Objectives:

1. To understand the spectrum of pathological lung conditions, which complicate intensive care treatment.
2. To learn about the role of diagnostic imaging and its technical difficulties and requirements in the intensive care environment.
3. To become familiar with the most important imaging signs and symptoms of tracheobronchial and lung conditions, influencing the treatment and survival of the intensive care patient.

A-196 16:41

Point-of-care versus diagnostic ultrasound in the intensive care unit

E. Danse, P.-F. Laterre, L. Jacquet, A. Dragean, I. Nica, P. Trefois, L. Annet; Brussels/BE (etienne.danse@uclouvain.be)

This topic will be focused on the role of sonography in the critical care. Point care sonography is mainly dedicated to procedural guidance (vessels access or fluid puncture) or assessment of fluid in the pleural space or the abdominal cavity (for instance, FAST sonography in trauma patients). This "ultrasonic" stethoscope is more and more popular due to its miniaturisation at low cost. Diagnostic sonography has another medical scope based on the imaging knowledge of radiologists and on the capabilities of mid-range or high-level machines. The B mode and Color Doppler modalities are routinely used with additional contribution of contrast ultrasound when needed or available. In the intensive care unit, point care or diagnostic sonography are contributive for the diagnosis work-up of critical care patients, allowing an optimal use of CT and angiography or an urgent access to the operating room.

Learning Objectives:

1. To understand the concept and role of point-of-care ultrasound and its technical and training requirements.
2. To become familiar with the role and tasks of diagnostic ultrasound versus point-of-care ultrasound in the most common pathologic conditions in intensive care.
3. To learn more about typical ultrasound findings and their significance in the diagnosis, differential diagnosis and therapy of intensive care patients.

A-197 16:59

Imaging in polytrauma

U. Linsenmaier; Munich/DE (Ulrich.Linsenmaier@klinik-pasing-perlach.de)

Management of patients after polytrauma on IC units can be complex and demanding. Clinical diagnoses rely today on a thorough diagnostic workup which is mostly based on a standardised whole body CT (WBCT). ICU patients undergo follow-up MDCT to control findings (e.g. in non-operative treatment), new clinical CT indications arise, CT is often combined with bedside US and CR. Radiological Management of patients with polytrauma: imaging protocol for the initial workup: WBCT comprises nCCT, CMCT of thorax, neck and c-spine (arterial) and (pv) abdomen. CRs were mostly replaced, US is only used as FAST (focused abdominal sonography in trauma). WBCT can be modified by CTA (@35-45s; for e.g. extremity injuries), late CT scans (@120s; e.g. for bleeding dynamics, pseudoaneurysms) and delayed CT urography (CTU @ 400-500s, for pelvic and GU injuries) and also retrograde CT cystography. CT scout views and clinical findings determine the extent. Follow-up imaging of ICU patients after polytrauma: comprise dedicated MDCT, US and CR, secondary imaging procedures are MR, MRA (indicated only in stable patients) and DSA (e.g. for interventional procedures). Findings from initial WBCT determine how to proceed in a "first things first" priority-oriented clinical algorithm. Special considerations apply in imaging MOF, shock, brain oedema and in paediatric and pregnant polytrauma. Radiological findings must be discussed in the clinical context. Treatment is priority oriented and carefully planned in the context of possible concomitant injuries, and the possible risk of multi-organ failure (MOF).

Learning Objectives:

1. To appreciate the clinical significance of conditions characterised by multiple severe injuries and their systemic and multi-organ complications.
2. To explain the special role of imaging, the diagnostic algorithm and the technical, organisational and training requirements for the diagnosis and follow-up of polytrauma patients.
3. To consolidate knowledge of imaging signs and symptoms and their diagnostic value in patients with polytrauma.

Panel discussion:

What training and special skills are radiologists expected to have in order to work with intensive care units? How should we manage the clinical and technical challenges posed by this very specific environment?

17:17

16:00 - 17:30

Room Z

Vascular

RC 715

Dialysis fistula

Moderator:

H.A. Deutschmann; Graz/AT

A-198 16:00

A. Preoperative mapping

L. Turmel-Rodrigues; Tours/FR (luc.turmel@wanadoo.fr)

Nephrologists and surgeons are increasingly aware of the limitations of physical examination as a tool to assess arterial and venous anatomy prior to creating a vascular access. Greater emphasis is now being placed upon more objective methods. Arterial mapping is feasible almost exclusively by color duplex ultrasonography. Imaging of the veins is indicated if there are inadequate findings on physical examination or whenever central vein stenosis is suspected. Iodinated contrast venography and later carbon dioxide venography were the modalities of choice before the advent of ultrasonographic mapping in the 1990s. CT angiography and magnetic resonance angiography play an equally shrinking role. Anatomic variability is a common feature of upper limb vasculature. The most common arterial variant is a high origin of the radial or ulnar artery at any level from the axillary artery to the elbow. Despite having more anatomical variation than arteries, the cephalic and basilic veins are the predominantly seen veins in the forearm and upper arm of normal subjects. At the elbow, the accessory cephalic, main cephalic, median cubital, and forearm basilic veins converge to form a venous network in the shape of capital "M". Vessel size is usually underestimated since it is not always easy to tell from an image if a vein or artery is partially or completely spastic despite warming or use of vasodilators. There is a wide variation in practice as to what a surgeon does with a venous mapping report and the vascular access that is finally created.

Learning Objectives:

1. To become familiar with the indications and techniques for pre-operative arterial venous mapping.
2. To learn about the venous anatomy.
3. To become familiar with the potential pitfalls of preoperative mapping.

A-199 16:30

B. Screening for problems

D. Vorwerk; Ingolstadt/DE (dierk.vorwerk@klinikum-ingolstadt.de)

Dysfunction of dialysis fistulas and grafts is frequent and usually a stenotic process represents the underlying cause. While in grafts - in the absence of side branches - this will result in complete thrombosis after reaching a critical stenosis in conjunction with thrombophilic circumstances, in fistulas partial thrombosis is not rare leaving some parts of the fistula patent. There is few scientific work about the value of regular screening programs in dialysis fistulas and grafts and most did not find in an improved patency after starting surveillance programs by ultrasound. However, reintervention is not a good marker for the success of a surveillance program as it could be for the purpose of treatment of a stenotic lesion as well as for thrombosis. Definitely reintervention for a restenosis is usually simple, quick, effective and inexpensive while treating a thrombosed fistula or graft is time-consuming, expensive and technically more challenging. Alternatively to ultrasound, measurement of recirculation is a less time-consuming method to detect dysfunction in addition to clinical exam and palpation.

Learning Objectives:

1. To understand the spectrum of problems with dialysis fistula.
2. To learn about screening protocols and the results of screening.
3. To learn about the most common problems and how to detect them.

Author Disclosure:

D. Vorwerk: Consultant; Covidien, Cook, Bard,. Speaker; Cordis, Gore.

A-200 17:00

C. Evaluation of malfunction

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

The incidence of end-stage renal disease is increasing, with limited availability of transplants, hemodialysis accesses have become the most commonly performed type of vascular surgical procedure. However, only 50% of all haemodialysis accesses remain patent at 3 years and interventional radiology plays a major role in maintaining function. Indications for intervention include failing haemodialysis graft or fistula, arm oedema, imaging findings indicative of a significant stenosis > 50% or presence of accessory veins. Clinical assessment alone will detect a large number of failing fistula's. If the venous pressures during haemodialysis exceed 120 mmHg, fistula flow falls to < 500 ml/min, graft flow decreases to < 650 ml/min, or access blood flow falls by more than 25%. There remains debate if prophylactic treatment of failing fistulas results in better outcomes. Venous stenoses are characterised by extensive fibrosis and require ultra-high pressure balloon inflations or cutting balloon angioplasty for optimal treatment. Stenting provides no clear benefit over PTA alone and eliminates the option of using the stented vein for future surgical revision. Stenting is generally reserved for sub-optimal results with no convincing evidence currently to support using covered stentgrafts over bare nitinol stents. When critical flow reduction and clotting ensue, the bulk of the thrombus is red thrombus, which is rich in fibrin and red cells and easily extracted with aspiration, rheolytic methods or pulse-spray thrombolysis, but a platelet-rich white clot at the arterial anastomosis may require mechanical removal with an angioplasty balloon or devices such as the Fogarty thrombectomy in 35% to 60%.

Learning Objectives:

1. To understand the main indications and results of angioplasty.
2. To learn about thrombectomy and aspiration.
3. To become familiar with the indications for stenting.

Saturday, March 9

08:30 - 10:00

Room A

Interactive Teaching Session

E³ 820a

Pitfalls in heart imaging

A-201 08:30

A. CT

G. Bastarrika; Toronto, ON/CA (bastarrika@unav.es)

Cardiac CT is becoming the imaging modality of choice for an increasing number of clinical indications, not only to rule out coronary artery disease but also to evaluate cardiac morphology and function, and to determine patient outcome after coronary artery revascularization. However, as with any other imaging tools, appropriate interpretation of cardiac CT examinations is required in order to assess the clinical value of this newly established diagnostic imaging modality. This process requires performance of thorough cardiac CT acquisition protocols, detailed knowledge of standard cardiac anatomic and physiologic terminology, as well as appropriate post-processing, reading, and reporting. In particular, radiologists need to recognize and be aware of the imaging findings that may confound and mislead to interpretation errors. This lecture will summarize practical aspects of post-processing, reading and reporting non-invasive cardiac CT examinations. The value and limitations of every available CT post-processing technique including two-dimensional multiplanar reformations, curved multiplanar reformats, maximum intensity projection (MIP), and volume-rendered images will be explained. Hints to improve reading results by recognizing technical causes for various artifacts in cardiac CT will be elucidated and reading approaches to diminish false positives, false negatives and inaccuracies when assessing coronary artery stenosis will be suggested. Finally, the essentials to achieve a comprehensive and structured cardiac CT report will be provided.

Learning Objectives:

1. To learn about practical aspects of postprocessing, reading and reporting non-invasive cardiac CT examinations.
2. To learn how to improve reading of results by recognising technical causes for various artifacts in cardiac CT.
3. To become familiar with approaches to reducing false inaccuracies and misinterpretations when assessing coronary artery stenosis.

Author Disclosure:

G. Bastarrika: Speaker; Bayer, General Electric, Medrad, Siemens.

A-202 09:15

B. MRI

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

Cardiac Magnetic Resonance (CMR) is a complex imaging technique due to the intrinsic anatomical and technical peculiarities of the exam. The first include the non-orthogonal cardiac orientation within the chest cavity requiring dedicated acquisition planes, but also the complex respiratory and cardiac motion to which heart is subject and the ubiquitous presence of fat tissue surrounding the cavities which can be overcome respectively using a combination of ECG-gated and breath hold sequences with additional utilisation of fat-suppression techniques. Potential additional anatomical pitfalls also include normal structures and variants like the Moderator band, papillary muscles and the presence of prominent crista terminalis or myocardial trabeculations which recognition is mandatory and may mimic in some cases a pathological condition. Technical issues of CMR concerns the continuous intracavitary inflow of protons and the associated "slow-flow" artifacts (limiting visualisation of endomyocardial border in some cases), pitfalls related to ECG gating like inadequate synchronization or the T-Wave Swell phenomenon and finally a series of specific artifacts intrinsically related to the use of different pulse sequences that may interfere with image quality. An additional more complex issue to consider is also the widespread diffusion of high-field magnets which have further enhanced those aspects. Knowledge of the spectrum of those CMR peculiarities is mandatory in order to approach and provide a correct diagnosis according to the main clinical request. Present lecture with review most important anatomical and technical pitfalls of CMR examination offering, when possible, practical solutions to overcome those limitations.

Learning Objectives:

1. To learn about common pitfalls in MRI evaluation of the heart.
2. To become familiar with cardiac anatomical variants, potentially mimicking disease.

Author Disclosure:

M. Francone: Speaker; Bracco Medical Imaging.

08:30 - 10:00

Room B

Special Focus Session

SF 8a

Is diagnostic catheter angiography still useful in neuroimaging?

A-203 08:30

Chairman's introduction

M. Essig; Erlangen/DE (mediag@me.com)

With the rapid development of CT and MRI - angiography most diagnostic catheter angiographic studies have been replaced and conventional angiography has gained in the field of interventions. However, there are contraindications and limitations of these non-invasive techniques for diagnostic work-up. In this Special Focus Session "Is diagnostic catheter angiography still useful in neuroimaging?", the audience will learn about the current indications of diagnostic catheter angiography, its alternatives and the pro- and cons - both in three lectures and a panel discussion to follow.

Session Objectives:

1. To become familiar with the current debate on the need for diagnostic catheter angiography.
2. To learn about the pros and cons of diagnostic catheter angiography.
3. To learn about the pros and cons of alternative non-invasive angiography techniques.

A-204 08:35

What can we expect from vascular diagnostic procedures?

R. Siemund; Lund/SE (roger.siemund@skane.se)

Diagnostic vascular procedures are an important part in the primary work-up, therapy planning and follow-up of many disease of the central nervous system. Assessment of the supaaortic vessels is obviously mandatory in case of intracranial bleeding and acute or sub-acute stroke. Even in many cases with unclear neurological disease or symptoms vascular assessment is unavoidable at certain points during the diagnostic work-up in order to prove or to rule out, e.g. vasculitis or sinus thrombosis. For the referring clinicians and for the radiologist performing these vascular procedures, it is crucial to choose the most appropriate modality in each case. This presentation will focus on the different diagnostic needs in certain clinical situations. Strategies to choose the optimal modality based on a trade off between diagnostic yield, patient risk and economic costs will be discussed.

Learning Objectives:

1. To learn about the expectations from vascular diagnostic procedures in the diagnostic work-up.
2. To become familiar with the expectations from vascular diagnostic procedures in therapy planning and therapeutic procedures.
3. To learn about the expectations from vascular diagnostic procedures in the follow-up assessments.

A-205 08:58

Can non-invasive techniques as CTA and MRA replace catheter angiography for diagnostic work-up?

L. van den Hauwe; M. Voormolen, T. van der Zijden, R. Salgado, J.W. Van Goethem, P.M. Parizel; Antwerp/BE (lucvdhauwe@mac.com)

Although catheter angiography remains the gold standard for cerebrovascular imaging, in recent years, it has been replaced to some extent by less-invasive techniques, such as CTA, MRA, and ultrasound. Some of these techniques allow for cerebrovascular imaging without exposure to ionising radiation, and/or without requiring an exogenous contrast agent that could cause nephrotoxicity, allergic reaction, or other adverse effects. Moreover, all of these techniques avoid the extra time, expense, and possibility of complications that are associated with arterial catheterization. Ongoing developments in CT- and MR-based angiography continue to improve the effectiveness of these techniques, and to expand the clinical roles that they can fulfill. Nowadays, these noninvasive techniques not only provide images with high spatial resolution, but also offer time-resolved images, in which arterial and venous phases can be distinguished, and can provide selective visualisation of vessels supplied by a single supplying artery. This presentation will review the latest developments in CT- and MR-based cerebral angiography, and illustrate the use of these CT- and MR-techniques in the diagnosis of cerebral aneurysms and vascular malformations.

Learning Objectives:

1. To become familiar with the diagnostic potential of CTA and MRA.
2. To understand the current proved clinical indications where CTA and MRA can replace catheter angio.
3. To learn about safety issues in non-invasive procedures.

A-206 09:21

Diagnostic catheter angiography is not dead: current indications and advantages over the non-invasive techniques

T. Engelhorn; Erlangen/DE (tobias.engelhorn@uk-erlangen.de)

Despite computed tomography (CT) and magnetic resonance imaging (MRI), angiography including dynamic contrast-enhanced sequences, diagnostic catheter angiography is still considered the gold standard for imaging cerebral vasculature. Hereby, diagnostic catheter angiography is typically done in intracranial hemorrhages to exclude arteriovenous malformations (AVMs), dural extra-intracranial arteriovenous fistulas and aneurysms as cause of haemorrhage. AVMs as well as dural fistulas can be obscured by the surrounding blood in CT and MRI; aside, small (blister-like) aneurysms (< 2 mm) can be overlooked with CT and MRI angiography. In already diagnosed AVMs, fistulas and aneurysms, diagnostic catheter angiography has to be performed to assess the exact architecture of the vascular malformation to decide absolutely certain if endovascular treatment is possible and what (special) material will be needed for neurointerventional treatment. Furthermore, diagnostic catheter angiography is still needed for follow-up imaging after endovascular and surgical treatment of vascular malformations and intracranial stenosis. Nevertheless, despite the problem of metal artefacts intravenous high-resolution flat panel detector CT (DynaCT) seems to be almost comparable to diagnostic catheter angiography in follow-up imaging after neurointerventional procedures.

Learning Objectives:

1. To learn about the current indications for diagnostic catheter angiography.
2. To become familiar with complication rates of selective catheter angiography in high volume centers.
3. To appreciate some technical innovations for diagnostic catheter angiography.

Panel discussion:

The pros and cons of diagnostic catheter angiography in neuroimaging

09:44

08:30 - 10:00

Room C

New Horizons Session

NH 8

MR/PET: a marriage made in heaven or hell?

A-207 08:30

Chairman's introduction

B. Hamm; Berlin/DE (bernd.hamm@charite.de)

This New Horizons session aims to provide the latest insights into the hybrid imaging technique of MR/PET. Reflecting current research interests, this session focuses on MR/PET in neuroimaging and in oncologic imaging. These topics will be presented from two perspectives: that of nuclear medicine and that of radiology. MR/PET uniquely combines functional and morphological diagnostic imaging in a single examination. With this new technology, imaging eliminates the known limitations of anatomical and molecular resolution. What we will also discuss in this session are the challenges we are faced with in showing that this new hybrid technology improves not only diagnostic accuracy but also treatment outcome.

Session Objectives:

1. To introduce the potential of this new imaging modality.
2. To appreciate a new opportunity for cooperation between radiology and nuclear medicine.

A-208 08:33

MR/PET in neuroimaging: nuclear medicine

O. Sabri; Leipzig/DE (osama.sabri@medizin.uni-leipzig.de)

With the recent introduction of simultaneous PET-MR imaging systems, it is possible for the first time to investigate functional and morphological brain changes or different functional brain processes at the same time in the living human subject. This new opportunity has great potential to improve both clinical routine and research brain imaging. Examples of improved clinical routine imaging relate to dementia and brain tumour imaging. Research applications focus on the exciting opportunity to acquire PET and MR data simultaneously, focusing our interest to fast kinetic processes, like

changes in cholinergic neurotransmission/brain. Networks in cognitive impairment states of different dementia forms and Parkinson's disease, or changes of CBF early after ischemic stroke. To achieve this goal, a number of methodological challenges related to the unique technique design of combined PET-MR systems needs to be overcome, like realizing attenuation correction of the PET data, desirably without measured attenuation data. Taken together, combined brain PET-MR imaging is an important tool to support patient handling and research in neuropsychiatry and will help us to develop further towards individualized medicine.

Learning Objectives:

1. To learn about what we are able to do now.
2. To understand the nuclear aspect of neuroimaging.
3. To learn about the possibilities and limitations of neuroimaging.

Author Disclosure:

O. Sabri: Consultant; Bayer Healthcare. Grant Recipient; Bayer Healthcare. Investigator; Bayer Healthcare. Speaker; Bayer Healthcare.

A-209 08:51

MR/PET in neuroimaging: radiology

B.R. Rosen; Charlestown, MA/US (bruce@nmr.mgh.harvard.edu)

PET and MRI are imaging modalities routinely used for clinical and research applications. PET is a quantitative technique that provides exceptionally sensitive assays of a wide range of biological processes. MRI provides high-resolution anatomical information with excellent soft tissue contrast, and the ability to measure a variety of physiological, metabolic and biochemical parameters. Given the complementary nature of each modality's strengths and weaknesses, integrating PET and MRI should allow both investigators and clinicians the opportunity to gain in a single examination many of the positive attributes of both, and mitigate some of their limitations. More important, the wealth of information beyond morphology that MRI provide enables PET/MRI to go far beyond simple anatomical registration of PET molecular imaging, while the simultaneous acquisition of PET and MRI data opens up opportunities impossible to realize using sequentially acquired data. This manuscript paraphrases the Wagner Lecture delivered by B.R. at the 2011 Society of Nuclear Medicine Annual Meeting and summarizes the technical aspects of the novel technology PET/MRI in addition to emphasizing the areas where PET/MRI may make a significant impact. Although these areas include oncologic, neurologic, cardiac and psychiatric applications, PET/MRI has the potential to impact dramatically the burgeoning field of molecular imaging.

Learning Objectives:

1. To demonstrate the value of this hybrid technique.
2. To understand the radiological aspect of neuroimaging.
3. To learn about the possibilities and limitations of neuroimaging.

Author Disclosure:

B. R. Rosen: Advisory Board; Janssen Scientific. Consultant; Siemens Medical Solutions. Other; Expert Witness for Wolf Greenfield Patent Lawyers.

A-210 09:09

MR/PET in oncologic imaging: nuclear medicine

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

We evaluated a new generation of whole-body hybrid PET-MR scanner to assess its performance and added value in clinical application in oncology. A new whole-body hybrid PET/MR system (Philips Ingenuity TF) consisting of a GEMINI Time-of-Flight PET system and an Achieva 3 T X-series MRI system was tested in a clinical setting. The two scanners are separated by approximately 3 m, with a sliding bed allowing 180° rotation of the patient from one scanner to another with accurate registration between the two modalities. An initial evaluation included 62 patients having two successive studies on PET-CT and PET-MR device. This initial phase was then followed by routine utilisation of the device in clinical applications, in particular, in head and neck cancers, in breast and prostate cancers as well as in paediatric cases. In the initial cohort of patients, PET images acquired in the PET/MR with a delay of 85 ± 22 min (range 49-120 min) showed perfect correlation and identical diagnostic quality compared to the first PET acquired on PET/CT. In 42 patients (68%), additional high-resolution MR sequences were acquired for clinical diagnosis showing excellent quality without any visually detectable artifacts. SUV measurements of tumour lesions obtained after correction with MR attenuation maps showed an excellent correlation with PET-CT ($R^2 = 0.89$ and $R^2 = 0.95$). Our preliminary data show that total body PET/MR is clinically applicable in oncologic patients yielding a comparable diagnostic performance as PET/CT with respect to lesion detection and localisation.

Learning Objectives:

1. To learn about what we are able to do now.
2. To understand the nuclear aspect of oncologic imaging.
3. To learn about the possibilities and limitations of oncologic imaging.

A-211 09:27

MR/PET in oncologic imaging: radiology

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

Sequential CT, MR and PET/CT is routine in daily oncology practice. In particular, PET/CT has emerged as an important method to detect, characterise, monitor and follow-up different tumour entities. Compared to CT, however, MRI provides superior soft tissue contrast and enables additionally to assess functional information, why MRI plus PET/CT would be desirable in many cases. But sequential imaging has several limitations: it is uncomfortable for critically ill patients, costly and inefficient from a work-flow perspective. It results in spatial mismatch and misalignment correction is time consuming and still limited. Scientific and clinical considerations consequently argue for temporal and spatial coregistration of MR and PET data. Various MR techniques for imaging of perfusion, diffusion and metabolism could be precisely be related to PET-based measurements of perfusion, metabolism and cell receptor densities. Simultaneous PET/MR imaging can be advantages in different tumour, e.g. lung cancer, breast cancer, prostate cancer, lymphoma, seminal carcinoma concerning detection, staging as well as for therapy monitoring and follow-up. Coregistration of MR and PET data will also be useful for MRI-gated PET measurements of moving organs (in e.g. bronchial carcinoma) and can support biologically adapted Radiotherapy. It furthermore reduces the x-ray exposures, which is important particularly for young patients and patients who need multiple follow-up examinations. But crossfire of criticism is still justified, because the novel imaging technology may not enter routine before improvements of diagnostic accuracy, influence on therapeutic management and economic reasonability have been carefully considered and evidenced by clinical studies.

Learning Objectives:

1. To demonstrate the value of this hybrid technique.
2. To become familiar with the radiologic aspect of oncologic imaging.
3. To learn about possibilities and limitations of oncologic imaging.

Author Disclosure:

H.-P. Schlemmer: Research/Grant Support; Siemens.

Panel discussion:

What benefits and risks should we expect in terms of basic research, clinical service, and economics?

09:45

08:30 - 10:00

Room D1

CLICK (Clinical Lessons for Imaging Core Knowledge): Never without Arteries

CC 818

How old are you in reality? Vascular age and clinical events

Moderator:

L. Lonn; Copenhagen/DK

A-212 08:30

A. Clinical considerations

E. Minar; Vienna/AT (erich.minar@meduniwien.ac.at)

"Abstract Not Submitted"

Learning Objectives:

1. To learn about the frequency and importance of vascular diseases.
2. To become familiar with clinical risk stratification strategies.
3. To learn about the possibility of reducing cardiovascular risk.

A-213 09:00

B. Imaging techniques and typical findings

H.J. Lamb; Leiden/NL (H.J.Lamb@lumc.nl)

In this lecture, an overview will be given on available imaging techniques for cardiovascular imaging. Focus will be on imaging modalities used for the assessment of cardiovascular risk, with special attention to obesity related imaging procedures. Imaging strategies are needed for selecting obese patients at risk for developing obesity related cardiovascular complications and progression to type 2 diabetes. In these selected patients, tailored, more aggressive therapy should be initiated guided by imaging findings.

Learning Objectives:

1. To learn about the imaging modalities used for the assessment of cardiovascular risk.
2. To learn how to select the right test for the right patient.
3. To become familiar with the newest innovations and newest guidelines in non-invasive cardiovascular risk assessment.

A-214 09:30

C. Interactive case discussion: how to deal with the results?

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

In this session, several cases from patient care and preventive screening programs will be discussed. First, the application of the appropriate risk stratification strategy based on clinical risk scores and imaging risk scores will be discussed. It will become that the strategy is tailored to specific patient populations. Second, the audience is asked to participate in the choice of the appropriate imaging technique, the interpretation of the results and the recommendation for advanced image workup or treatment. Finally, misuse of stratification tests in patients is discussed and explained. The audience will be encouraged to participate in the discussions via the electronic voting system.

Learning Objectives:

1. To understand the strength of non-invasive risk stratification in properly selected patient populations.
2. To consolidate knowledge of the selection of the appropriate imaging technique, image interpretation and image-based treatment recommendation.
3. To learn about the risks of the inappropriate use of such risk stratification tests (Ca-scoring) in symptomatic patients.

08:30 - 10:00

Room D2

Oncologic Imaging: Follow-up of Systemic and Local Therapies

CC 819

Imaging after systemic therapies: advanced techniques

Moderator:

D.-M. Koh; Sutton/UK

A-215 08:30

A. What can we expect from biomarkers

B. Van Beers; Clichy/FR (bernard.van-beers@bjn.aphp.fr)

The purpose of this lecture is to become familiar with biomarkers and to consolidate knowledge of various biomarkers and their utility. Evidence-based assessment of anatomical and functional imaging biomarkers for tumour response. Biomarkers are quantitative parameters measured with imaging methods that can objectively assess disease status. Compared with biochemical and histological markers, imaging biomarkers have the advantage of being spatially and temporally resolved and are thus especially useful for assessing response to treatment. Anatomical imaging biomarkers based on tumour size (RECIST) are increasingly used but have limitations for assessing response to targeted treatments that induce biological changes much earlier than size changes in tumour burden. Therefore, reliance on tumour viability has increased. Viability criteria such as the mRECIST, EASL and Choi criteria are based on size measurements of viable, contrast-enhancing tumour regions or on tumour attenuation. The diagnostic efficacy and the reproducibility of the different viability criteria should be further compared. In addition, there is a growing interest for validating functional imaging biomarkers such as perfusion and diffusion parameters obtained with ultrasound, CT and MR imaging. Although promising for early assessment of response to treatment, these newer functional biomarkers need extensive validation and standardization for their wide clinical use. The added value of the more complex functional biomarkers relative to the viability parameters should also be shown. Viability and functional imaging biomarkers are evolving and emerging parameters for the early assessment of response to treatment.

Learning Objectives:

1. To become familiar with biomarkers.
2. To consolidate knowledge of various biomarkers and their utility.

A-216 09:00

B. MRI biomarkers: from acquisition to post-processing

O. Lucidarme, M. Wagner, C. Pellot Barakat, F. Frouin; Paris/FR
(olivier.lucidarme@psl.ap-hop-paris.fr)

MRI biomarkers must be able to show how tumours will respond to specific treatment. They need to allow an assessment of the effectiveness of new treatment more rapidly than classical clinical end points. These biomarkers must be easy to obtain in order to facilitate a large spread of the technique. They have to be reproducible. The longest diameter of the tumour remains the easiest biomarker that can be obtained from any kind of morphologic acquisition with no need of post-processing. Additional information about the tissular organization and cellularity can be now easily obtained using modern scanners through diffusion-weighted sequences. The ease with which those sequences are obtained masked for a while the necessity to perform a more complex post-processing than the one initially done to get reliable biomarkers. The MRI biomarkers of the microcirculation are numerous reflecting the O₂ consumption, the blood volume, the blood flow, the vessel permeability, the extravascular volume. To get them, we need to do more sophisticated acquisitions and image processing that take into account the T1 of the tissue, the arterial input function, the respiratory motion, etc. Most of these new MRI biomarkers are now used in research and in phase I studies but remains not validated in more advanced clinical trial or in clinical practice. If we want to be able to use them widely and reliably we need to perfectly understand what are the consequences of the choices we make during the acquisition and the post-processing of these biomarkers.

Learning Objectives:

1. To become familiar with MRI biomarkers.
2. To learn about tips and tricks for MRI biomarker evaluation.

A-217 09:30

C. Assessing the precision and accuracy of biomarker imaging: is it reproducible?

C.B. Sirlin; San Diego, CA/US (csirlin@ucsd.edu)

Validation of imaging biomarkers is the process of demonstrating that the biomarkers are acceptable for their intended purpose. Two important metrics used in validation are accuracy and precision. Accuracy refers to the correctness of an imaging biomarker (e.g., hepatic proton density fat fraction estimated by MR imaging) in predicting an endpoint of interest. The endpoint of interest may be another imaging biomarker (e.g., hepatic proton density fat fraction measured by MR spectroscopy), a histology-based biomarker (e.g., steatosis grade estimated by histology), a disease process-based biomarker (e.g., gene expression assessed by an immuno-histochemical analysis), or a clinical outcome (e.g., future development of cirrhosis assessed by a longitudinal outcome study). Depending on the endpoint, biomarker accuracy often is evaluated by diagnostic performance/ROC analysis or regression analysis. Precision refers to the closeness of agreement (degree of scatter) between a series of biomarker estimates made on the same subject under prescribed conditions. The closer the agreement between repeated estimates, the more likely the estimates will be similar in the future, assuming no true change in the underlying property. For this reason, knowing the precision of a quantitative biomarker is critical for interpreting changes over time when the biomarker is estimated longitudinally in clinical care or clinical trials. Precision has technical and biological components. Technical precision may be considered at four levels: within-examination repeatability, between-examination repeatability, between-"laboratory" (e.g., manufacturer, platform, field strength, center) reproducibility, and robustness (invariance to typical changes in acquisition parameters). Biological precision may be affected by temporal variability and spatial variability.

Learning Objectives:

1. To understand imaging biomarker precision (repeatability and reproducibility) and accuracy and how it is evaluated.
2. To understand how to interpret biomarker precision and accuracy in the context of the biomarker's intended use.

Author Disclosure:

C. B. Sirlin: Advisory Board; GE, Bayer, Genzyme. Consultant; Bayer, Genzyme, Takeda, Profil, Isis, Vical, Merck, Synageva, Gilead, Siemens. Equipment Support Recipient; Siemens, GE. Research/Grant Support; NIH, Bayer, Bracco, GE, Siemens. Speaker; Bayer.

08:30 - 10:00

Room E1

Emergency Radiology

RC 817

Polytrauma: redefining imaging issues for management priorities

A-218 08:30

Chairman's introduction: advanced imaging, logistics and management priorities in patients after polytrauma

H. Alkadhi; Zurich/CH

The management and logistics of the polytrauma patient remains challenging. This holds true for emergency physicians, orthopaedic surgeons, and for radiologists. In addition, workflow issues continues to evolve, with the current focus on the introduction of whole-body CT into the early resuscitation phase of severely injured patients as a standard and basic diagnostic imaging method. This session is aimed at a thorough discussion on the requirements for advanced imaging in the early clinical situation, logistics and management priorities, and on quality control in emergency radiology.

A-219 08:40

A. Vascular trauma

G. Schueller; Bülach/CH (gerd.schueller@spitalbuelach.ch)

In vascular trauma, it is essential to immediately recognize life-threatening conditions and to initiate early treatment. New logistic concepts enable an accelerated diagnostic work-up, which is mainly driven by the early use of multidetector CT. The majority of patients succumb at the site of the injury according to severe injuries of the CNS, heart and great vessels. There is another peak of early deaths within the first 4 h after the injury, which, in the majority of cases, is due to visceral hemorrhage. On the other hand, this means that the vast majority of internal injuries can potentially be survived. From a radiologic point of view, this capability becomes feasible if standard of care is carried out by dedicated facilities in which trauma teams provide service in an 24 by 7 mode. The goal of this lecture is to describe the most relevant traumatic lesions to the aorta, the thorax, the abdomen as well as the pelvis. Both, classifications of major injuries will be emphasized, and several cases will be discussed, pointing out the crucial role of an interdisciplinary approach of surgeons, anesthesiologists and radiologists in the emergency setting.

Learning Objectives:

1. To become familiar with the use of dedicated MDCT protocols, classification of vascular injuries and treatment options.
2. To become familiar with alternative imaging modalities such as US, DSA and MR.
3. To learn about typical and atypical imaging findings.

A-220 09:00

B. Chest and abdomen

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

Thoraco-abdominal injuries are a significant cause of death in the polytraumatized patients. Early recognition and communication of life-threatening thoraco-abdominal injuries is the major task the radiologists involved the emergency room. Although, most of these patients reach the hospital prior to die, 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 way, 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 emergency room will be emphasized.

Learning Objectives:

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

A-221 09:20

C. Extremities

U. Linsenmaier, L.L. Geyer;

Munich/DE (Ulrich.Linsenmaier@klinik-pasing-perlach.de)

Extremity injuries in patients after polytrauma can be complex and are initially often difficult to be fully diagnosed. Emergency radiology diagnosis is mostly based on a standardised whole body CT (WBCT), which can be extended and adapted to cover extremity injuries. Extremityinjuries comprise: fractures off (1) long bones, (2) articular joints, (3) complex fractures of hands and feet, (4) vascular, (5) soft tissue, (6) nerve and plexus injuries and (7) amputations. Imaging protocol: extremity MDCT is indicated in all major and complex bony fractures, carried out early or integrated with WBCT, CTA MIPs and MPRs enable a thorough workup. The role of US and CR is limited. Secondary imaging procedures comprise MR, MRA (in stable patients only) to evaluate instable articular injuries, injuries of tendons or major ligaments and nerve and plexus injuries) and DSA (for intervention). Clinical findings and findings from WBCT determine how to proceed, "first things first" in a priority oriented clinical algorithm. Treatment of extremity injuries must be priority oriented and carefully planned in the context of possible concurrent injuries, and a possible risk of multi-organ failure (MOF).

Learning Objectives:

1. To become familiar with imaging strategies, the role of CR, CT and MR.
2. To understand common classification systems and their impact on patient management.
3. To learn about typical and atypical imaging findings.

Panel discussion:

How to speed up your diagnoses?

09:40

08:30 - 10:00

Room E2

Foundation Course: Neuroimaging

E³ 820b

Metabolic and neurodegenerative disorders

Moderator:

S. Lehéricy; Paris/FR

A-222 08:30

A. Dementia

B. Gómez-Ansón; Barcelona/ES (bgomez@sanpau.cat)

Cognitive decline and dementia constitute an increasingly important public health issue in Europe and worldwide. Our insight in several of these conditions has increased. Thanks to knowledge gained in brain imaging. Also, imaging plays a crucial role in early, and differential diagnosis of dementia conditions. Recently, surrogate markers with imaging have been described in research literature, that can aid in treatment response and prognosis. Different techniques, such as CT, MRI, SPECT and PET with different tracers provide various types of information, and thus may have an added value to patient management. As progress is made, controversies arise about the most efficient use of imaging tools in clinical practice at different levels of health care, and especially in European countries with universal coverage. This lecture will deal with these various aspects. Recommendations and guidelines to investigate patients with dementia with imaging, and the added value of knowledgeable radiologists will be discussed. Some of the imaging findings in the most common neurodegenerative dementias such as AD, and FTLT will be covered. In addition, due to recent advances in the field, the following contributions of imaging in knowledge about, and in clinical practice in dementia will be presented in more detail: 1) Reportable causes, such as prion disease and other rapidly progressive dementias; 2) Vascular involvement in dementias: vascular/mixed type dementia, and amyloid angiopathy; and 3) Ventricular dilatation and NPH.

Learning Objectives:

1. To understand when and why you should image dementia.
2. To become familiar with the imaging findings of the most common primary degenerative and secondary vascular dementias.
3. To understand how to recognise normal pressure hydrocephalus as an underlying cause of subcortical dementia.

A-223 09:00

B. Movement disorders

T.A. Yousry; London/UK (t.yousry@ucl.ac.uk)

Disease or degeneration of the basal ganglia, cerebral cortex and sometimes the thalamus give rise to disorders of movements (MD) known as dyskinesias (Greek: difficult movement), which can be differentiated into hypokinetic and hyperkinetic syndromes. We will be concentrating on the hypokinetic syndromes, which include Idiopathic Parkinson's disease (IPD), atypical PD (APD): multiple system atrophy (MSA), progressive supranuclear palsy (PSP) and cortico basal degeneration (CBD). These movement disorders (MD) are often difficult to diagnose and to treat. Up to now, the diagnosis is based on clinical criteria. However, despite the fact that imaging plays an increasing role in establishing and confirming the diagnosis of MD, many radiologists are not familiar with the role of the various imaging techniques, in establishing the diagnosis, monitoring disease progression and furthering our understanding of the pathophysiology of MD. We will first review the role of "conventional" MRI in the workup of MD by presenting imaging signs that assist in the daily routine and that should be known by radiologists and neuroradiologists exposed to this disease entity. We will then review the contribution of specific imaging techniques such as DTI, SWI and high field imaging as well as quantitative MR post-processing techniques in improving the diagnosis, providing biomarkers for the monitoring of the natural history and furthering our understanding of the pathophysiology of MD.

Learning Objectives:

1. To learn the typical imaging findings, their anatomic substrate and the limitations of conventional MRI.
2. To understand the contribution of advanced imaging techniques such as DTI, SWI and high field imaging as well as quantitative MR post-processing techniques.
3. To understand the role of MR in the diagnosis and differential diagnosis of movement disorders.

Author Disclosure:

T. A. Yousry: Advisory Board; Biogen Idec. Author; T Yousry. Board Member; European Radiology. Research/Grant Support; MS Society of Great Britain and Northern Ireland, PSP Association, MRC, Wellcome Trust, Stroke Association, British Heart Foundation, UCL/UCLH Biomedical Research Centre, Biogen Idec, GlaxoSmithKline, Novartis. Speaker; ESOR, King Abdullah Medical City.

A-224 09:30

C. Metabolic disorders

J.F. Schneider; Basle/CH (jacques.schneider@ukbb.ch)

Metabolic disorders may present at any age. Their clinical symptoms are often scarce or non-specific. Brain MRI is often used in the setting of an acute illness but may be delayed in slowly progressive disease. Imaging appearance can be confusing as acute and chronic signal intensity alterations may overlap in many disorders. Furthermore, imaging appearance will vary during the course of the disease. Recognition of signal changes in specific structures is most helpful in the acute setting before chronic changes set in, which will blur characteristic patterns. A systematic approach based on the pattern of brain involvement is useful in the analysis of neurometabolic disorders, and has even been computerized. First, a decision whether grey or white matter involvement or both must be made based upon volume and signal alterations on T1-wi, T2-wi, FLAIR imaging and contrast enhancement. Second, alterations within either focal grey matter structures or specific white matter tracts must be recorded and estimation upon their timing, whether acute or chronic, must be made. Finally, this pattern recognition must be supplemented by microstructural data from diffusion-weighted images (DWI) and metabolic data from proton MR spectroscopy (MRS). Additional information from DWI is often restricted to the acute setting, because chronic diffusivity changes are mainly driven by unspecific myelin breakdown. On the other hand, MRS may not only identify abnormal levels of normal metabolites or demonstrate the presence of abnormal metabolites, but can also be used to monitor therapy.

Learning Objectives:

1. To become familiar with the imaging findings of the most important innate metabolic defects affecting CNS.
2. To learn how to recognise patterns of gray and white matter involvement.
3. To learn about specific discriminating imaging findings.

08:30 - 10:00

Room F1

Breast

RC 802

Clinical challenges in breast MRI

A-225 08:30

Chairman's introduction

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

Breast MRI is now recognised as one of the most useful breast imaging techniques. In this session we address the use of MRI as a screening tool in the high risk population. The high sensitivity of dynamic contrast enhanced MRI together with the high negative predictive value make this a worthwhile test that should be implemented in clinical practice. Diffusion weighted imaging is now used diagnostically and could be considered in the screening situation. The advantage is no requirement for contrast and the rapidity and lower cost of the test. However further trials are needed to confirm this as a screening tool. Non mass like enhancement is an interpretation challenge in breast MRI. Often there is confusion between normal parenchymal enhancement and that of a more sinister pathology such as lobular cancer or DCIS. This presents difficulties for the radiologist. This talk gives guidance as to the correct interpretation of this feature and advises on further management. The use of MRI in the management of patients having neo-adjuvant chemotherapy is widely accepted. Baseline examinations to assess the disease extent and subsequent examinations to establish size or volume changes together with a pre-operative examination to facilitate surgical planning are well accepted. The use of functional information that is available is less well established. Analysis of the DCE data can predict response after one or two courses of treatment and the ADC values at baseline can be prognostic. Baseline choline measurements can also be of prognostic value with a low measure predicting a good response.

Author Disclosure:

F. J. Gilbert: Equipment Support Recipient; GE. Grant Recipient; Philips. Speaker; Bracco.

A-226 08:35

A. High risk patients: establishing clinical protocols

J. Veltman; Almelo/NL (j.veltman@zgt.nl)

Contrast-enhanced MRI has, especially in younger women with dense breasts, a superior sensitivity for detecting breast cancer. Young women usually do not need screening unless they have an increased risk for developing breast cancer. An increased risk can be based on a positive familial history or based on a proven gene-mutation. The BRCA1 and BRCA2 gene mutations are the most well known gene mutations related to an increased breast cancer risk. In this group, false negative rates up to 62% have been reported for mammography. Several papers have demonstrated the value of contrast-enhanced MRI in high risk screening for early detection and even demonstrated a more favourable lymph node status for these women. An upcoming MRI technique for detecting and classifying breast lesions is diffusion-weighted imaging (DWI). The main advantages of DWI are the short examination time and that no contrast is needed. In literature, DWI has demonstrated great diagnostic potential. Especially, high sensitivities have been reported (80%-97.8%). The specificity and spatial resolution are however still moderate. The high sensitivity values reported do give DWI potential to become a fast, non-contrast, and therefore relatively cheap, highly sensitive screening technique. At this point, contrast-enhanced MRI is the best available modality for the detection of breast cancer in women with an increased risk. The detection of smaller lesions, the patient anxiety, the often benign morphologic characteristics seen in cancers and the often aggressive nature of breast cancer in young women should lower the threshold for MRI-guided-biopsies significantly.

Learning Objectives:

1. To become familiar with the literature on the role of breast MRI in screening of high risk patients.
2. To understand current protocols in clinical practice.
3. To appreciate the challenges of breast MRI imaging in this patient group.

A-227 08:58

B. Non-mass like enhancement (NMLE): when to biopsy?

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

Non-mass-like enhancement is a frequent finding in breast MRI. It relates to the fact that enhancement occurs in the normal-appearing fibroglandular tissue that surpasses that of the other parts of the parenchyma. There is no associated space occupying lesion. In pre-contrast non-fat-suppressed or fat-suppressed T1- and T2-weighted images, there is usually no observable correlation. The differential diagnosis of non-mass-like enhancement is between benign non-specific fibrocystic disease/adenosis, hormonal stimulation, and subclinical mastitis on one hand versus DCIS or (less likely) diffusely infiltrating (usually lobular) cancer on the other. Key components of differential diagnosis is configuration of the enhancement (does it follow the orientation of the milk duct or not?) and symmetry (symmetric or asymmetric). Less important criteria are internal enhancement (internal architecture) and enhancement kinetics. It is important to realize that enhancement kinetics can only be used to corroborate the suspicion of DCIS - but they cannot be used to alleviate the indication to biopsy a finding which, based on configuration and asymmetry, is suspicious. Management depends on the different constellation of clinical, mammographic, and MRI findings. It usually includes short-term follow-up (6 months) and, if stable/persistent, MR guided vacuum biopsy.

Learning Objectives:

1. To learn about the clinical significance of NMLE.
2. To understand differential diagnosis for NMLE.
3. To become familiar with a work-up algorithm of NMLE cases.

A-228 09:21

C. Monitoring response to neo-adjuvant chemotherapy

T.H. Helbich; Vienna/AT (Thomas.Helbich@meduniwien.ac.at)

Assessment of the change in tumour burden is an important feature of the clinical evaluation of cancer therapeutics. Tumour shrinkage and time to the development of disease progression are important end-points in cancer clinical trials. However, these end-points are useful only if they are based on widely accepted and readily applied standard criteria. Criteria, known as RECIST, were published and are updated on a regular base. The revised RECIST includes a new imaging appendix and underlines the importance to move from anatomic unidimensional assessment to either volumetric anatomical assessment or to functional assessment with PET or MRI. The goal of the lecture is to discuss the value of the different MR imaging techniques (e.g. MR spectroscopy, diffusion-weighted imaging, angiogenesis mapping, PET-MRI) that evaluate response to treatment in breast cancer. Participants will learn about particular imaging challenges of assessing response to neo-adjuvant chemotherapy. In addition, they will learn to understand clinical aspects of neo-adjuvant chemotherapy based on RECIST.

Learning Objectives:

1. To understand the clinical aspects of neo-adjuvant chemotherapy.
2. To appreciate evidence-based protocols for imaging in this clinical setting.
3. To learn about particular imaging challenges of assessing response to neo-adjuvant chemotherapy.

Author Disclosure:

T. H. Helbich: Advisory Board; Phillips, Hologic. Grant Recipient; SIEMENS.

Panel discussion:

How can the specificity and sensitivity of breast MRI in these indeterminate clinical and imaging scenarios be maximised?

09:44

08:30 - 10:00

Room F2

Special Focus Session

SF 8b

GI imaging: technological advances and clinical applications

A-229 08:30

Chairman's introduction

S.A. Jackson; Plymouth/UK (simon.jackson1@nhs.net)

During the past two decades, gastrointestinal imaging has undergone a number of exciting and rapid technological advances resulting in new areas of clinical application in the management of patients with GI and abdominal pathology. This evolution has included both improvements in speed and diagnostic accuracy of

the cross-sectional imaging modalities but also the emergence of new functional and quantitative techniques. In particular, the role of both the non-ionising radiation modalities of ultrasound and MRI as well as developments in MDCT have led to significant improvements in the assessment of anatomy, organ function and disease activity as well as the emerging concept of personalised imaging. This session will review the place of these technological advances with cutting edge, in-depth lectures presented by international GI radiology experts assessing the current and future imaging applications in the management of patients with GI disease.

Session Objectives:

1. To review the significant recent advances in GI imaging.
2. To understand the place of these advances in the clinical imaging of patients.
3. To summarise the future directions of GI radiology in the 21st century.

A-230 08:35

CEUS of the bowel wall: when and how

F. Maccioni; Rome/IT (francesca.maccioni@uniroma1.it)

Contrast-enhanced ultrasound (CEUS) may play a relevant role in the evaluation of bowel wall microvasculature particularly in Crohn's disease (CD), although strictly indicated for characterisation of liver lesions only. CEUS of the bowel requires the use of harmonic technology and specific softwares. Post-processing includes analysis of TTP (time to peak), time-intensity curve and patterns of contrast-enhancement distribution within the bowel wall (inward, outward). Ultrasound contrast agents for intravenous use are made of a suspension of micro-bubbles (mean diameter 3.0 -3.5 µm) passing through the pulmonary microcirculation. They are safe and do not require laboratory tests before their administration, not being nephrotoxic. Advantages in the evaluation of CD include the possibility to evaluate degree, characteristics and dynamics of contrast-enhancement of diseased intestinal segments without radiation exposure. Dynamics and patterns of enhancement have been correlated to CD activity with good sensitivity and specificity. CEUS assessment of microvascular changes before and after pharmacological treatment may be valuable to monitor therapeutic effects. On the other hand, CEUS cannot provide information on the entire small and large bowel, because of its limited field of view. Only a few centimeters of diseased bowel, usually the terminal ileum, may be investigated, while CD frequently involves longer intestinal segments of small and large bowel. Therefore, the choice of the segment to analyze with CEUS is crucial. A limited evaluation may impair the final evaluation. CEUS of the bowel should be considered an advanced but focused diagnostic tool, to use after a comprehensive intestinal evaluation.

Learning Objectives:

1. To review the relevant clinical indications for CEUS of the bowel.
2. To learn how to optimally perform a CEUS examination of the bowel wall.
3. To appreciate important findings in patients with IBD and learn how to evaluate inflammatory activity of the bowel wall.

A-231 08:58

Dual-energy (spectral) CT: GI applications

P. Rogalla; Toronto, ON/CA (Patrik.Rogalla@uhn.on.ca)

Dual-energy CT refers to the use of CT data representing two different energy spectra to display anatomy and pathology in addition to differentiating and classifying tissue composition. First applications are dating back to several decades ago, however, only recent technological advances in rapid data acquisition allowed for virtually simultaneous recording of two spectra: dual-source, rapid kV switching, dual energy helical or volume scanning, and dual-layer detector technology. Bowel peristalsis obviates the need for quasi simultaneous data recording to avoid misregistration. Nevertheless, clinical applications of dual-energy of the GI tract are sparse but exciting: mesenteric ischaemic disease, bleeding, Crohn's disease, and CT colonography including digital cleansing and polyp detection using CAD. Beyond the fascinating technology, the challenging question however remains: is there an incremental value over single energy CT that translates into better patient care?

Learning Objectives:

1. To review the concept and technique of dual-energy CT.
2. To understand the clinical application of dual-energy CT in GI imaging.
3. To appreciate the additional benefits of the technique in routine clinico-radiological practice.

Author Disclosure:

P. Rogalla: Research/Grant Support; Toshiba Medical Systems.

A-232 09:21

MR imaging of GI tract motility

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

Rapid sequence MRI now allows capture of intestinal motility. In particular with sub-second image acquisition, it is possible to image bowel peristalsis and function. The technique can be applied anywhere from the mouth to the colon, but most work has focussed on gastric imaging and increasingly for the assessment of small bowel motility. MRI evaluation of gastric emptying has been validated against barostat measurements and scintigraphy, and is has entered clinical practice in the evaluation of gastric function both in disease and in response to pharmacokinetic stimulation. Repeat measurement of gastric volume is used to calculate emptying times while rapid sequences such as TRUEFISP facilitates evaluation of peristaltic activity. Validating MRI assessment of small bowel motility is more complex-there is no simple standard if reference. Nevertheless, increasing data confirms the ability of MRI to detect abnormal small bowel motility, particularly in the context of Crohn's disease, and following drug stimulation or inhibition. Software solutions are being developed which can quantify intestinal motility captured using MRI. This presentation will describe basic MRI protocols for assessing motility, introduce how software can be used to quantify activity, outline current areas of research and explore how the technique can be used in clinical practice.

Learning Objectives:

1. To learn about the MRI protocols that can best assess bowel motility.
2. To understand the various software approaches to quantifying bowel motility.
3. To become familiar with how motility MRI can be used in clinical practice.

Panel discussion:

When should we integrate these technological advances into our routine practice?

09:44

08:30 - 10:00

Room G/H

EFOMP Workshop

New technology in diagnostic radiology: new frontiers in imaging of the lung

EF 1

Lung and chest imaging: new approaches

Moderators:

P. Sharp; Aberdeen/UK

W.J.M. van der Putten; Galway/IE

A-233 08:30

Welcome address

J.I. Bilbao¹, P. Sharp²; ¹Pamplona/ES, ²Aberdeen/UK (jibilbao@unav.es)

A-234 08:40

Radiologist's point of view: clinical and technical requirements for imaging of the lung

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

Lung imaging has recently shown a series of groundbreaking technological developments. They especially involve CT, MRI, and PET, and are mainly related to high imaging speed; gating techniques; signal enhancement technologies including new contrast agents and mechanisms, as well as new probes and targets. Some years ago, MRI paved the way for comprehensive imaging of structure and function in lung disease. Such protocols targeted perfusion, ventilation, V/Q ratio; gas exchange, vascular permeability, blood flow, shunt; haemodynamics, heart function, lung volumes, respiratory motion and mechanics. Recent developments, such as „Interpolated volume imaging“ with high spatial resolution; contrast enhancement; single and multiphase MR angiography; diffusion-weighted and diffusion tensor MRI sequences; multidirectional blood flow measurements; angiogenesis imaging and high-resolution ventilation imaging with hyperpolarized ¹²⁹Xenon gas are the main drivers for broader translational and clinical implementation. In the meantime, CT has demonstrated a surprising development towards a complex quantitative imaging technology with fast progress in iterative image reconstruction, post-processing, registration algorithms as well as multi-energy CT, such as imaging of ventilation by inhaled Xenon gas. Beyond the modality-driven radiological view onto the future direction of pulmonary functional and molecular imaging, the objectives are shifting from morphology, e.g. size, volume, shape onto function, metabolism and molecular interactions as well as on multilevel analysis of tissue composition. Thus, future

endpoints of pulmonary imaging might be: inflammation, homeostasis and energy balance, real-time visualisation of lung function: „Watch the lungs work“; imaging tumour biology and phenotype/genotype correlation.

Learning Objectives:

1. To comprehend the new approaches towards functional and molecular lung imaging.
2. To understand their potential in comprehensive and quantitative lung imaging.
3. To become familiar with new applications of structural functional and molecular imaging in lung disease.

Author Disclosure:

H. -U. Kauczor: Advisory Board; Siemens. Investigator; Boehringer Ingelheim. Speaker; Siemens, Boehringer, Bayer, Bracco.

A-235 09:10

Respiratory motion correction in lung imaging

J.A. Schnabel; Oxford/UK (julia.schnabel@eng.ox.ac.uk)

Lung imaging poses challenging problems for diagnostic image interpretation and treatment planning due to motion corruption caused by respiratory motion and inconsistent breath holds. This is particularly true for multi-modality lung imaging, where complementary information provided by different scanning systems cannot be adequately fused without prior motion compensation. We present recent methodological advances for respiratory motion correction in single- and multi-modality lung imaging. We have developed a range of non-linear registration methods, which are suitable for CT-CT lung registration, taking the complex sliding motion of the lungs into account. In addition, we have designed a modality-independent shape descriptor (MIND) suitable for MR-CT lung registration and reconstruction. Finally, we have made advances in registering diagnostic CT volumes to PET/CT acquisitions, combining sliding motion with rigid/non-rigid motion modelling. We have applied our lung registration framework including 10 patients with empyema, imaged using CT and MR; 10 patients with lung cancer scanned with CT over time; and 10 patients with lung cancer scanned with diagnostic CT and PET/CT. Using clinically annotated landmark locations, we find a sub-voxel accuracy alignment and improved overlaps of the lungs after registration, compared to more conventional lung registration methods. Recent advances in non-linear registration of single- and multi-modality lung imaging have shown that respiratory motion can be compensated for, paving the way for more accurate clinical diagnosis and more effective treatment planning.

Learning Objectives:

1. To comprehend the problem of motion corruption and difference in breath holds in lung imaging.
2. To become familiar with state-of-the-art motion correction methods in single- and multi-modality lung imaging.
3. To understand the concept of modelling complex sliding motion of the lungs.

A-236 09:35

Role of tomosynthesis in lung imaging

M. B  th; Gothenburg/SE (magnus.bath@vgregion.se)

Tomosynthesis is an imaging technique that in recent years has become available for lung imaging. Using low-dose projections of the chest, acquired over a limited angular range, an arbitrary number of section images can be reconstructed, enabling the chest to be visualised in millimetre-thick slices at a very low effective dose. Compared to conventional chest radiography, the disturbance of overlapping anatomy (the main limiting factor for detection of pathology, e.g. pulmonary nodules in chest radiography) is considerably reduced in chest tomosynthesis. Early evaluations have also shown that the detectability of pulmonary nodules is significantly higher in chest tomosynthesis than in conventional radiography. However, compared to computed tomography (CT) the limited angular range used in tomosynthesis results in a reduction in depth resolution, not allowing tomosynthesis to reach the same detection rate as can be obtained with CT. Especially, pathology in the subpleural region may be more difficult to interpret. Nevertheless, most lesions are visible in retrospect on chest tomosynthesis, suggesting that the technique may be suitable for follow-up. This presentation will summarise early evaluations and reported clinical experiences of the technique, as well as describe some of its strengths and limitations.

Learning Objectives:

1. To understand the technical principles of chest tomosynthesis.
2. To become familiar with the results of the latest clinical evaluations of chest tomosynthesis.

08:30 - 10:00

Room I/K

Chest

RC 804

Patterns in chest radiology: are there subtype patterns of ground glass opacity (GGO)?

A-237 08:30

Chairman's introduction

A. Oikonomou; Alexandroupolis/GR (aoikonom@med.duth.gr)

Ground-glass opacity (GGO) is characterised on HRCT by the presence of a hazy increase in lung opacity that does not cause obscuration of underlying bronchial and vascular margins. Although a very common finding, it also constitutes a very non-specific term since it can be seen in a variety of different intraalveolar and interstitial processes with different histology including inflammatory, infectious and neoplastic diseases that have a common physiologic mechanism: partial displacement of air. GGO may even be seen in normal processes such as poor ventilation in dependant lung areas and in expiration. Moreover, GGO can represent either an ongoing, active and potentially treatable disease or an irreversible process. In order to interpret correctly this highly non-specific but very significant finding, it is crucial to attempt to further classify the different large main entities in which this radiologic finding appears. Are there specific radiologic and HRCT findings that can help us differentiate GGO in autoimmune-inflammatory conditions from infectious and neoplastic processes? Are there associated findings other than GGO - such as nodules, reticulation or focal disease and distribution of findings that can narrow the differential diagnosis? Systematic evaluation of GGO and associated findings as well as integration with clinical information (acute, subacute or chronic symptoms) is essential in defining GGO subtypes in order to improve radiologic diagnosis.

Session Objectives:

1. To learn about the prevalence and low specificity of GGO.
2. To appreciate the need for definition of GGO subtypes to improve radiological diagnoses.

A-238 08:35

A. Ground glass opacification: why do we see it and what does it mean?

S.R. Desai; London/UK (sujal.desai@nhs.net)

Radiologists who regularly review high-resolution CT (HRCT) should be aware of the range of patterns and, more importantly, their potential pathological meaning. A pattern of ground-glass opacification is one of the more common HRCT findings but, to the unwary, its interpretation can be problematic. An important underlying principle is that a ground-glass pattern may be caused by any process - physiological or pathological - which partially displaces air. Physiological (i.e. non-disease related) ground-glass opacification is perhaps most commonly seen in subjects who, for whatever reason (e.g. breathlessness, obesity), are unable to maintain or achieve a satisfactory inspiratory effort during scanning. A generally increased lung density (in contrast to adults) is also a feature in infants and young children simply because there are fewer alveoli in the developing lung. Finally, it is worth noting that intravenous contrast administration (presumably because of a relative but temporary increase in capillary blood volume causing partial displacement of air) can unpredictably increase lung density. Disease processes which lead to partial filling of the air spaces, thickening of the interstitium, partial collapse of alveoli and/or an increased capillary blood volume will also manifest as a pattern of ground-glass opacification. In clinical practice, the recognised causes of ground-glass opacities on HRCT include pulmonary oedema (cardiogenic or otherwise), infections (e.g. pneumocystis jiroveci pneumonia) and some of the idiopathic interstitial pneumonias (e.g. non-specific interstitial pneumonia and respiratory bronchiolitis-associated interstitial lung disease). The presentation will review and revise the causes of physiological and disease-related ground-glass opacification on HRCT.

Learning Objectives:

1. To appreciate the different physiological conditions which cause GGO pattern.
2. To learn about the associations and reversibility of physiology-related GGO.

A-239 08:58

B. Inflammatory and infectious GGO

K. Marten-Engelke; Göttingen/DE (kmarten@med.uni-goettingen.de)

Ground-glass opacity (GGO) is defined as increased attenuation of the lung parenchyma without obscuration of the pulmonary vascular markings on CT images. GGO may be the result of a variety of interstitial and alveolar infectious and non-infectious inflammatory diseases. As an imaging finding alone, GGO does usually not allow a specific diagnosis. GGO in inflammatory disorders often will be present in the company of other interstitial or alveolar findings. However, the number of diseases that cause diffuse-isolated GGO or GGO as the predominant finding is relatively small and can be prioritised with clinical information. The most common cause of diffuse-isolated GGO in immunocompromised hosts are a variety of diffuse, opportunistic pneumonias, e.g. pneumocystis jiroveci pneumonia (PCP), cytomegalovirus pneumonia (CMV) or herpes simplex pneumonia (HSV), that constitute the first differential. Chronic onset disorders in immunocompetent patients include cellular non-specific interstitial pneumonia (NSIP), subacute hypersensitivity pneumonitis (HP), organising pneumonia, air-space sarcoid and drug-induced lung disease. In these disorders, ancillary findings such as an associated reticular pattern with traction bronchiectasis/bronchiolectasis (NSIP), mediastinal lymphadenopathy (sarcoidosis), superimposed nodularity or cysts may help to refine the diagnosis. In patients with collagen vascular disorders, e.g. scleroderma, GGO secondary to pulmonary involvement needs to be differentiated from drug-induced lung disease. This refresher course will put GGO in the context of outpatients versus inpatients, the acuity of clinical symptoms, e.g. fever, cough and dyspnoea, signs of massive systemic inflammation, and the clinical situation such as inhalational history, pneumotoxic drug administration, immunocompromisation, or bone marrow-suppression.

Learning Objectives:

1. To learn more about the inflammatory conditions which cause GGO.
2. To appreciate the histopathological correlates of inflammatory and infectious GGO.
3. To become familiar with GGO in autoimmune and infectious lung disease.

A-240 09:21

C. GGO in dysplasia and neoplasia

G.R. Ferretti, S. Lantuejoul; Grenoble/FR (GFerretti@chu-grenoble.fr)

In this course, we will review the dysplastic and neoplastic conditions that are associated with persistent GGO in the lung parenchyma. We will separate these conditions into those that are responsible for localised diseases such as single nodular GGO and those responsible for more extended diseases. Nodular GGO can be separated into pure or mixed or part-solid nodules. Pathology-radiology correlations showed that Nodular GGO are related to atypical adenomatous hyperplasia (AAH), adenocarcinoma (ADC) in situ (AIS), minimally invasive ADC (MIA), and invasive ADC according with the new IASLC/ATS/ERS lung adenocarcinoma classification. Differential diagnosis include exceptional metastases of angiosarcoma and melanoma as well as infection, inflammation and localised fibrosis. Diffuse GGO related to neoplastic conditions is rare and may be due to lepidic ADC (former advanced ADC with BAC component), diffuse large B-cell non-Hodgkin's Lymphoma, Intravascular lymphomatosis (IVL), mucosa-associated lymphoid tissue (MALT) lymphoma. These neoplastic diseases should be differentiated from infectious and inflammatory causes of diffuse GGO. We will review the value of different morphological CT criteria in order to differentiate benign from malignant localised GGO such as the size, the morphology (round, oval, flat), presence of mixed versus pure GGO, and the multiplicity of nodular shadows. Discussion will also include the changes that may occur within the nodule as well as the mean doubling time. The role of PET CT and trans-thoracic biopsy will be discussed. Finally, we will present the current recommendations regarding the management of nodular GGO.

Learning Objectives:

1. To learn more about the dysplastic and neoplastic conditions causing GGO.
2. To appreciate the histopathological correlates of dysplastic and neoplastic GGO.
3. To understand how to estimate malignancy on the basis of GGO pattern.

Panel discussion:

How should we report and manage ground glass opacity?

09:44

08:30 - 10:00

Room L/M

Vascular

RC 815

How I report

Moderator:

D. Bilecen; Basle/CH

A-241 08:30

A. CTA and MRA of supra-aortic arteries

J.H. Gillard; Cambridge/UK (jhg21@cam.ac.uk)

There have been considerable advances in the imaging tools available for imaging the supra aortic vessels, specifically the carotid arteries. Developments ranging from rotational DSA (allowing for accurate delineation of vascular disease) to improvements in CTA and MRA (particularly Gadolinium-enhanced studies) have greatly improved our diagnostic armamentarium. In addition, there is increased understanding that atheromatous disease localised to the carotid bifurcation is only part of the problem with cerebrovascular disease. Increased coverage of the arch and intracranial circulation are becoming increasingly important requiring greater spatial coverage. In the future, imaging of the wall components may become important. For the moment, however, management remains dependent on the accurate assessment of luminal stenosis. The greatest evidence suggests that contrast-enhanced MRA is the investigation of choice. However, CTA is extremely popular especially with clinicians, particularly as it allows algorithms for including or excluding calcification. There is a lesser evidence base, although the relentless progress of technology such as dual beam techniques makes it difficult to provide timely evidence. There are pros and cons for all methodologies, which will be addressed.

Learning Objectives:

1. To learn about a structured reporting approach to angiographic studies of supra-aortic arteries.
2. To understand the role of post-processing techniques and quantitative analysis of arterial stenosis.
3. To be able to answer specific clinical questions about supra-aortic arterial occlusive diseases.

A-242 09:00

B. CTA and MRA of thoracic and abdominal aorta

H.J. Michaely; Mannheim/DE (henrik.michaely@umm.de)

This refresher course will review pertinent and state-of-the-art techniques for angiographic imaging of the aorta with Magnetic Resonance Imaging and Computed Tomography Imaging. Clinical protocols and applications will be presented based on specific pathologies and key findings which should be included in every report will be highlighted. Where necessary radiologic-pathologic correlations and classifications are presented.

Learning Objectives:

1. To learn about a structured reporting approach to aneurysmal and obstructive diseases.
2. To learn the classifications of aneurysmatic aortic diseases.
3. To understand the role of post-processing techniques in aortic diseases.
4. To be able to answer specific clinical questions about aortic diseases.

Author Disclosure:

H. J. Michaely: Speaker; Siemens Healthcare Sector.

A-243 09:30

C. CTA and MRA of peripheral arteries

T. Leiner; Utrecht/NL (t.leiner@umcutrecht.nl)

CTA and MRA are highly valuable imaging techniques in the diagnostic and interventional workup of patients with (suspected) peripheral arterial occlusive disease. In this part of the refresher course, the role of CTA and MRA in the diagnostic and interventional pathway of patients with suspected peripheral arterial occlusive disease will be discussed, also relative to the role of more widely available techniques such as duplex ultrasonography. An important focus of the presentation will be how to report relevant findings in a structured and coherent fashion to the referring clinician. The role of source image review and advanced postprocessing techniques to detect and to visualize clinically relevant features to optimally facilitate interventional radiological and surgical treatment will be discussed in detail. In this

presentation, the relative merits and shortcomings of both techniques in specific patient populations will also be discussed.

Learning Objectives:

1. To learn about a structured reporting approach to peripheral arterial obstructive diseases.
2. To understand the importance of quantitative analysis of peripheral arterial obstructions and how to report these analyses.
3. To be able to answer specific clinical questions about peripheral arterial diseases.

Author Disclosure:

T. Leiner: Grant Recipient; The Netherlands Organisation for Health Research and Development. Research/Grant Support; My department receives research support from Philips Healthcare, Bracco, Bayer Healthcare. Speaker; Philips Healthcare, Bracco, Bayer Healthcare, GE Healthcare, Lantheus Medical.

08:30 - 10:00

Room N/O

Interventional Radiology

RC 809

What should every radiologist know about the endovascular treatment of abdominal aortic aneurysms?

A-244 08:30

Chairman's introduction

H. Rousseau, J. Auriol, C. Lions, F. Mokrane; *Toulouse/FR*
(rousseau.h@chu-toulouse.fr)

Endovascular aneurysm repair (EVAR) is a well-established technique for the treatment of abdominal aortic aneurysms (AAA). Meta-analysis have demonstrated that it can reduce perioperative mortality, complications and hospitalization but patient selection, technical expertise, surveillance and complication detection and management are crucial to determine long-term performance of EVAR devices. Actually, profound knowledge of state-of-the-art imaging techniques and strong diagnostic and interventional imaging skills play a fundamental role. Whether it is patient assessment, the choice of the appropriate technique and follow-up, the outcome of interventional procedures will always be closely related to the efficiency of pre, peri and post-procedural imaging. There will be a discussion on imaging after EVAR, focusing on imaging techniques like CT, MRA and CEUS, just to name a few.

Author Disclosure:

H. Rousseau: Consultant; GORE, MEDTRONIC, BOLTON.

A-245 08:35

A. Pre-therapeutic radiological evaluation

J. Raupach, O. Renc, P. Hoffmann, J. Zizka; *Hradec Kralove/CZ*
(janraupach@seznam.cz)

Endovascular abdominal aortic aneurysm repair (EVAR) was introduced over 20 years ago to primarily treat old and sick patients. Due to technical improvements and satisfactory clinical results of this technology, the number of patients treated with stent-grafts is steadily increasing. There is also tendency to use this therapy for ruptured abdominal aortic aneurysms. Pre-operative assessment of aortic morphology regarding suitability for stent-graft implantation is, therefore, an important challenge for every radiologist now. Main limitation of EVAR is unfavourable anatomy of landing zones and access vessels. Gold standard for EVAR planning is contrast-enhanced CTA. Alternative modality for patients with contraindications for CT, such as renal impairment, is unenhanced MR with steady-state free precession sequence. A number of 2D or 3D reconstructions are generated to provide information about the aneurysm morphology. Dedicated vessel analysis and planning software can be applied. Usually, axial images and thin MPR reconstructions are sufficient in emergent cases. Proper stent selection is a domain of operator and is still matter of his/her experience. The planning procedure can be subdivided into 4 different sections: infrarenal neck, aneurysmal sac, aortic bifurcation and access vessels. There are several critical and rules which must be obeyed during the evaluation process and general radiologists should be aware of. The presentation will review main inclusion and exclusion criteria for EVAR.

Learning Objectives:

1. To learn about the best pretreatment imaging modality.
2. To understand planning and sizing of appropriate stent-graft.
3. To become familiar with critical criteria and vessel morphology.

A-246 08:58

B. EVAR techniques and results

F. Fanelli; *Rome/IT* (fabrizio.fanelli@uniroma1.it)

Abdominal aortic aneurysm (AAA) is a relatively common disease among the elderly population. AAA, more than 5 cm in diameter, is generally prone to rupture with a mortality rate up to 63%. Stent-grafts' expected characteristics are related to low profile, adequate flexibility, kink resistance, longitudinal strength, easy and precise deployment, reliable fixation system, low permeability and modularity for customization of limb length. Endoleak is the most frequent complication of EVAR. Type I and III require immediate treatment for the continuous pressure present within the sac. Type II is necessary when the sac increases. Aortic stent-grafts can be successfully positioned in more than 90 % to 95 % of cases. A cause of failure may be the inability to insert the device through a severely diseased or tortuous iliac artery. Device misplacement or migration are rare but dangerous and require surgical conversion. EUROSTAR reports operative complications can be grouped into three categories: failure to complete the procedure (2.5 %); device or procedure related complications (10 %); arterial complications (3%). The incidence rate of systemic complications within the first 30 days is 18 %. Mortality within 30 days after operation is 2.6 %. The recent introduction of fenestrated and branched aortic endografts has greatly broadened the management options of patients with aortic aneurysms. Consequently, the use of such devices is becoming widespread and thanks to technology clinical outcomes are proving quite satisfactory.

Learning Objectives:

1. To understand indications and contraindications for EVAR.
2. To know more about advantages of different types of stent-graft.
3. To become familiar with percutaneous vascular access.
4. To learn about the latest trials.

Author Disclosure:

F. Fanelli: Consultant; Medtronic, Ev3 - Covidien, WL Gore. Research/Grant Support; Cook. Speaker; Cook, Medtronic, WL Gore.

A-247 09:21

C. Imaging follow-up and treatment of complications

R. Morgan; *London/UK* (robert.morgan@stgeorges.nhs.uk)

The first part of the lecture will discuss the optimal imaging protocol for follow-up after endovascular aneurysm repair. The merits of CT versus ultrasound versus MRI will be discussed. In the second part, the material will focus on the different types of complications after EVAR and their management. This will include the management of type 1a and 1b endoleaks, the embolisation of type 2 endoleaks by both the transarterial and the direct sac puncture routes, iliac limb problems, endograft migration and component separation.

Learning Objectives:

1. To learn about available imaging methods for follow-up.
2. To become familiar with complications and failure of EVAR.
3. To understand how to treat endoleaks.

Author Disclosure:

R. Morgan: Advisory Board; Angiodynamics. Consultant; William Cook, Europe, Covidien.

Panel discussion:

What are the best imaging methods for follow-up?

09:44

08:30 - 10:00

Room P

Cardiac

RC 803

Practical approach to cardiovascular risk stratification with CT and MRI

Moderator:

C. Peebles; *Southampton/UK*

A-248 08:30

A. Modern views on value of coronary calcium scoring for risk assessment

A. Stadler; *Vienna/AT* (alfred.stadler@meduniwien.ac.at)

The assessment of the amount of arterial calcification with computed tomography is a standard method in the risk stratification of coronary heart disease. Coronary calcium detection by CT has been shown to identify atherosclerotic plaque and to quantitatively assess coronary calcium. Many studies have demonstrated the as-

sociation between the degree of coronary calcium, the burden of atherosclerosis, and the risk for cardiovascular events associated with coronary calcium. The CAC scoring can provide individual risk assessment and can reclassify the low and particularly intermediate Framingham risk cohort into lower- and higher-risk strata. Absence of CAC is associated with a very low risk of future cardiovascular events, with modest incremental value of other diagnostic tests in this very low-risk group. The role of CAC in the work up of symptomatic patients is under discussion and there is evidence that the absence of CAC has a high negative predictive value for ruling out acute coronary syndrome. Although the CAC measurement is highly standardised, some technical aspects have to be considered, all possibilities of dose reductions have to be utilised. This presentation will show the technical and epidemiological fundamentals of CAC scoring and discuss the clinical applications of the method.

Learning Objectives:

1. To understand what kind of information calcium scoring can deliver and the appropriate indications.
2. To become familiar with its role in an asymptomatic and in a symptomatic population.
3. To learn about the current data and guidelines supporting its use for assessment of cardiac risk.

A-249 09:00

B. Coronary CTA: from detection of stenosis to prognosis

N.R. Mollet¹, F. Cademartiri²; ¹Turnhout/BE, ²Rotterdam/NL
(nramollet@gmail.com)

CT coronary angiography permits comprehensive assessment of coronary artery disease including detection of both significant stenosis and non-significant plaques, and their location and extent within the coronary tree. Plaques can be further divided into calcified, non-calcified or mixed plaques. Such comprehensive assessment of coronary artery disease may further improve risk stratification compared to assessment of the calcified plaque burden only. The vast majority of current publications investigating the prognostic value of CT coronary angiography included symptomatic patients. These studies have shown that CT coronary angiography has an independent prognostic value compared to traditional risk factors. Moreover, CT coronary angiography significantly improved currently used risk stratification models, e.g. the Framingham risk score alone or combined with calcium scoring. To date, data on the prognostic value of CT coronary angiography in asymptomatic individuals is scarce, mainly because of the relatively high radiation exposure using older 16- or 64-slice CT equipment. However, radiation exposure can be significantly reduced to values approaching those of traditional calcium scoring using more up-to-date CT scanner technology. The results of currently ongoing follow-up studies investigating the prognostic value of CT coronary angiography in high-risk, asymptomatic patients are needed to further establish its precise role in clinical decision making.

Learning Objectives:

1. To understand the accuracy of CTA in the diagnosis of coronary disease.
2. To become familiar with the strengths and limitations of the various quantification techniques.
3. To appreciate the prognostic value of CTA in coronary disease.

A-250 09:30

C. Myocardial perfusion and viability for risk scoring

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

The combined evaluation of coronary anatomy, myocardial perfusion at rest/stress as well as viability imaging using late gadolinium enhancement provides a comprehensive evaluation of ischaemic and non-ischaemic heart disease. Recent advances in myocardial perfusion imaging include demonstration of superior performance over SPECT imaging, whole heart perfusion imaging and developments from visual to true quantitative perfusion analysis. Integrated coronary/perfusion/viability evaluation has great diagnostic as well as prognostic performance. Perfusion analysis provides highly relevant information on the haemodynamic significance of a coronary artery stenosis in correspondence to the invasive assessment fractional flow reserve measurement. Myocardial perfusion may help to select optimal therapy in coronary artery disease. Dysfunctional, hibernating myocardium can be characterised by the combined assessment of perfusion (perfusion-contrastility (mis)match), late gadolinium enhancement of scar transmurality and recovery of wall motion under low dose dobutamine stimulation. MRI evaluation of perfusion, scar, area at risk, wall motion at rest and under stress provides optimal data for improved risk stratification in various clinical scenarios.

Learning Objectives:

1. To become familiar with the current status of CT and MRI for evaluation of myocardial perfusion and viability.

2. To understand the accuracy of myocardial perfusion in identifying ischaemia and its role in risk assessment.
3. To learn the prognostic value of viability imaging in ischaemic heart disease.

08:30 - 10:00

Room Q

Paediatric

RC 812

Imaging the paediatric spine

Moderator:

C.J. Kellenberger; Zurich/CH

A-251 08:30

A. Craniocervical junction abnormalities

B. Ozgen Mocan; Ankara/TR (burce@hacettepe.edu.tr)

Craniocervical junction (CCJ) is defined as the region extending from the basiocciput to the second cervical interspace. This region anatomically consists of the occiput, the first and second cervical vertebrae, surrounds the cervicomedullary junction and the lower cranial nerves. Evaluation of this region requires a basic knowledge of the anatomical landmarks and the normal osseous relationships. The radiologists must also be familiar with the CCJ craniometry that uses several lines, angles and measurements, such as Chabera's line, McGregor's line and Welcher's basal angle. The CCJ pathology may result in clinical symptoms when there is compression of adjacent neurovascular structures or abnormal cerebrospinal fluid dynamics and the symptoms may range from pain, vertigo to cranial nerve palsies. The discussion of CCJ pathologies often involves the terms platybasia, basilar invagination and basilar impression; terms that are often subject to confusion and misnaming. The disorders of this region include congenital malformations (as a component of a syndrome such as achondroplasia, Down syndrome or as an isolated developmental anomaly) as well as acquired conditions including inflammatory, infectious and neoplastic processes.

Learning Objectives:

1. To learn about normal cervical junction development and anatomy.
2. To understand congenital cervical junction anomalies.
3. To appreciate acquired cervical junction pathology.

A-252 09:00

B. Inflammation, infection and tumours: the role of imaging

M.I. Argyropoulou; Ioannina/GR (margyrop@cc.uoi.gr)

Intramedullary and intradural-extramedullary tumours are less common than intracranial tumours. Spinal cord enlargement and heterogeneous appearance with solid and cystic components represent the main characteristics of intramedullary tumours. Low-grade astrocytomas (pilocytic) are the most common followed by gangliogliomas. Extensive involvement of the spinal cord is common. Holocord involvement and calcifications are most frequently seen in gangliogliomas. Paediatric intramedullary ependymomas are almost never seen outside the context of NF2. Metastatic disease due to CSF seeding of intracranial tumours (Medulloblastomas) represent the most common intradural-extramedullary tumours. Multiple intradural neurinomas and meningiomas are found in NF2. Inflammatory demyelinating disorders may affect the cord and the spinal nerve roots in childhood. Guillain-Barre syndrome is an autoimmune acute demyelinating poly-radicleoneuropathy characterised by either diffuse or ventral nerve root enhancement. Spinal cord lesions in multiple sclerosis (MS) are mainly located dorsolaterally, extend over less than two vertebral segments in length and affect less than half of the cross-sectional area of the cord. Spinal cord lesions in Acute disseminated encephalomyelitis (ADEM) extend over more than three vertebral segments in length and occupy more than two-thirds of the cross-sectional area of the cord. Differences in brain and spinal cord imaging findings are useful in the differential diagnosis between MS and ADEM. Spinal cord involvement similar to that found in ADEM may be found in idiopathic acute transverse myelitis (ATM) and in neuromyelitis optica (NMO). Lack of brain involvement in ATM and the presence of the NMO specific IgG autoantibody are useful in the differential diagnosis with ADEM.

Learning Objectives:

1. To learn about the etiologies and the imaging findings of infectious, para-infectious and autoimmune disorders.
2. To appreciate the role of spinal MRI in the differential diagnosis of multiple sclerosis vs its mimics.
3. To become familiar with the imaging findings of primary and metastatic tumours.
4. To learn about the indications of whole spine MRI with presence of brain tumours.

A-253 09:30

C. Imaging spinal trauma in childhood

M. Maas; Amsterdam/NL (m.maas@amc.nl)

The presentation will focus on acute trauma in the cervical spine and more chronic, sports-related overuse kind of trauma in the lumbar spine of pediatric patients. The clearance of the paediatric cervical spine on admission on the Emergency Room remains a challenge for both clinicians as well as attending radiologists. The literature on the use of The National Emergency X-Radiography Utilisation Study (NEXUS) criteria in children is discussed. Also, the use of MDCT in the paediatric population is critically debated. Focus is set on age-related trauma mechanism. In clearing C-spine, conventional Radiography remains mainstay. Guidelines for interpretation of these views will be given and examples of its use are presented. In addition, the imaging findings when using MDCT will be enhanced. A brief discussion on use of MRI in the (sub) acute setting, in the light of evidence-based criteria will be supplied. In high-performing athletes, overuse trauma of the spine, mainly the lumbar spine is well known. The urge for competing at the highest level leads to intensive training programs in young children and adolescents. The growing lumbar spine is an area of well-known overuse-related injuries. Within the range of stress-induced bone marrow edema like patterns of abnormality, the devastating end stage is a stress fracture, of the pars intervertebralis. The potential role of imaging, both in detecting as well as in potential prognosis will be discussed. Imaging strategy both in the acute as well as in the overuse type of injury will finalize the presentation.

Learning Objectives:

1. To understand how best to investigate suspected spinal trauma in a child.
2. To appreciate the imaging findings.
3. To consolidate knowledge about the differences between paediatric and adult spinal trauma.

10:30 - 12:00

Room A

Interactive Teaching Session

E³ 920a

Tips and tricks in chest imaging

A-254 10:30

A. Plain radiography

J. Cáceres; Barcelona/ES (josecac@gmail.com)

There are certain signs in the chest radiograph, which help in the identification and differential diagnosis of selected processes. Their appearance is characteristic enough to be identified. Some of them correspond to normal variants, which should not be confused with pathologic processes. In this presentation, we will describe several signs in chest imaging that, in our experience, have proven helpful to us in the diagnosis of chest pathology.

Learning Objectives:

1. To become familiar with useful signs in the diagnosis of chest disorders in the chest radiograph.
2. To learn about common pitfalls in plain radiography of the chest.
3. To understand the mechanisms that cause errors in image interpretation of chest radiographs.

A-255 11:15

B. CT

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

Interpretation of chest images is fraught with errors. Confusing images may occur in chest CT and conventional radiography. Understanding the cause of the error and using some "tricks" the radiologist may overcome these situations. Three aspects that may be of useful are: Gravity, Space and Time. Gravity may help the radiologist by using simple manoeuvres such as prone or lateral decubitus. Space relates to the location of the lesion. Upper or lower lobe locations are associated with certain pathologies. Time lapse is a major factor that may influence our diagnosis. Previous studies are essential. Fast growth or reduction of a lesion usually is associated with non-neoplastic disorders. Follow-up in acutely ill patients may be of great value and well as in lesions in oncologic patients. The lecture will present cases of variable difficulty where using these simple "tricks" the diagnostic problem can be solved.

Learning Objectives:

1. To become familiar with useful signs in the diagnosis of chest disorders in CT.
2. To learn about common pitfalls in CT of the chest.
3. To understand the mechanisms that cause errors in image interpretation of chest CT.

10:25 - 12:00

Room B

ESR meets South Africa

EM 3

Imaging HIV and TB

Welcome by the ESR President:

G.P. Krestin; Rotterdam/NL

Presiding:

J.I. Bilbao; Pamplona/ES

C. Sperry; Cape Town/ZA

A-256 10:30

Introduction

C. Sperry; Cape Town/ZA (csperry@iafrica.com)

In South Africa, HIV infection is a high risk factor for stroke in young patients. Prof Victor Mngomezulu will present HIV-related Cerebrovascular Disease: The South African experience. A systematic review of published literature from three major South African academic centres in the last 12 years. The concept of the Rich focus as the cause of tuberculous meningitis is controversial. Using original images from Arnold Rich's work, as well as that of the South African physician JN Coetzee's thesis on tuberculous meningitis, Dr Pieter Janse van Rensburg will illustrate why there is doubt as to the role of the Rich focus as the cause of basal cisternal tuberculous meningitis and propose a more likely pathogenetic mechanism based on radiological-pathological correlations using MR imaging. The incidence of tuberculosis (TB) is increasing in both developing and developed world, and is complicated by the emergence of multi-drug resistant disease and co-infection with HIV. Dr Tracy Kilborn will cover the varied presentations of TB in the spine and discuss the MRI features. South Africa has the highest global HIV prevalence, estimated at 5.6 million people, including 377,000 children. Prof Richard Pitcher describes the 5-year findings of a Cape Town-based US-UCT collaborative paediatric pulmonology HIV-research group focussing on severe CXR abnormalities in HIV infected children. The two interludes will be presented by Prof Zarina Lockhat. The first will cover radiology training in South Africa. The final interlude will be a celebration of SOUTH AFRICA: the country, its people, its diversity, and its attractions.

Session Objectives:

1. To learn about cerebrovascular disease in HIV infected patients in South Africa.
2. To understand the pathogenesis of TB meningitis and its implications for treatment.
3. To become familiar with the MR imaging of spinal TB in children and possible differential diagnoses.
4. To consolidate knowledge of chest radiograph reporting in HIV-infected children.
5. To appreciate South Africa, the country, its diversity and how its radiologists are trained.

A-257 10:35

HIV-related cerebrovascular disease: the South African experience

V. Mngomezulu; Johannesburg/ZA (victor.mngomezulu@wits.ac.za)

The purpose of this lecture is to describe the South African experience in HIV-related cerebrovascular disease. A systematic review of published literature from the three major South African academic centres in the last 12 years was conducted in order to catalogue their combined experience and to highlight unique features of these conditions in the setting of a developing country with a relatively high seroprevalence. A comparison was made with experiences in developed countries. In South Africa, HIV infection is a high risk factor for stroke in young patients less than 46 years. These patients do not exhibit the usual risk factors for stroke found in non-infected patients. Most (> 90%) present with ischaemic stroke and (< 5%) with intracranial haemorrhage. In the majority of cases (> 80%), a primary aetiology is usually found and in 20% HIV vasculopathy, presenting with characteristic clinical and imaging features is thought to be the cause. 2/3 of infarcts are large vessel cortical and 1/3 small vessel sub-cortical infarcts. Intracranial haemorrhage is often a consequence of HIV-related dilated aneurysmal arteriopathy. Dissection is a possible complication of this arteriopathy and is thought to be a more likely cause of SAH than saccular aneurysm formation and rupture. In 40-50% patients, stroke is the first manifestation of HIV infection. Intravenous drug abuse and atherosclerotic strokes are not prominent features. HIV-related cerebrovascular disease in South Africa mirrors that found in most parts of the world. There are however some features that appear to be unique in this setting.

Learning Objectives:

1. To learn about the clinical and imaging spectrum of cerebrovascular disease in HIV infected patients in South Africa.
2. To appreciate the role of other co-factors in the pathogenesis of HIV related cerebrovascular disease.
3. To become familiar with the challenges and technical strategies in the medical and interventional management of these conditions.

A-258 10:50

Interlude: Radiology training in South Africa

Z. Lockhat; Pretoria/ZA (Zarina.Lockhat@up.ac.za)

Academic Radiology in South Africa is dynamic, evolving and exciting. Various facets and institutions are involved in academic training, teaching and continuing medical education. These include the Radiological Society of South Africa (RSSA), The College of Medicine of South Africa (CMSA), the nine academic universities, and the international liaisons that the RSSA has nurtured and developed over many years. The College of Medicine hosts biannual national examinations in Diagnostic Radiology and Imaging, and this is supported by the academic institutional curriculum, which may extend over a period of four or five years. Training and examinations in Radiology is constantly being reviewed and refined with consultations between the RSSA and CMSA, and attention being given to local and international standards. Training and teaching is conducted in many forms, with supervision by Consultant Radiologists and includes didactic lectures, presentations at multidisciplinary interdepartmental meetings, journal review, group and individual tutorials and workshops. Practical training is hands-on with supervision by Consultants in all aspects of Radiology including general radiology and special investigations, mammography and biopsy, ultrasound, CT and PET/CT, MRI and angiography and intervention. Registrars rotate through these subspecialty areas during their training. Candidates have access to academic libraries, a multitude of e-resources, and digital imaging. The Radiological Society of South Africa plays a fundamental role in continuing medical education and specialty training in South Africa. The RSSA has hosted numerous international speakers at congresses, workshops, webinars, visiting lecture programs. There is ongoing support for private and public sector radiologists and specialists in training in terms of radiological literature, awards and financial support towards fellowships and postgraduate training. Amongst the challenges facing South African Radiology, are the vast spectrum of pathology that is seen in imaging not only due to Tuberculosis and AIDS, but diseases peculiar to the African continent; and perhaps more importantly, the retention of highly skilled and talented Radiologists.

A-259 10:55

New concepts in the pathogenesis of cerebral TB

P. Janse van Rensburg, R. Hewlett; Stellenbosch/ZA (neurotb2013-ecr@yahoo.com)

From its inception, the concept of the Rich focus as the ordinary cause for tuberculous meningitis has been controversial. Unfortunately, the concept persists unequivocally in certain parts of academic literature. Using some of the original images from Arnold Rich's work, as well as that of the South African physician JN Coetzee's thesis on tuberculous meningitis, we illustrate why there is significant doubt as to the role of the Rich focus as the cause of basal cisternal tuberculous meningitis. A more likely pathogenetic mechanism based on the original work done by them, as well as on radiological-pathological correlation using MRI, is direct infection of the choroid plexi. The MRI correlate of the Rich focus is proposed to be the combination of granulomata and meningeal enhancement following the course of a convexity sulcus amongst others. Although the Rich focus may co-exist with basal cisternal tuberculous meningitis, these eruptive granulomata have no role in the pathogenesis of the inflammatory reaction localised to the basal cisterns.

Learning Objectives:

1. To learn more about the morphological spectrum of tuberculous meningoencephalitis as shown on contrast MRI.
2. To understand the pathogenesis of TBM and its implications for disease progression and treatment.
3. To appreciate the importance of imaging-pathologic correlation.
4. To become familiar with imaging of TBM.
5. To consolidate knowledge of neurotuberculosis.

A-260 11:10

Interlude: South Africa: the country, its people, its diversity and its attractions

Z. Lockhat; Pretoria/ZA (Zarina.Lockhat@up.ac.za)

South Africa (SA) is an extraordinary country, with so many mixed cultures, extreme diversity and a deep rooted history, that is constantly undergoing change not as an event but rather as a process. Herewith, I have tried to present a lighthearted celebration of South Africa, the country, its people, its diversity and its attractions. The Great Outdoors- SA has an abundance of everything nature can bestow, mountains, forests, endless beaches and world heritage sites. With a population of 55 million people, diverse, yet integrated, it is a nation that is growing and healing, and the pride of our nation include people who have had a profound effect on the national and international psyche. South Africa, like many other countries, has its fair share of troubles and tribulations; however, its people have a tenacity and resilience whose stories shine brightly despite all the dark headlines we are sadly famous for. Leave ordinary behind, visit South Africa, and explore and experience the land of the Big Five, the longest wine route in the world, diamonds, gold, whale watching, shark diving, languorous hikes and climbs, the Comrades or the Two Oceans Marathon, the Cape Argus cycling tour.

A-261 11:15

Spinal tuberculosis in children

T. Kilborn; Cape Town/ZA (tracykilborn@gmail.com)

Children represent a high-risk group for acquiring tuberculosis (TB). Although TB involving the spine occurs in less than 1% of paediatric patients with TB, it remains a significant cause of morbidity usually as a result of its insidious onset and indolent course that results in delayed presentation. Radiography has disadvantages, the atlanto-occipital and cervicothoracic junctions and posterior elements are difficult to visualise. CT carries a high-radiation burden but is useful prior to surgical reconstruction. MRI is the optimal imaging modality. Spondylodiscitis is the most frequent manifestation of spinal TB. Hallmarks are the involvement of multiple vertebral bodies (usually > 3) most commonly thoracic. The resultant kyphotic gibbus is more often responsible for cord compromise than the inflammatory mass. Lack of proteolytic enzymes results in partial or complete disc preservation, commonly with anterior subligamentous, paravertebral or extradural spread, all specific for TB. The addition of a coronal T2 of the mediastinum to show lymphadenopathy and parenchymal disease is useful in supporting the diagnosis, as skin testing is frequently negative. Radiculomyelitis is seen on post-contrast MRI in up to 80% of cases of meningitis as a result of inferior extension but can also be seen in spondylodiscitis. Intramedullary tuberculomas and tuberculous abscesses are rare, more commonly associated with meningitis than as an isolated finding, their T2 signal correlates with the degree of caseous necrosis; the pattern of contrast enhancement and MRS assist in diagnosis. Accurate, timely radiological diagnosis is crucial in spinal TB to guide management and achieve good clinical outcomes.

Learning Objectives:

1. To learn about the spectrum of tuberculous infection of the spine in children namely; intramedullary spinal tuberculomas, tuberculous spondylitis and rarely tuberculous epidural abscess.
2. To appreciate the incidence of tuberculous arachnoiditis and tuberculomas in patients presenting with tuberculous meningitis and its implications for management.
3. To become familiar with MR imaging of spinal TB and possible differential diagnoses.
4. To discuss the role of ultrasound and CT in the imaging algorithm.
5. To understand the importance of accurate and timely radiological diagnosis for guiding management.

A-262 11:30

Chronic chest radiographic changes in a cohort of HIV-infected South African children

R. Pitcher, C. Lombard, M. Cotton, S. Beningfield, H. Zar; Cape Town/ZA (pitcher@sun.ac.za)

Sub-Saharan Africa (SSA) remains the region most affected by HIV. South Africa has the highest global prevalence, estimated at 5.6 million people, including 377,000 children. However, there has been progress in addressing the SSA HIV pandemic. Twenty-two countries, including SA, documented a declining HIV incidence from 2001 to 2009; approximately 105,000 South African children are now on ART, compared to 12,000 in 2005. Respiratory illness is the leading cause of morbidity and mortality in HIV-infected children and includes both acute and chronic conditions. The high burden of respiratory illness is reflected in a high prevalence

of chest x-ray (CXR) abnormality. The CXR remains the most common imaging modality in the evaluation of respiratory illness in HIV-infected children in low and middle income countries. A better understanding of the clinical and immunological correlates of severe CXR abnormalities is, therefore, important for those practicing in Sub-Saharan Africa. This presentation describes the 5-year findings of a Cape Town based collaborative paediatric HIV-research group and focuses on severe CXR abnormalities in 330 HIV-infected children with limited access to antiretroviral therapy (ARV). CXR reporting methodology will be described. The prevalence of severe radiographic abnormality and the main chest radiographic patterns will be documented. The clinical and immunological correlates of severe CXR abnormality as well as the factors implicated in persistence, will be defined. The impact of ARV's on the natural history of severe CXR abnormality will be reported. Recommendations will be made with respect to appropriate interventions to prevent severe CXR abnormalities in this context.

Learning Objectives:

1. To learn about the level of chronic chest radiographic changes encountered in HIV-infected children who do not have access to HAART.
2. To better understand the clinical and immunological correlates of chest radiographic changes in HAART-naïve HIV-infected children.
3. To appreciate
 - a. the burden of paediatric pulmonary disease on resource-limited healthcare environment with a high prevalence of paediatric HIV-infection.
 - b. the impact of HAART on chest radiographic changes in HIV-infected children.
 - c. the importance of the early initiation of HAART in HIV-infected children.
 - d. the challenges to healthcare delivery in a resource-limited healthcare environment.
4. To become familiar with standardised chest radiographic reporting techniques utilised for research in paediatric pulmonary radiology.
5. To consolidate knowledge of paediatric chest radiograph reporting, with particular emphasis on:
 - i. The impact of technical factors
 - ii. The importance of standardised terminology
 - iii. Paediatric-specific normal variants
 - iv. Useful chest radiographic signs

Panel discussion:

HIV and TB: What impact do they have on health care workers? 11:45

10:30 - 12:00

Room E2

Foundation Course: Neuroimaging

E³ 920b

Tumours and phacomatosis

Moderator:

N. Girard; Marseille/FR

A-263 10:30

A. Brain tumours

M.M. Thurnher; Vienna/AT (majda.thurnher@meduniwien.ac.at)

Brain tumour imaging objectives include: a) the diagnosis of brain tumour and the ability to distinguish it from non-tumoural lesions, b) assessment of histological grade of the tumour, c) delineation of the tumour borders and exact extension, d) differentiation between tumour and peritumoural oedema, and e) the evaluation of possible recurrence and therapy-induced phenomena. In the past years, several advanced MR techniques have been developed that provide new insights into pathophysiology of brain tumours. In general, the more aggressive a neoplasm, the more abnormal the vasculature with greater vascular density, tortuosity, permeability and higher tumour blood volume. Perfusion MRI methods have been developed to provide non-invasive and robust surrogate markers of tumour angiogenesis and capillary permeability. Furthermore, MRI provides information on microstructural (diffusion-weighted imaging), physiologic, and metabolic (MR spectroscopy) changes of tumour tissues. In this lecture, the most common diagnostic problems in evaluation of brain tumours and a standardised MRI protocol for brain tumour characterisation will be discussed.

Learning Objectives:

1. To learn about the imaging findings and the limitations of conventional MRI in the evaluation of brain tumours.
2. To become familiar with new MRI techniques available for advanced brain tumour imaging.
3. To learn about the potential of 'functional imaging' (fMRI, PET, SPECT) in tumour characterisation, treatment decisions, and follow-up.

A-264 11:00

B. Tumours of the spinal cord

J. Van Goethem; C. Venstermans, F. De Belder, L. van den Hauwe, P. Parizel; Antwerp/BE (johan.vangoethem@ua.ac.be)

Tumours of the spinal cord are rare but may cause significant and longstanding morbidity. Detecting spinal cord tumours on imaging and differentiating them from other pathology is the most important task for the neuroradiologist. Second, determining the relationship of the tumour with the spinal cord and the extent of the tumour along with non-tumoural spinal cord changes such as oedema or syringomyelia is essential in therapy planning and monitoring. Finally, attempting to diagnose the type of tumour according to imaging criteria may be difficult in some cases but is less critical in patient management.

Learning Objectives:

1. To become familiar with the imaging findings of primary and metastatic tumours of the spinal cord.
2. To be able to recognise metastatic disease in the extradural, epidural, subdural and paraspinal compartments.
3. To learn how best to use imaging and create the appropriate protocol.

A-265 11:30

C. Phacomatosis

M.A. Papathanasiou; Athens/GR (matpapath@hotmail.com)

The phacomatoses, also referred to as neurocutaneous syndromes, are congenital malformations affecting mainly structures of ectodermal origin, i.e., the nervous system, the skin, the retina, the globe and its contents. Visceral organs are also involved, but to a lesser extent. The classical diseases included in this group are neurofibromatosis, type I (NF1-Von Recklinghausen disease) and type II (NF2-bilateral vestibular schwannomas), tuberous sclerosis (Bourneville's disease), retinocerebellar angiomas (Von Hippel-Lindau disease) and encephalotrigeminal angiomas (Sturge-Weber syndrome). Although these conditions are separate, each the result of a change in a distinct gene, they share a tendency towards development of hamartomatous lesions and tumours of the nervous system, associated with other multisystem features. In addition, even though the genes involved are different, they all act through a tumour suppressor mechanism. The imaging findings of these disorders will be reviewed and appropriate imaging protocols will be presented for each of the conditions. The role of neuroradiology will be discussed in confirming the diagnosis, follow-up of patients and screening of asymptomatic relatives.

Learning Objectives:

1. To learn how and when you should image.
2. To consolidate knowledge about conventional neuroimaging findings of the more common phacomatoses.
3. To be informed of the possible applications of advanced neuroimaging techniques.

10:30 - 12:00

Room G/H

EFOMP Workshop

New technology in diagnostic radiology: new frontiers in imaging of the lung

EF 2

Lung imaging: multidisciplinary scenario

Moderators:

A. Torresin; Milan/IT

J.N. Vassileva; Sofia/BG

A-266 10:30

Pulmonary nodule detection using CAD

A. Retico; Pisa/IT (alessandra.retico@pi.infn.it)

Computer-aided detection (CAD) systems can be usefully implemented to assist the radiologists in the detection of pulmonary nodules in screening for lung cancer with low-dose computed tomography (CT). The main necessary steps to build a CAD system are presented: the lung segmentation algorithm, the selection of the nodule candidates, the feature extraction and the classification procedure to reduce the number of false positive findings. The use of CAD systems for the detection of pulmonary nodules at low-dose CT screening for lung cancer may have a strong impact on the positivity of screening results and follow-up recommendations; thus, a high sensitivity and a limited false-positive rate are the fundamental goals to be

achieved by the CAD developers. As different CAD systems may be characterised by different strengths and weaknesses, a procedure to combine them can enhance the detection performance. The method to combine CAD systems, the CAD usage modalities, and the way to estimate the impact of CAD systems on the observer performance are discussed.

Learning Objectives:

1. To comprehend the basic steps to design a CAD system for lung nodule detection in CT scans.
2. To be aware of the possible usage of CAD as second reader in the clinical practice.
3. To understand how the impact of CAD on the reader sensitivity is evaluated.

A-267 10:50

Optimisation in lung imaging of children

C. Owens; London/UK (owensc@gosh.nhs.uk)

This presentation will try to address the issues surrounding the use of CT in children and to outline the concept of how CT can be designed and customised for children, so as to be 'fit for purpose.' That is to answer specific clinical questions accurately and precisely, yet be delivered at the lowest possible radiation dose to the patient. The session will attempt to outline the role which CT plays and the relative strengths and weaknesses within cardiothoracic (body) CT using specific examples.

Learning Objectives:

1. To understand the importance of a dynamic team approach to optimisation of local CT techniques in all hospitals.
2. To appreciate the iterative nature and concept of sharing protocols across sites.
3. To become familiar with the techniques, tips and tricks to perform 'as low as reasonably achievable' CT imaging that is 'fit for purpose'.
4. To consolidate knowledge of low dose acquisition of CT images and post processing techniques to optimise images using images to illustrate.

A-268 11:10

Lung imaging: developments in role of PET

M.-E. Meyer, P. Bailly, J. Daouk; Amiens/FR
(Meyer.Marc-Etienne@chu-amiens.fr)

Respiratory motion management: Lung PET acquisitions typically last several minutes, leading to a spread in the activity projection. In reconstructed images, this spreading results in poor evaluation of the lesion intensity and overestimation of the lesion size. Respiratory-gated PET/CT acquisition is one solution to this problem. Several processing methods are based on amplitude- or frequency-based analyses of the respiratory signal and reconstruction of a few gates, each of which contains negligible residual motion. However, none of these methods are fully satisfactory, due to inappropriate attenuation correction (although the latter can be improved by breath-hold or 4D CT acquisitions). Moreover, positional blurring related to the underlying, inter-cycle variability in respiratory amplitude may still exist, especially with frequency-based methods. To overcome this issue, advanced techniques relying on proper event selection (respiratory motion compensation or full motion correction) have been suggested. Adaptive treatment and advanced follow-up: Even though clinical PET imaging of the lung is mainly performed for diagnostic purpose, it also has other uses. Various methods for gross tumour volume definition have been developed for radiotherapy planning. Furthermore, gated PET/CT acquisitions may help to optimise the definition of processing margins and minimize the dose delivered to non-malignant tissues. Moreover, the lesion's functional volume measured with ^{18}F -FDG PET during radiochemotherapy is likely to have significant prognostic value. Lastly, other radiopharmaceutical agents are being developed for the optimization of radiotherapy planning, notably by assessing hypoxic cell targeting (e.g. ^{18}F -FMISO).

Learning Objectives:

1. To learn about respiratory motion management in PET acquisitions.
2. To understand techniques of respiratory motion compensation or full motion correction to prevent inappropriate attenuation correction and errors in quantification.
3. To consolidate knowledge of adaptive treatment and advanced follow-up: optimisation of radiotherapy planning.

A-269 11:35

Lung imaging: developments in role of MR

J.M. Wild; Sheffield/UK (j.m.wild@sheffield.ac.uk)

MRI of the lungs has evolved radically in the last ten years to the point that it is now becoming used routinely in clinical practice. This talk will focus on the technical challenges and solutions for imaging lung structure and function with MRI methods using both the endogeneous protons in the lungs and inhaled magnetic contrast agents. The low proton density in the lungs ($\sim 0.1 \text{ g/cm}^3$) and the magnetic inhomogeneity between tissue and air (susceptibility difference $\sim 8 \text{ ppm}$) make structural proton MRI of the lung micro-structure challenging, particularly at higher B0 fields. Short echo time pulse sequences, parallel imaging and respiratory gating can all help improve proton anatomical MRI. Signal from the major pulmonary vessels can be enhanced using paramagnetic contrast agents and T1 weighted ultrafast pulse sequences for volume coverage providing 3D pulmonary angiograms. Pulse sequence methods for pulmonary angiography and time resolved pulmonary perfusion mapping will be covered. The role of under sampled and view shared sequences with parallel imaging will be discussed within the constraints of tradeoffs between spatial and temporal resolution. Functional lung imaging methods will be covered with particular focus on the role of inhaled gaseous contrast agents ranging from pulmonary blood pool enhancement by oxygen inhalation to state of the art methods for imaging lung function with hyperpolarised ^3He and ^{129}Xe MRI. Again the focus will be on technical challenges with a "how to do it" theme. Clinical images will be used as a means of highlighting the applications of the respective methodologies.

Learning Objectives:

1. To comprehend the basic MR physics of imaging protons and hyperpolarised gases in the lungs.
2. To understand the techniques that are in use in clinical lung and pulmonary vascular MRI.
3. To become familiar with established and future clinical applications of MRI in lung and pulmonary vascular disease.

Author Disclosure:

J. M. Wild: Advisory Board; Novartis. Author; NA. Board Member; NA. CEO; NA. Consultant; NA. Employee; University of Sheffield. Equipment Support Recipient; GE Healthcare. Grant Recipient; Novartis, GSK, Bayer, Pfizer. Research/Grant Support; EU FP7, EPSRC.

10:30 - 12:00

Room L/M

Standards and Audit Session

Assessment of radiologists' professional performance

Moderator:

E.J. Adam; London/UK

A-270 10:30

Radiologists' performance: assessment using peer review

G. Boland; Wellesley, MA/US (gboland@partners.org)

Peer review is a necessary and essential quality standard, but is adherence to a routine robust program is variable across imaging practices. Peer review should focus not just on perception error but on reporting content, language and mode of communication, as well as adherence to best practices, national guidelines and variability of radiologist recommendations, ideally within a clinically time-sensitive framework. There is lack of consensus on how to achieve these goals including the percentage, frequency and types of cases peer reviewed, whether by individuals or consensus, by subspecialty or generalist radiologist, by rank or educational level (trainee versus practicing specialist), real time versus remote peer review (weeks or months after the original imaging procedure), use of electronic tools and/or integration, communication of variation or error to radiologists, referring physicians and/or patients, medico-legal issues, remuneration policies and disciplinary procedures. This lecture will address the current and future status of peer review, evaluating the issues highlighted above and will propose workable peer review tools and procedures that are intended to maximize quality and minimize unnecessary overhead.

Learning Objectives:

1. To comprehend the importance of peer review to education, clinical care, research, best practices and cost.
2. To understand how to implement an effective peer review program.
3. To become familiar with the differing peer review tools including electronic decision support.

Author Disclosure:

G. Boland: Board Member; Radiology Consulting Group.

A-271 11:00

Radiologists' individual performance: use of standardised test images

A.G. Gale; Loughborough/UK (a.g.gale@lboro.ac.uk)

How well an individual radiologist performs is complex. Such performance can be understood in two ways: how well does someone identify an abnormality correctly and how well do they agree with colleagues on the radiological outcome. Various measures of performance can be utilised such as; sensitivity, specificity, ROC scores, abnormality detection and radiological feature classifications. Test sets of carefully selected exemplar images are useful in assessing these skills. Such sets are particularly important in screening scenarios where in real life the abnormality incidence is very low and so it can be difficult to gauge an individual's skill level. However, care must be taken in interpreting the results of test sets as the individual knows it is a test, the sets are usually weighted with abnormal and possibly rare cases - all factors which affect any performance measures. Illustrations will be presented from the use of the PERFORMS national self-assessment scheme in the UK which is used in breast screening. Individuals examine sets of recent challenging screening cases and receive immediate detailed feedback as well as subsequent feedback where their performance is anonymously compared to colleagues. The scheme identifies individuals who are under-performing, the underlying reasons for their performance can be determined and improvement strategies proposed for them to follow. The PERFORMS scheme is available internationally as well as being rolled out across other radiological domains. Overall it is argued that screening performance test sets, are a very useful educational exercise as well as an external quality assurance tool.

Learning Objectives:

1. To understand the use of standardised test sets.
2. To comprehend the advantages and limitations of using test sets to measure the radiological performance.

Author Disclosure:

A. G. Gale: Research/Grant Support; NHS Breast Screening Programme.

A-272 11:30

Radiologists' performance: referrers' view

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

Since 1988, several authors have surveyed the views and expectations of referring clinicians regarding the radiology report. Their findings are strikingly similar, taking into account that these have been obtained over a quarter of a century, and in several countries in North America and Europe. In general, referring clinicians are rather pleased with the radiology report. Their greatest concern is that the radiologist may not properly address the clinical question. However, they are quite aware that the radiologist, to think and act as a clinician, needs adequate clinical information and a clearly formulated clinical question. They value clarity, brevity, clinical correlation and timely delivery of the report. Depending on their specialism, referrers appreciate the report to a different degree. General practitioners rely more on the report than on hospital specialists and they especially value the radiologist's advice on planning of future investigations. A clear majority of the referrers would favor a shift from free text reporting to structured reporting, as well as the use of a comprehensive radiological lexicon. Although radiologists share many of the views and expectations of referrers, concretizing these preferences will necessitate fundamental organisational and educational changes. Together with the conviction that things are at their best the way they are, the main obstacle is fear of productivity loss. As we already know very well what referring clinicians want, there is little need for further descriptive research. Instead, we should concentrate on guidelines, education, and technical solutions for the productivity problem.

Learning Objectives:

1. To become familiar with the views and expectations of referring clinicians concerning communication with the radiologist and more specifically regarding the radiology report.
2. To understand the different needs of particular subgroups of referrers.
3. To become familiar with the views and expectations of referrers regarding structured reporting and its potential effect on productivity and training.

12:15 - 12:45

Room A

Plenary Session

HL 2

Wilhelm Conrad Röntgen Honorary Lecture

Presiding:

J.I. Bilbao; Pamplona/ES

A-273 12:15

Interventional oncology: the era of molecular targeted therapy

J.-F. Geschwind; Baltimore, MD/US (jfg@jhmi.edu)

Cancer is a disease characterised by healthy cells undergoing genetic mutations that result in the uncontrolled growth of a tumour, which in turn causes a grave disruption of homeostasis and eventually leads to death. Current treatments including surgery, chemotherapy, radiotherapy and immunotherapy have not proved effective enough to cause a significant reduction of cancer-related mortality in the last decade. The WHO projected the number of global cancer deaths to increase 45% from 2007 to 2030 (7.9 to 11.5 million deaths). Cancer is also characterised by several hallmarks or phenotypes, which can be difficult to target. One of the most important phenotypes is the up-regulation of the major energy-producing pathway, glycolysis, which plays a crucial role in the uninterrupted growth of tumours and is an indispensable "metabolic event" critical for the sustained growth and invasion of tumours. This phenotype has been used clinically for diagnostic purposes but never exploited as a possible therapeutic approach. A new class of drugs has been designed to selectively target such a pathway causing tumour cell death. Although cancer is considered a "systemic" disease, it can be treated loco-regionally. The progress in imaging technology has led to a revolution in image-guided therapies for cancer. It has become possible to zoom in on the tumour and deliver toxic doses of chemicals or radiation, which would not be feasible systemically. With better drugs, more effective drug delivery systems and sophisticated imaging, we now have more potent tools to design weapons with increased precision and lethality against cancer.

Learning Objectives:

1. To learn about basic principles of cancer biology.
2. To understand the importance of tumour metabolism and recognise its role in cancer growth.
3. To appreciate the growing impact of image-guided therapies for cancer.

Author Disclosure:

J. -F. Geschwind: CEO; PreScience Labs, LLC. Consultant; Biocompatibles/BTG, Bayer HealthCare, Guerbet, Nordion, Merit, Abbott and Jennerex. Grant Recipient; Biocompatibles/BTG, Bayer HealthCare, Philips Medical, Nordion. Other; Founder, PreScience Labs, LLC.

12:30 - 13:30

Room N/O

The Beauty of Basic Knowledge: Head and Neck

MC 24C

Main pipelines of the neck: pharynx and larynx

A-274 12:30

Main pipelines of the neck: pharynx and larynx

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

The purpose of this lecture is to familiarize the radiologist with current imaging protocols for the evaluation of common pathologic conditions of the larynx and pharynx, to describe the key anatomic structures relevant to tumour spread and to discuss the clinical implications of CT and MRI in the pre-therapeutic work-up of squamous cell carcinoma of this region. A systematic review will include key radiologic features and characteristic patterns of submucosal spread in squamous cell carcinoma of the larynx and pharynx, as well as implications of cross-sectional imaging for staging and treatment. The lecture will also review the characteristic aspect of rare tumours of the region and of common and less-common inflammatory or traumatic conditions. Typical radiologic findings in neoplastic and non-neoplastic conditions will be discussed with an emphasis on potential pitfalls and on how to

avoid them. Emphasis will be put on what the clinician needs to know and how to report the findings in a systematic way.

Learning Objectives:

1. To become familiar with the anatomy of the pharynx and larynx.
2. To learn how to choose and tailor imaging techniques according to clinical presentation.
3. To appreciate the most common pathologies affecting these structures.
4. To be able to provide a useful differential diagnosis of pharyngeal and laryngeal lesions.

12:30 - 13:30

Room P

The Beauty of Basic Knowledge: Musculoskeletal Imaging

MC 25C

Inflammatory/infectious disorders

A-275 12:30

Inflammatory/infectious disorders

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

There are a host of inflammatory and infectious 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 Enteses. The imaging manifestations will also be linked with the evolution of the pathological processes covering acute, sub-acute and chronic stages of the inflammatory/infectious disorders. By the end of the session, the audience will have a clear understanding of how to make best use of the imaging modalities in the correct diagnosis of a wide variety of inflammatory and infectious conditions that can affect the musculoskeletal system.

Learning Objectives:

1. To understand the pathophysiology of inflammatory conditions of the musculoskeletal system.
2. To learn about the basic imaging criteria for the diagnosis of arthritis, osteomyelitis, and spondylitis.
3. To become familiar with the differential diagnosis of the most common inflammatory diseases.

14:00 - 15:30

Room B

EFRS meets Spain

EM 5

Knowledge development as a tool for radiographers' professional improvement

Presiding:

G. Paulo; Coimbra/PT

C. Ruiz Blanco; Madrid/ES

A-284 14:00

Introduction

G. Paulo¹, C. Ruiz Blanco²; ¹Coimbra/PT, ²Madrid/ES (graciano@estescoimbra.pt)

Radiographers' involvement in ECR has already a tradition and a history of success, revealed not only by the increase of participants but also for the quality development of the scientific content of Radiographers' sessions. The consolidation of the relationship between ESR/ECR and the young EFRS (European Federation of Radiographer Societies, founded in 2008 and representing Radiographers' Societies from 33 European Countries and 35 Higher Education Institutions - HENRE) gave us the opportunity to have, for this first time in ECR history an "EFRS MEETS" session. For this session, the country of ECR 2013 President, Prof. José Ignacio Bilbao, was chosen and therefore we have the privilege and the honour to receive Radiographers'

from Spain, represented by their National Society AETR (Asociación Española de Técnicos en Radiología), that represents near 10,000 Radiographers in the fields of Diagnostic imaging, nuclear medicine and radiotherapy, working in a very high-standard Health System, with almost 800 hospitals, providing care to 46 millions inhabitants. At this first historical EFRS meets session, the invited speakers will give us a perspective of Spanish Radiographers' role in advanced areas of practice. In the last decade, AETR has essentially been focused in promoting Radiographer Education in Spain and therefore an overview about this topic will also be addressed. This "EFRS meets Spain" session intends to be a space of a proactive debate and exchange of knowledge as a trigger for the development of the profession.

Session Objectives:

1. To understand Spanish radiographers' education and professional status and its comparison with other European countries.
2. To learn about the role of radiographer within the framework of the Spanish health system.
3. To learn about areas of professional development for radiographers in Spain.

A-285 14:05

The Spanish radiographer's role in advanced MRI research

E. Alfayate Sáez; Madrid/ES (ealfayate@fundacioncien.es)

A Radiographer, as part of a MRI research team, is more than just a professional obtaining patient's images for either the investigational studies or clinical trials. Being part of the team means participating and understanding the project as a whole. It means one must know the study's objectives, collaborate in the protocol design and optimization, and inform the patient about the exam and steps to follow in order to maximize his cooperation. Personal data protection and individual privacy must be guaranteed through all the process; a written informed consent should be signed by the patient as well. Taking care of all these particular aspects is very important for a successful completion of each study/trial. Due to rapid technological advances, and the necessity to deal permanently with state-of-the-art scientific areas, Continuous Professional Development (CPD) for a Radiographer working in a research team is critical. The radiographer is part of a multidisciplinary team, where each professional performs a very specialized task, combining efforts is crucial in order to produce a work of excellence that can be shared with the scientific community. Thanks to the continuous investment in new technology, we have the opportunity, in our site, to conduct research in diverse areas, such as cardiology, traumatology, gynaecology, obstetrics and neurology. Through this presentation we will share some of the research we are working on, as well as the importance of the Radiographer role in a research centre.

Learning Objectives:

1. To understand the role of radiographer in a MRI research centre.
2. To understand the daily activity in a MRI research center and the continuous professional development related to it.
3. To learn about the potential areas of research development in MRI.

A-286 14:23

The radiographer's specialisation in ultrasound: two decades of experience in a public hospital

M.P. Peña Fernández; Getafe/ES (mpalomapena@yahoo.es)

About 20 years ago, a Radiology Department from a hospital belonging to the community of Madrid, from the Spanish National Health System, started to train Radiographers to perform ultrasound procedures. Currently, there are 10 radiographers performing ultrasound in our Hospital. To perform ultrasound exams with high-quality standards, a good training and a professional commitment with Continuous Professional Development (CPD). According to our experience, a training period of 7 months (35 h per week) was considered adequate as a minimal requirement for a Radiographer to perform high-standard ultrasound exams. Radiologists' support and participation in the learning process was extremely important for the success of the integration of Radiographers in Ultrasound. Study protocols and image quality parameters were established in order to facilitate the delegation process from Radiologists. Radiographers give oral and/or written comments about imaging findings, to facilitate the clinical report made by the Radiologist. The integration of Radiographers in performing ultrasound exams resulted in a considerable improvement on the Department productivity and patient workflow.

Learning Objectives:

1. To understand the role of the radiographer in ultrasound.
2. To learn about inter-professional relations in ultrasound.
3. To appreciate the advantages of a radiographer in ultrasound for radiology department outcomes and for the quality of patient care.

A-287 14:41

Interlude: Radiology and Spanish art

C. Ruiz Blanco; Madrid/ES (presidencia@aetr.net)

This interlude in digital video format, wants to show another application of x-rays used in Art. This relation of the x-rays and art goes back to France, during the First World War, where the first x-ray art image was made, using an x-ray table. In 1931, the Siemens-Reiniger-Feixa build the first x-ray unit especially designed for the study of paintings. This technique has evolved using the technological developments advances of the radiological field, such as film digitalization, digital x-ray systems, CT, and even more sophisticated techniques. The use of Radiology in art created the possibility to analyse, study, observe and identify, through a "non-invasive" technique, several kinds of damages from different sources, giving important orientations for restoring strategies. The use of x-rays is also used in the conservation and restoration of archaeological artifacts, giving orientation for cleaning and conservation and also information about the method of the origin and creation of archaeological objects. The given information also contributes to obtain information about the evolution of civilizations as well as artistic changes through centuries. There are several other applications for Radiology in art. Through this video, a visit to several Spanish museums will give us an overview about this interesting topic.

A-288 14:46

The radiographer as the interface between patient and technology in promoting safety in radiation protection

J.A. Soria Jerez; Madrid/ES (juansoria.madrid@gmail.com)

Since Roentgen discovered x-rays, two facts are scientifically irrefutable: they are an irreplaceable tool for clinical diagnosis and therapy and despite this major advantage they are not harmless. During the exposure to ionising radiation, several interactions with matter happen that can cause deleterious effects to patients and staff, if high-standard radiation protection measures are not used. Radiographers, acting in the interface between patient and technology in medical imaging, are the ultimate gatekeepers of patient and staff radiological protection, keeping always in mind the necessity to deliver acceptable diagnostic images according to ALARA principal. Being the last contact point with the patient before the exam is performed its mandatory that the Radiographer verifies several important check points related to patient information, patient physical condition and the clinical information given by the referrer in order to guarantee the best approach for the exam performance, namely if it is justified. A specific explanation about the exam to be performed must be given, with a language adequate for patient understanding, not only to obtain the necessary informed consent but also to get the maximum cooperation possible. Taking into account the diversity of parameters used when performing the radiological procedure, they should be carefully adapted to each individual patient and to the outcome expected according to the clinical information. In this presentation, an overview through the key elements for the radiological procedure will be made concluding that an optimal knowledge about them will allow to obtain the best diagnostic image with the lowest exposure possible.

Learning Objectives:

1. To learn how to enhance patient safety in radiation protection.
2. To learn about radiographers' role in optimising procedures.
3. To understand the continuous professional development requirements needed to maintain high standards in patient safety.

A-289 15:04

Educational status of radiographers in Spain: comparison with the EU

M.R. Soto García; Barcelona/ES (martasotogarcia@gmail.com)

As Radiographers, in Spain we develop our professional activity in a technoscientific area that is in constant evolution and specialization. The characteristics and the importance of these activities are linked to the continuous advances of the techniques taken in the Diagnose for the Image centres. This reality requires a deep change in the formative curricular content in our profession. Our profession must evolve towards university training. It is very important to the process of the medical image, that the developments in technology are accompanied by well-trained professionals, trained in the different modalities and possibilities of acquisition of images, and with adequate knowledge of use, protection concepts and attention to patients, that only a grade career can give. Without this base, the quality of medicine in this country is seriously limited. Because of that, we should not let Radiographers be condemned to undertake their duties in Spain, in comparison with the EU spirit in the right of free circulation of citizens, because the bureaucratic and real difficulties that take to have a lower qualification to the rest of countries around us are insurmountable. For this reason, I will present the actual situation in

Spain, in relation with the rest of Europe, through the different comparative studies of Radiographers that have been done by the Ministry of Health and Consumer Affairs, as well as the different Associations and Syndicates of the states, European and International that represent our community. So, which is our present educative framework in respect to our European workmates?

Learning Objectives:

1. To understand the Spanish radiography education model.
2. To learn about the limitations of Spanish education on free movement on professionals in Europe.
3. To learn about solutions for education-model development regarding professional harmonisation.

Panel discussion:

Could a transnational and multi-professional combined statement contribute to professional development? 15:22

16:00 - 17:30

Room A

Interactive Teaching Session

E³ 1120

Breast cancer

A-296 16:00

A. Detection

C.S. Balleyguier; Villejuif/FR (balleyguier@igr.fr)

Breast Cancer detection relies almost exclusively on the radiologist. Mammography is the basic tool for screening. Sonography and MRI are complementary techniques. Sensitivity of mammography is very high (close to 90%) in case of fatty breast. However, accuracy declines in case of dense breast. The most challenging cancers are infiltrative lobular carcinoma and cancers presenting only with architectural distortion. Mammography is by far the best examination for the detection and characterisation of microcalcifications. Sonography is not a screening tool, but is a useful complement to questionable mammograms. MRI is very powerful and might become the primary screening tool in selected populations like high-risk women, but should not replace mammography in all cases due to the risk of false positive findings. A combined report of both MRI and mammogram is desirable. The radiologist should be familiar with the most common traps: lesions seen on only one view, cancer seen only as a mild asymmetry of breast density, identification of neoplastic calcification in the middle of uneven microcalcifications and mildly enhancing images in MRI or lesions masked by a severe background enhancement. The radiologist should be fully aware of BIRADS terminology and should be able to propose the correct indications for biopsy, as well as the preferred guidance.

Learning Objectives:

1. To understand the respective role of each imaging technique in the diagnosis of breast cancer.
2. To learn about common pitfalls in the diagnosis of breast cancer.

A-297 16:45

B. Follow-up

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

The role of radiologist is to provide detailed pre-operative assessment and post-therapy follow-up included detection and differential diagnosis of recurrence and post-therapy sequelae. Diagnostic tools are combination of clinical examination, mammography, sonography, MRI, PET/CT and guided biopsy. Additional diagnostic help is obtained by comparison with prior films. The quality of the post-operative imaging depends also on preoperative assessment. All the congenital and benign conditions must be known before surgery in order to avoid post-operative interpretation problems. Pathology results and preoperative films as well as prior surgical and/or needle biopsy results must be present. Post-therapy conditions are sometimes challenging because post-therapy changes may mimic recurrent disease. Breast cancer is a heterogeneous disease, therefore, the spectrum of morphology and progression dynamics may be very different. Follow-up is chosen when the post-therapy changes are stable or show typical benign morphology features. Progressing or indeterminate lesions have to be biopsied if all imaging modalities fail to provide an equivocal diagnosis. Monitoring neoadjuvant chemotherapy by prediction of response is a new step toward individualized therapy of breast cancer.

Learning Objectives:

1. To understand the common features of recurrent breast cancer.
2. To learn how to establish imaging follow-up protocols or breast cancer.

16:00 - 17:30

Room B

State of the Art Symposium

SA 11

Evaluation of response in haematological malignancy

A-298 16:00

Chairman's introduction

E. de Kerviler; Paris/FR (eric.de-kerviler@sls.aphp.fr)

Response to treatment in haematological malignancies has long been assessed by the evolution of serological markers in multiple myeloma or bidimensional measurements of target lesions in lymphoma. However, these response criteria failed to identify patients with minimal residual disease or with inactive residual masses. Functional imaging such as PET, diffusion or perfusion studies have already proven to be effective or are very promising ones. This aim of this multidisciplinary session with a Nuclear Medicine physician, a Haematologist and a Radiologist, is to present the State of the Art in the management of patients with haematological malignancies and to show the techniques that may become tomorrow's standards.

Session Objectives:

1. To become acquainted with the standard criteria for therapeutic response in myeloma and lymphoma.
2. To demonstrate the role of CT, MRI and PET in the assessment of therapeutic response.
3. To show that functional imaging is now essential for patient evaluation at baseline and follow-up.
4. To consider future imaging biomarkers in the assessment of response.

A-299 16:05

Opportunities and limitations of PET, CT and MRI answering the haematologist's questions

T.C. Kwee; Utrecht/NL (thomaskwee@gmail.com)

Imaging plays an important role in the evaluation of lymphoma; relevant targets for imaging include 1. tumour characterisation and detection of Richter's transformation, 2. staging, 3. response assessment and 4. restaging. Although several of these targets can be reached to some extent, considerable challenges remain. In this lecture, the imaging characteristics of lymphoma at ultrasound, CT, MRI, and PET with ¹⁸F-FDG will be briefly reviewed. Subsequently, the utility and limitations of structural imaging with CT and MRI, and the additional value of ¹⁸F-FDG PET will be demonstrated. Finally, the following emerging imaging concepts and techniques will be discussed: tumour biology assessment with ¹⁸F-FDG PET, immuno-PET with ⁸⁹Zr-rituximab and diffusion-weighted MRI.

Learning Objectives:

1. To learn the various imaging features of lymphoma.
2. To learn the advantages and limitations of CT, PET, and MRI in the evaluation of lymphoma.
3. To understand the importance of and opportunities provided by (new) functional imaging methods for staging and follow-up of lymphoma.

A-300 16:28

Evaluation of response in multiple myeloma

J. Hillengass; Heidelberg/DE (jens.hillengass@med.uni-heidelberg.de)

Multiple myeloma is a haematologic malignancy characterised by the infiltration and proliferation of monoclonal plasma cells mainly in the bone marrow. Previously, treatment-response was assessed mainly by measurement of the concentration of monoclonal protein in serum and light chains in urine. The introduction of cross-sectional imaging such as MRI, CT and PET-CT to extend or even replace conventional radiological survey in the imaging work up of patients with monoclonal plasma cell diseases led to new insights in the pathophysiology of the disease but also showed that imaging findings improve response assessment. Especially, MRI has extended the knowledge concerning growth patterns of myeloma cells in bone marrow. It was found that patients with this disease can present with either a diffuse infiltration, a focal pattern or a combination of both. Furthermore, some patients even do not show any signs of infiltration at all. Although conventional response criteria correlate with imaging-based assessment of the remission of the disease, it has been demonstrated that, e.g., PET-CT is able to detect response to therapy

earlier. Furthermore, several studies revealed that a complete remission of myeloma confirmed by MRI or PET-CT goes along with a better prognosis compared to a complete response based only on serological parameters. Therefore, current studies address the capabilities of the novel imaging techniques to assess minimal residual disease to identify possible sources of relapse.

Learning Objectives:

1. To understand the pathophysiologic mechanisms of multiple myeloma.
2. To be able to compare the significance of imaging and serological markers for response evaluation in myeloma.
3. To assess the significance of the depth of response to systemic treatment.

A-301 16:51

Evaluation of response in lymphoma with PET/CT

S.F. Barrington; London/UK (sally.barrington@kcl.ac.uk)

Changes in glucose metabolism with 18 F Fluorodeoxyglucose (FDG) Positron Emission Tomography and CT (PET-CT) give an early indication of response to lymphoma treatment, prior to changes in tumour size. 'Interim' PET-CT (iPET) after 1-3 cycles of chemotherapy is more accurate than CT alone and outperforms the international prognostic score (IPS) in advanced Hodgkin Lymphoma (HL) and the IP index (IPI) in aggressive non-Hodgkin Lymphoma (NHL). The importance of iPET lies in its potential application for response-adapted therapy, with current phase III trials in progress to establish: 1. if abbreviated chemotherapy ± radiotherapy is sufficient to cure patients with good 'metabolic' response in HL. 2. If escalation of chemotherapy and/or early transplantation can improve survival in patients with poor 'metabolic' response in advanced HL and aggressive NHL. iPET assesses the degree of chemosensitivity rather than the completeness of overall response. A method of interpretation which reflects the continuous nature of data obtained using iPET with the ability to alter the threshold used to define a 'positive' versus negative result, according to the clinical or research question led the development of a five-point scoring system (5PS). The 5PS was adopted at the first international conference in iPET held in Deauville. The 'Deauville Criteria' (DC) grade response by comparing any residual uptake with uptake in normal mediastinum and liver. The DC have been validated in an international study in HL and have good interobserver agreement in a multicentre trial setting. DC are gaining widespread acceptance for clinical and trial use.

Learning Objectives:

1. To understand the role of interim PET/CT in the evaluation of metabolic response to lymphoma.
2. To become aware of proposed reporting criteria developed for assessment of interim PET/CT.
3. To get an overview of current clinical trials exploring the role of response adapted therapy according to PET/CT.

Panel discussion:

Is it time for biomarker response criteria in haematological malignancies?

17:14

16:00 - 17:30

Room C

Urogenital Imaging

CC 1121

Stones: diagnosis and intervention

Moderator:

N.C. Cowan; Oxford/UK

A-302 16:00

A. Imaging patients with renal colic

G. Heinz-Peer; St. Pölten/AT (gertraud.heinz@stpoelten.kkoe.at)

Helical CT is now accepted as the imaging technique of choice for evaluating patients with acute flank pain in whom renal or ureteral calculi are suspected. It is superior to excretory urography and there is no need for intravenous contrast media injection for this study. Diagnostic confidence is often improved and the likelihood of stone passage can be predicted. Non-urologic causes of abdominal pain can often be diagnosed. Recently, dual-energy CT scanners have been utilised to detect and to characterise urinary tract calculi. It has been shown that uric acid stones can be differentiated from non-uric acid stones with high specificity. Disadvantages of CT include that it is generally more expensive compared to conventional techniques and that it may be less accurate in guiding treatment, since the degree of obstruction

is less clear. The overall radiation dose to patients is greater than that of observed when excretory urography was the imaging study of choice. Ultrasonography (either by itself or in conjunction with conventional radiography) is utilised to image renal colic patients as an alternative to CT at some institutions. The color Doppler twinkling artifact increases sensitivity in detecting small urinary tract stones that lack posterior acoustic shadowing. Magnetic resonance urography has been used by some as another alternative to CT. The management of urinary stone disease depends on the clinical presentation, stone location, stone size, and possibly on stone "hardness".

Learning Objectives:

1. To learn about imaging approaches to patients with renal colic.
2. To become familiar with the strengths and limitations of various imaging techniques.
3. To learn about the management of patients with renal colic.

A-303 16:20

B. Percutaneous treatment of renal stones

S. Moussa; Edinburgh/UK (smoussa@sky.com)

Urinary tract calculi: common condition, 15% of men and 6% of women in developed countries will have one stone, 50% will recur, majority are idiopathic 80%. Treatment modalities include Extracorporeal Shock Wave Lithotripsy (ESWL), Flexible Ureteroscopy and Lasertripsy, Percutaneous Nephrolithotomy (PCNL), Litholapaxy, Open surgery! Stone size (burden), stone position, radiolucency, obstruction, anatomy, body (spinabifida, spinal deformity/fusion), renal (horseshoe, ectopic), calyceal (duplex, diverticular). are the factors affecting the management of urinary tract calculi. The management of stone disease has evolved in recent years since the advent of ESWL as well as with advances in interventional radiological techniques allowing for safer percutaneous access to the upper urinary tract. There has been an increase in the use of CT in the evaluation of patients with stone disease, particularly complex stones where 3D reconstruction has been shown to be of great value as well as CT-guided renal access. The technique of percutaneous nephrolithotomy will be described together with factor affecting the choice of approach, number of puncture and patient position. Examples of some complex cases will be discussed. For best practice in stone management, the following points must be considered: accurate imaging and preoperative evaluation of the patient, if possible use of 3D-CT for planning, close discussion between radiologist and endourologists, team effort including anaesthesia and all theatre staff, and recognition and early management of complications.

Learning Objectives:

1. To appreciate the importance of imaging, stone selection and planning for percutaneous nephron-lithotomy (PCNL).
2. To become familiar with the technical aspects and different approaches to PCNL.
3. To appreciate the importance of recognising and avoiding complications.

A-304 16:40

C. Intervention in ureteral obstruction and ureteral trauma

A. Magnusson; Uppsala/SE (anders.magnusson@radiol.uu.se)

There are a variety of causes of obstruction of the upper urinary tract out of which ureteral stones, gynaecologic malignancies and prostatic cancer are the most common. Treatment depends upon the level of obstruction, and whether it is an acute or chronic obstruction. Acute as well as chronic obstruction is usually initially treated by the insertion of a nephrostomy tube. However, chronic upper urinary tract obstruction is often later treated by the insertion of a ureteric stent using either an ante- or retrograde approach. Most nephrostomy tubes are inserted using ultrasound guidance combined with fluoroscopy but in some cases, it is necessary to use CT guidance. The majority of nephrostomy insertions can wait until daytime with one important exception, patients with obstruction and suspicion of infection of the upper urinary tract. These patients require immediate relief as it is a life-threatening condition! Nephrostomy relief was one of the first interventional procedures, but the technology has evolved so that today it is simple and safe. Trauma to the ureter is rare, and are most likely to occur iatrogenically. Patients with ureteral trauma and urine leakage requires relief with a nephrostomy tube. Often these tube insertions are more complicated because it generally is no hydronephrosis due to urine leakage.

Learning Objectives:

1. To learn how to manage a patient with ureteral obstruction.
2. To understand when and how to treat a patient with ureteral trauma.
3. To learn more about how to perform a nephrostomy.

A-305 17:00

D. Interactive case discussion

N.C. Cowan; Birmingham/UK (nccowan.uro@gmail.com)

16:00 - 17:30

Room D1

CLICK (Clinical Lessons for Imaging Core Knowledge): Never without Arteries

CC 1118

Stroke

Moderator:

M.M. Thurnher; Vienna/AT

A-306 16:00

A. Clinical considerations

P.M. Parizel, P. Cras, T. Menovsky, T. Van der Zijden, M. Voormolen; Antwerp/BE (paul.parizel@ua.ac.be)

Stroke is the most common non-traumatic neurological emergency, and the leading cause of serious, long-term disability. Worldwide, each year, an estimated 15 million people suffer a stroke. Accurate data on stroke incidence across Europe are lacking, but according to WHO estimates, the number of stroke events is likely to increase to more than 1.5 million per year in 2025. On average, higher rates of stroke occur in eastern, and lower rates in Southern European countries. Stroke risk factors and predisposing diseases can be broadly categorized as "controllable" or "uncontrollable". Controllable risk factors are subdivided into medical (hypertension, atrial fibrillation, hypercholesterolemia, diabetes, atherosclerosis) and lifestyle (smoking and tobacco use, alcohol use, obesity, physical inactivity). Uncontrollable risk factors include age, gender, race, family history, previous stroke or TIA, fibromuscular dysplasia, patent foramen ovale. In acute stroke patients, non-invasive multiparametric neuroimaging plays a pivotal role in patient selection, treatment decision-making, and guiding therapeutic interventions. Identification of the ischaemic penumbra, using MRI and/or CT, has entered routine clinical practice. In acute stroke patients, the challenge for radiologists is to provide a fast and accurate diagnosis, and using the tools that are available, to assess the infarct core/ ischaemic penumbra, to guide the decision-making, and to perform interventional treatment of stroke patients, in order to reduce the size of the infarction and to protect the surrounding brain at risk. Ultimately, thanks to advanced neuroimaging techniques, we have the potential to elucidate mechanisms of recovery and develop imaging biomarkers for predicting recovery and monitoring treatment responses.

Learning Objectives:

1. To become familiar with the frequency and causes of stroke.
2. To learn about the most important risk factors and predisposing diseases.
3. To learn about the importance of imaging for treatment decision-making and planning.

A-307 16:30

B. Imaging techniques and typical findings

J. Vymazal; Prague/CZ (Josef.Vymazal@homolka.cz)

Cerebrovascular disease represents a major source of global mortality and morbidity. Imaging examinations play a critical role in the management of stroke patients, from establishing the initial diagnosis to determining and guiding further treatment. Haemorrhagic stroke, or intracerebral haemorrhage, represents 10-15 % of stroke cases and approximately 85 % of strokes are ischaemic. The specificity of clinical tests is unacceptably low, therefore imaging is the initial step in the management of a stroke patient. Non-contrast CT confirms the presence of haemorrhage, it does not exclude ischaemia and/or stroke mimics such as encephalitis, multiple sclerosis, hypertensive encephalopathy, etc. Perfusion CT confirms the presence of ischaemia immediately. Its radiation burden is not negligible. MRI with SWI confirms the presence of haemorrhage and DWI reveals ischaemia minutes after stroke. Perfusion MRI with DWI is able to detect the ischaemic penumbra. PWI and DWI with MRI always cover the whole brain. Modern state-of-the-art CT scanners cover almost the whole brain with PWI; older scanners a limited slab only. The presence of penumbra is important for further management decisions but it is not unambiguous. MRI is also better in imaging the posterior fossa and better detects small infarcts. There is no radiation burden with MRI. However, MRI is slower, it

has limited availability and it is often not suitable for restless patients and those with some metallic implants.

Learning Objectives:

1. To learn about state-of-the art imaging in cases of suspected stroke.
2. To discuss potential pros and cons of using MR and CT.
3. To become familiar with most recent innovations in stroke imaging.

A-308 17:00

C. Interactive case discussion: what is next after diffusion and perfusion?

A. Dörfler; Erlangen/DE (arnd.doerfler@uk-erlangen.de)

The management of acute ischemic stroke is rapidly developing. Clinical data suggest that interventional stroke treatment may provide superior clinical outcomes when compared with intravenous thrombolytic therapy only. However, organized and comprehensive stroke care is currently delivered in only a few cerebrovascular centers providing an efficient system for rapid diagnosis and especially dedicated interventional stroke treatment. Delivery of expert and timely neuroendovascular interventions to a large number of acute stroke patients is challenging. Especially advanced neuroimaging capabilities have shown to be crucial for patient selection for subsequent aggressive therapies. Hereby the combination of various imaging techniques may help to differentiate patients who may profit from intravenous or interventional therapy in an even extended time window from those who do not. Regarding our own experience, „multimodal MR imaging“ and a mismatch between findings on diffusion and perfusion MR images may be pragmatically used to predict the presence of a penumbra and provide substantially greater information about brain ischemic pathophysiology and overall a more sensitive diagnosis for acute stroke, especially in patients with an uncertain time window of symptom onset and vertebrobasilar ischemia. The current presentation focuses on our imaging workflow and algorithm of patient selection. A focus is put on interactive clinical cases, subsequent interventional stroke treatment and on some organisational aspects necessary for providing a comprehensive neurointerventional stroke service.

Learning Objectives:

1. To become familiar with typical cases demonstrating the crucial role of imaging modalities in the diagnosis and treatment decision-making in ischaemic stroke.
2. To consolidate knowledge of the selection of the appropriate imaging technique, image interpretation and image based treatment recommendation.
3. To learn about the importance of imaging for treatment decisions and planning.

16:00 - 17:30

Room D2

Head and Neck

RC 1108

Skull base lesions: imaging studies and differential diagnosis

Moderator:

L. Grzycka-Kowalczyk; Lublin/PL

A-309 16:00

A. Anterior cranial fossa with special emphasis on olfactory apparatus lesions

T.P.J. Duprez; Brussels/BE (thierry.duprez@uclouvain.be)

Medical imaging has nowadays integrated the diagnostic armamentarium of anosmic patients regarding not only qualitative assessment of the olfactory tract but also quantitative evaluation of olfactory bulb volumes which are known to closely correlate to the olfactory function. Many clinical studies in various pathological conditions have evidenced the value of such measurements in the work-up of olfactory dysfunction for both aetiological and prognostic purposes. Imaging work-up also plays a role in the medico-legal evaluation of post-traumatic anosmia together with electrophysiological and clinical olfactory testings. Technical improvements in fibre tracking (FT) using diffusion-tensor imaging (DTI) and appropriate designs of olfactory stimulation at BOLD-based functional MRI (fMRI) are expected to allow insights into the neurophysiological processes and circuitry of olfaction in a very near future. Imaging work-up of the anosmic patients will be the corner stone of this lecture. The relevance of the different imaging techniques will be detailed. Beyond the work-up of anosmia, a comprehensive overview of the most common lesions of the olfactory tract seen in clinical practice will be given. Additional review of lesions observed at the anterior cranial fossa near the olfactory tract will be done which comprehensively includes all commonly observed developmental, traumatic, inflammatory and neoplastic conditions that are not arising from the olfactory tract. Their potential impact on the olfactory function or on other sensory/neurological

functions will be underlined. Clues to clinical/radiological differential diagnoses of most common conditions and radiological features at the anterior cranial fossa will be highlighted.

Learning Objectives:

1. To learn the imaging techniques of the anterior skull base with an emphasis on the olfactory apparatus.
2. To become familiar with the imaging findings.
3. To understand how to differentiate between lesions in the anterior skull base.

A-310 16:30

B. Middle cranial fossa pathologies

A. Borges; Lisbon/PT (borgalexandra@gmail.com)

The central skull base (CSB) is a complex anatomic area pierced by a variety of foramina and canals which provide crossroads for disease spread between the extracranial head and neck and the middle cranial fossa. Of utmost importance are the cavernous sinuses located intracranially on each side of the sphenoid body and the pterygopalatine fossa in the extracranial compartment, squeezed between the posterior wall of the maxillary sinus and the base of the pterygoid plates. Besides intrinsic pathology originating from the bone structures composing the central skull base and systemic disease, the CSB can also be involved by intracranial lesions and those originating from different compartments of the suprahyoid neck. Imaging bares a tremendous impact on the diagnosis and patient's management as this area is essentially occult to clinical examination. CT and MRI have a complimentary role in the evaluation of CSB lesions providing a roadmap of bone and soft tissue involvement, respectively. Often, tailored imaging technique is mandatory to answer specific clinical questions. Here, we present a radiology friendly approach to central skull base pathology based on the site of origin, pattern of growth and imaging characteristics of different lesions, highlighting the most important features in the differential diagnosis and in treatment planning.

Learning Objectives:

1. To become familiar with imaging strategies for the middle cranial fossa.
2. To know more about imaging findings of common lesions.
3. To learn how to differentiate between the lesions in middle cranial fossa.

A-311 17:00

C. Posterior cranial fossa pathologies

H. Tanghe; Rotterdam/NL (tanghe@planet.nl)

The jugular foramen is an opening in the skull base. The radiologic evaluation requires high quality imaging with CT and MR. Angiography is reserved for preoperative embolisation. It is important to recognize the "pseudo lesions". The most common tumour of the jugular foramen is the paraganglioma. The second is the schwannoma of the lower cranial nerve causes, the jugular foramen meningioma is the third most common. The differential diagnosis shall be discussed. The cerebellopontine angle (CPA) and the internal auditory canal (IAC): The IAC is a bony conduit for several nerve's and a vessel: the neuro-vascular bundle. The CPA is a cistern of the peripheral cerebral spinal fluid, and several anatomical structures goes through this cistern, it is also the place of some frequent disease processes. Most of the lesions in the CPA are benign tumours with in order of frequency: vestibular schwannoma and meningioma. The third most common lesion is a benign cystic lesion: the epidermoid cyst. In the IAC you can encounter the same benign tumoural lesion as in the CPA, but also inflammatory lesions, viral lesions and malign lesions. Why is it important in your imaging protocol of the IAC and CPA region to use gadolinium? The differential diagnosis of the different lesions shall be discussed.

Learning Objectives:

1. To learn the imaging techniques in the posterior cranial fossa.
2. To become familiar with the imaging findings of common posterior cranial fossa pathologies.
3. To understand how to differentiate between the lesions in the posterior cranial fossa.

16:00 - 17:30

Room E1

Musculoskeletal

RC 1110

The knee

A-312 16:00

Chairman's introduction

F.M.H.M. Vanhoenacker; Antwerp/BE (filip.vanhoenacker@telenet.be)

MRI of the knee joint is one of the most requested examinations in most MR departments. Most MRI exams are performed for evaluation of internal derangement of the joint due to trauma or (degenerative) cartilage lesions. Inflammatory disorders and infectious processes about the knee may cause significant morbidity and therefore early detection is of utmost importance. Soft tissue tumours (STT) and pseudotumours around the knee joint comprise a heterogeneous group of benign and malignant lesions. This integrated RC on the knee will provide an up-to-date overview of the role of imaging in the diagnosis and planning of treatment strategy of knee trauma, inflammation and soft tissue lesions. Current controversies and remaining clinical questions include the role of high-field MR imaging, imaging evaluation of clinical instability patterns, evaluation of disease activity of inflammatory disorders and response to Disease Modifying Anti-Rheumatic Drugs treatment and the role of functional imaging in the evaluation of STT.

A-313 16:05

A. Patterns of injury

P. Van Dyck; Antwerp/BE (pieter.van.dyck@uza.be)

Traditional classification systems for knee joint instability include straight, rotational and combined types of knee instability. The basic consideration in this classification is the status of the posterior cruciate ligament after injury. Correct diagnosis of knee instability is not a simple matter. Much controversy remains as to which ligaments are being tested during the standard clinical knee laxity tests. This sometimes leaves the clinician, even the most experienced ones, confused as to what the laxity tests really show. In addition, the arthroscope cannot fully assess the unstable knee. Thus, the addition of the information provided by magnetic resonance (MR) imaging can be extremely helpful in order to establish prognosis and plan for definitive treatment. Therefore, a thorough knowledge and recognition of the different knee ligament instability patterns by radiologists is essential to accurately report the findings on MR and to heighten awareness for specific injuries to improve their detection.

Learning Objectives:

1. To know 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 knee.

A-314 16:28

B. Inflammatory disease

A. Cotten; Lille/FR (anne.cotten@chru-lille.fr)

Inflammatory disorders of the knee are mainly related to infectious or rheumatic diseases, but other disorders can be associated with a similar clinical, biological or radiological presentation, including degenerative and crystal-induced diseases, and tumours. The bone, the joint and/or the soft tissue can be affected. The aims of this lecture are to present the main radiological features of the different inflammatory disorders encountered at the knee, the usefulness of each imaging modality and the more frequent misdiagnoses when such a condition is suspected.

Learning Objectives:

1. To know more about the imaging appearances of soft tissue and osteoarticular inflammation.
2. To become familiar with imaging findings of specific inflammatory conditions.

A-315 16:51

C. Soft tissue tumours/tumour-like lesions

J.C. Vilanova; Girona/ES (kvilanova@comg.cat)

Because MRI of the knee is the most frequent examination, so does the frequency of encountering incidental soft tissue tumour/tumour-like lesions in and about the knee. Although, sometimes imaging techniques are requested due to symptoms related to a soft tissue lesion around the knee. It is important for the radiologist

to be aware of the imaging appearance to avoid misdiagnosis and inappropriate treatment, and to be familiar on new functional MRI sequences (DWI-DCE) to improve the diagnostic work-up. Soft-tissue tumours/tumour-like lesions about the knee include a wide variety of entities, ranging from cysts or anatomical variants to aggressive high-grade sarcomas. Special vigilance in evaluation is warranted when a soft-tissue mass is not in the typical position or does not have other characteristic features of a cyst, when the size of the mass or the accompanying symptoms seem out of proportion to the injury or underlying degenerative process, and when symptoms persist beyond what is expected. It is essential to be familiar with the imaging characteristic appearance of these lesions to allow a confident diagnosis as most of these lesions are benign. A complete review of the spectrum of soft tissue lesions will be performed: sarcomas, lipoma, haematoma, haemangioma, chondroma, synovitis, bursae-cysts like lesions intra and para-articular, haematoma, ossifications, aneurysms, adventitial disease or anatomical variants such as accessory gastrocnemius muscle. Not only the most common lesions will be discussed but also less common but important lesions with characteristic US and/or MRI appearance.

Learning Objectives:

1. To know 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.

Panel discussion:

What are the remaining clinical questions that imaging currently cannot answer and how can we answer them in the future?

17:14

16:00 - 17:30

Room E2

Multidisciplinary Session: Managing Patients with Cancer

MS 11

Cholangiocarcinoma

A-316 16:00

Chairman's introduction

B. Hamm; Berlin/DE (bernd.hamm@charite.de)

Cholangiocarcinoma comprises carcinomas arising from the biliary duct system and can be divided into intra- and extrahepatic cholangiocarcinomas. Depending on the tumour localisation and extent, local and systemic therapy differs. Especially surgical therapy, which is the cornerstone of treatment in many patients, is demanding and complex. Radiology plays a key role in the primary diagnosis of this disease, therapy decision making, preparation for surgery, and image-guided locoregional therapy. An interdisciplinary experienced team is needed for the selection and performance of the appropriate diagnostic and therapeutic sequence in an individual patient. The diagnostic and interventional radiologist in this team has to know about surgical and clinical relevance of imaging findings and needs profound understanding of the potential of the different therapy options. This session gives an insight into experiences from the past and future concepts in the cholangiocarcinoma management provided by an expert team of clinicians from surgery, oncology, and radiology.

Session Objectives:

1. To learn about state-of-the-art diagnosis of cholangiocarcinoma.
2. To understand the value of surgical and systemic strategies in therapy.
3. To appreciate image-guided interventional treatment.

A-317 16:05

Surgery of hilar and extrahepatic cholangiocarcinoma

P. Neuhaus; Berlin/DE (peter.neuhaus@charite.de)

The characteristic growth pattern of hilar cholangiocarcinoma with periductal infiltration makes curative tumour resection with appropriate safety margins difficult. Therefore, a radical surgical strategy is required and extrahepatic bile duct resection alone is considered as palliative procedure, and recurrence is inevitable. Extended hepatectomies have evolved as curative treatment standard - adequate liver function provided. If permitted by tumour extension and liver volumes, a right-sided hepatectomy is preferable, because of its higher radicality compared to left hemihepatectomies. Due to the biliary anatomy, a R0 resection is more likely in right hemihepatectomies, since the left hepatic duct has a longer extrahepatic course, which facilitates an adequate safety margin. In addition, a second critical step, the dissection of the right hepatic artery running dorsally close to the tumour region, can be avoided. Major drawback of right trisectionectomies is a low-remnant liver volume, leading to an elevated perioperative risk. Therefore, optimal conditioning

of the liver is mandatory. This includes decompression of cholestasis via ERc or PTC, portal embolisation of the right lobe and treatment of cholangitis. However, in about 30%, severe atrophy of the left lobe due to long-standing cholestasis or occlusion of the left portal branch interdicts an extended right hemihepatectomy. For tumours below the cystic duct junction, surgery consist of partial pancreateoduodenectomy. In case of additional hilar involvement, combined hepatectomy and pancreatic resection might be considered in selected cases. Depending on tumour characteristics and surgical methods 5-year survival rates of 20-50 % have been reported after curative major liver resection.

Learning Objectives:

1. To become familiar with prognosis depending on the evolution of surgical approach.
2. To become familiar with surgical decision making: left/right liver resection, hilar resection, pancreatic head resection.
3. To become familiar with technique of extended right hemihepatectomy.
4. To become familiar with liver function, volume.
5. To become familiar with biliary decompression left/right, internal/external.

A-318 16:20

Radiology - diagnostics and portal vein embolisation in hilar and extrahepatic cholangiocarcinoma

T. Denecke; Berlin/DE (timm.denecke@charite.de)

In hilar and extrahepatic cholangiocarcinoma, en-bloc resection of the tumour is prognostically advantageous. This requires accurate diagnosis of the tumour before the resection. Some pitfalls may occur due to benign lesions mimicking cholangiocarcinoma with stricture of the biliary duct; the sequence of diagnostic imaging (including MRI with MRCP, CT, and ERC/PTC), examination protocol, and brush cytology help to avoid these. Furthermore, the prediction of the actual tumour extent has to be accurate. This necessitates not only accurate imaging but also a standardised terminology and classification system to enable non-ambiguous communication between the surgeon, gastroenterologist, and radiologist. This regards the tumour extent concerning bile ducts, portal vein, and hepatic arteries. Besides the local tumour extent, also the liver configuration and volume of the future liver remnant determine the possibility of surgery and the surgical technique. If too small, hyperplasia of the left-sided liver remnant in preparation of extended right liver resection can be achieved by right portal vein embolisation. Distinct volumetric and functional analysis of the embolized liver is performed also after embolisation to avoid hepatic insufficiency after the resection.

Learning Objectives:

1. To learn about diagnosis/differential diagnosis.
2. To learn about surgical planning through imaging: bile ducts, vascular system, hyperplasia induction, liver function testing.

A-319 16:35

Medical treatment of cholangiocarcinomas

H. Riess; Berlin/DE (hanno.riess@charite.de)

The purpose of medical treatment in patients with biliary tract cancers is to improve survival and quality of life. In the postoperative setting, adjuvant chemotherapy has been investigated alone or in combination with radiotherapy, however its role is still undefined, but it should be considered. Most patients present with unresectable or relapsed cancer. To ensure biliary drainage and to prevent cholangitis and biliary abscess formation is an essential prerequisite prior to the application of cytotoxic drugs. A few prospective randomised controlled trials demonstrated a survival benefit of chemotherapy as compared with best supportive care alone and improvement of quality of life has been confirmed. The combination regimen of gemcitabine combined with cisplatin (or oxaliplatin) has been recognised as standard therapy. Beyond these, other cytotoxic drugs have to be considered experimental. The same is true for molecular-targeted therapies due to the fact that to date only a few agents have been tested in this disease. Due to the fact that biliary tract cancers may remain limited to the liver for a long period of time hepatic arterial infusions therapy has been used with success but its role is still undefined. This and various issues remain to be investigated in the setting of large cooperative clinical trials.

Learning Objectives:

1. To become familiar with chemotherapy of extrahepatic cholangiocarcinoma.
2. To become familiar with treatment concepts for intrahepatic cholangiocarcinomas.
3. To become familiar with systemic vs. intra-arterial chemotherapy.

A-320 16:50

Radiology - diagnostics and image guided therapies in intrahepatic cholangiocarcinomas

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

Approximately 5-10 % of all cholangiocarcinomas (CC) are intrahepatic cholangiocarcinomas (ICC). Because of the lack of symptoms ICCs are usually later diagnosed, compared to extrahepatic CCs. ICCs are subclassified in a mass-forming, a periductal infiltrating and an intraductal ICC. Mass forming ICC is characterised by usually large hypovascular, intrahepatic mass in CT or MRI. Periductal infiltrating and intraductal ICCs usually present with a cholestasis distal to the tumour. Tumour thrombosis of intrahepatic portal vein branches is often associated with ICCs. Therapy of first choice is surgical resection, however only 10-30% are surgical candidates. Local tumour ablation using thermal (e.g. RFA, MWA) or radiogenic (e.g. CT-brachytherapy) are alternatives in non-surgical patients with localised disease. For RFA a maximum of 5 cm with a maximum of 5 lesions is commonly accepted as the upper limit. ICCs are often centrally in the liver with limitations to thermal ablation (e.g. heat sink effect). Radiogenic ablation (e.g. CT-guided brachytherapy) is suitable to overcome size and location limitations of thermal ablation. In unresectable, disseminated ICC whole liver treatment strategies (e.g. hepatic arterial infusion (HAI) or radioembolisation) could be an alternative to systemic chemotherapy. Liverarterial ports could be implanted by interventional radiologist (IR) using either the femoral or the subclavian artery as access site. Transarterial chemoembolisation (TACE) with doxorubicin and cisplatin as therapeutic agents is often performed in ICCs with median survival rates of 9-28 months. Radioembolisation with admission of Y-90 loaded particles via the liver artery into the tumour demonstrated a median survival of 9.3-22 months.

Learning Objectives:

1. To learn about image guided therapy decisions.
2. To learn about local ablation in non-surgical candidates (RFA, CT-brachytherapy).
3. To learn about intra-arterial port implantation.
4. To learn about transarterial radioembolisation.

Author Disclosure:

B. Gebauer: Other; Sponsorship for studies or traveling expenses or proctoring: Perceptive Inf./Parexel, C. R. BARD, SIR-Tex Medical, AGA Amplatz/St. Jude Medical, Cook, Angiodynamics/RITA, Bayer-Schering.

Case presentation (part 1): hilar cholangiocarcinoma 17:05

Case presentation (part 2): CCC multimodal treatment 17:17

16:00 - 17:30

Room F1

Special Focus Session

SF 11

Adults with congenital heart disease (GUCH)

A-321 16:00

Chairman's introduction: Why should a radiologist gather information on GUCH patients?

M. Gutberlet; Leipzig/DE (matthias.gutberlet@herzzentrum-leipzig.de)

The numbers of newborns with congenital heart disease (CHD) is not rising but the number of infants with congenital heart disease who achieve adulthood is constantly increasing due to improved medical treatment especially in cardiac surgery and pediatric cardiology. The imaging modality of choice during infancy in patients with congenital heart disease is echocardiography. But in older patients, especially after cardiac surgery, it becomes very often more and more difficult to achieve an adequate acoustic window to assess important anatomical structures. In particular the visualisation of the right ventricle, which is involved in many CHD, becomes difficult. Therefore, all cross-sectional imaging modalities, especially magnetic resonance imaging but also computed tomography, and also the radiologist comes into play.

Session Objectives:

1. To learn about the increasing number of GUCH patients.
2. To appreciate the importance of lifelong imaging follow-ups.
3. To become familiar with the need for specialised GUCH centres.

Author Disclosure:

M. Gutberlet: Research/Grant Support; BmBF (German Federal Ministry of Education and Research), Competence Network of Congenital Heart Defects. Speaker; Bayer, Bracco, Siemens, Philips, GE.

A-322 16:05

A list of typical surgical procedures: the top ten in GUCH

M. Hübler, D. Hitendu, M. Schweiger, M. Greutmann; Zurich/CH
(michael.huebler@kispi.uzh.ch)

Advances in the treatment of congenital heart disease (CHD) in pediatric cardiac care have resulted in an increasing number of grown up congenital heart (GUCH) patients. More than 90% of those diagnosed with CHD will now survive into adulthood thus increasing the prevalence of CHD in adults to about 0.4% of the general population. In the near future the number of GUCH patients will be exceeding those pediatric patients with CHD. Unfortunately quite a considerable number of GUCH patients will have anatomic and physiologic abnormalities. At least 10% of them suffer even from severe lesions with an urgent need for medical and/or interventional and/or surgical therapies. Echocardiography plays a key role as a diagnostic tool but specially in complex post-operative anatomies cross-sectional imaging techniques were indispensable. Almost two third of surgeries in GUCH patients were first surgical procedures. One third of them being single or multiple reoperations. Percentage of frequent surgeries in GUCH patients: Aortic valve / LVOT procedures: 25%; Tetralogy of Fallot repair/pulmonary valve replacement: 16%; Atrial septal defect surgery: 15%; Aortic arch/coarctation operations: 13%; Ventricular septal defect surgery: 10%; AV-valve repair: 8%; Univentricular heart/Fontan procedures: 6%; Transposition complex: 3%; Ebstein-repair: 2%; Heart transplantation/Mechanical circulatory support: 2%. Median age of the patients was 36.5 years (range limits 18.0 - 72.2 years). Perioperative mortality was higher after palliative surgery than after corrective surgery and was highest among patients with univentricular heart (20%) and transposition of the great arteries 12 (%).

Learning Objectives:

1. To become familiar with the most common surgical procedures in congenital heart disease (CHD).
2. To know more about the typical postoperative problems in GUCH patients.
3. To learn about how imaging can help the cardiac surgeon.

A-323 16:30

'Adults are not just big children': differences between children and adults

A.M. Taylor; London/UK (a.taylor76@ucl.ac.uk)

Though the assessment of congenital heart disease shares many similarities across all ages, there remain specific issues for those with adult, or grown-up, congenital heart disease. These include: the importance of cross-sectional imaging (MRI & CT) due to the difficulty of echocardiography in many patients (poor echo windows, complex vascular anatomy) in this patient group, the presence of historical operative procedures and anatomies (e.g. patients with Senning and Mustard procedures) that are now very rarely seen in the paediatric population, and, as the adult population with congenital heart disease ages, the ever increasing burden of atherosclerosis and other common disease of ageing. This presentation will outline the role of cross-sectional (MRI & CT) for assessing patients with adult congenital heart disease, with focus on pre-procedural planning and post-procedural following.

Learning Objectives:

1. To understand the age dependency in the selection of imaging modalities.
2. To learn about radiation exposure issues in GUCH patients.
3. To understand what the difference between imaging of children and adults.

Author Disclosure:

A. M. Taylor: Advisory Board; Medtronic. Employee; UCL Institute of Cardiovascular Science. Grant Recipient; Siemens, Medtronic, UK NIHR, UK DH. Research/Grant Support; Siemens – Research agreement. Speaker; Siemens – ESC Munich.

A-324 16:55

Which modality, for which patient? MRI or CT, that's the question

J. Bremerich; Basle/CH (jbremersch@uhbs.ch)

Both, MR and CT provide relevant information on cardiac morphology and function for management of CHD. Arguments in favour of CT are 1. short acquisition time which is particularly relevant in patients with limited capability to cooperate; 2. high sensitivity and specificity for calcification in pericardial/valvular disease or after surgical repair; 3. submillimeter spatial resolution enabling precise measurements for procedure planning or assessment of small structures such as atrial baffle stenosis after atrial switch procedure; 4. short bore with the patients head located outside the scanner, which is particularly helpful in claustrophobia; 5. 3D datasets enabling postprocessing in any desired plane and slice thickness; 6. no restrictions related to electric implants. Arguments for MR on the other hand are 1. no radiation required which is particularly relevant for repeated imaging in this young patient group, 2. capability of imaging cardiac function with the goldstandard

or flow quantification e.g. through baffles or in dysfunctional valves after surgical repair, 3. excellent soft tissue contrast enabling tissue characterisation. Both, MR and CT are powerful tools for imaging grown-up congenital heart disease. Thus, imaging should be tailored to the specific needs of the patient, desired information and available expertise and equipment.

Learning Objectives:

1. To learn about the pros and cons of different imaging modalities for GUCH patients.
2. To become familiar with imaging of the most common entities in GUCH.
3. To consolidate knowledge of imaging protocols after surgical correction of CHD.

Panel discussion:

Can we now get all the information we need to treat GUCH patients, non-invasively?

17:20

16:00 - 17:30

Room F2

Professional Challenges Session

PC 11

Personalised radiology

A-325 16:00

Chairman's introduction

G.P. Krestin; Rotterdam/NL

Medical imaging has always been personalized 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 personalized medicine. Stratification based on imaging biomarkers can help identify individuals for preventive intervention and can improve disease staging. In vivo visualisation of loco-regional physiological, biochemical, and biological processes using molecular imaging can detect diseases in pre-symptomatic phases or facilitate individualized drug delivery. Furthermore, imaging is essential to patient-tailored therapy planning, therapy monitoring, and follow-up of disease progression, as well as targeting non-/minimally-invasive treatments, especially with the rise of theranostics. For personalized medicine to reach its highest potential, medical imaging must be an integral part. Radiologists need to be prepared for this new paradigm as it will mean changes in training, in research, and in clinical practice. Following an in-depth explanation of the role of predictive, prognostic and personalized medicine for modern health-care, given by the Secretary General of EPMA, renowned experts in the different fields of personalized medical imaging will give an insight into the recent developments in this new area of our profession. The presentation will be followed by a panel discussion.

Session Objectives:

1. To understand the concept of personalised radiology.
2. To get an overview of the role of imaging in personalised medicine.
3. To learn about the concept of personalised medicine and personalised health-care.

A-326 16:06

Personalised medicine: hope or hype?

O. Golubnitschaja; Bonn/DE (Olga.Golubnitschaja@ukb.uni-bonn.de)

1. Current healthcare: what is behind the issue? For many acute and chronic disorders, the current healthcare outcomes are considered as being inadequate. In fact, severe chronic pathologies such as cardiovascular disorders, diabetes and cancer are treated after onset of the disease. Pessimistic prognosis considers pandemic scenario for type 2 diabetes mellitus, neurodegenerative disorders and some types of cancer over the next 10-20 years followed by economic disaster of healthcare systems in a global scale. 2. Advanced healthcare tailored to the person: What is beyond the issue? Advanced healthcare promotes the paradigm change from delayed interventional to predictive medicine tailored to the person, from reactive to preventive medicine and from disease to wellness. The innovative Predictive, Preventive and Personalised Medicine (PPPM) is emerging as the focal point of efforts in healthcare aimed at curbing the prevalence of both communicable and non-communicable diseases such as diabetes, cardiovascular diseases, chronic respiratory diseases, cancer and dental pathologies. Cost-effective management of diseases and critical role of PPPM in modernisation of healthcare is acknowledged as priorities by global and regional organizations and health-related institutions (UN, EU, NIH, etc). 3. Why integrative medical approach by PPPM as the medicine of the future? PPPM is the new integrative concept in healthcare. Expected outcomes are conducive to more effective population screening, prevention early in childhood,

identification of persons at-risk, stratification of patients for optimal therapy planning, prediction and reduction of adverse drug-drug or drug-disease interactions relying on emerging technologies: medical imaging, pharmacogenetics, pathology-specific molecular patterns, disease modelling, individual patient profiles, etc.

Learning Objectives:

1. To understand the definition of personalised medicine.
2. To learn about some of the successful examples of personalised healthcare.
3. To understand the present limitations in adapting personalised medicine.

A-327 16:22

Imaging for disease prediction

M. Vernooij; Rotterdam/NL (m.vernooi@erasmusmc.nl)

Epidemiology being a group-level discipline, it seems a long way off from personalized or individual-level medicine. But nothing could be less true. Regarding personalized medicine as stratified medicine, it is exactly this stratification that is enabled by results from epidemiological group-level studies. Increasingly, it is being realized that population studies will play a key role in achieving the medical paradigm shift from "cure" to "prevention". The large-scale application and analysis of medical images in controlled population cohorts is known as Population Imaging. It centers on the non- or minimally invasive assessment of structural and functional changes that may reflect specific pathology. The new imaging techniques that are currently applied in population studies are likely to be the beginning of an avalanche in epidemiologic studies of many diseases. Population Imaging enables epidemiologists to study disease at an earlier stage than when a clinical diagnosis can be made, allows for objective assessment of the disease or trait, and makes repeated assessment possible. Of essential importance is that recent developments in image data acquisition and analysis make it feasible to use these techniques at a large scale. Yet, this poses increasingly high demands on data management and storage infrastructures that are both costly and technically demanding. Other potential drawbacks include that population imaging is subject to important ethical considerations - for example, regarding incidental abnormalities - and is critically looked at regarding valorization of results. This presentation will discuss Population Imaging and its role in improving models for disease prediction and prevention.

Learning Objectives:

1. To learn about population imaging.
2. To become familiar with the role of imaging in disease prediction.
3. To understand the need for validated imaging biomarkers.

A-328 16:38

Molecular imaging: a solution for personalised diagnosis and treatment?

F.M.A. Kiessling; Aachen/DE (fkiessling@ukaachen.de)

With increasing knowledge in molecular mechanisms of diseases, the number of therapeutics that specifically block disease-related pathways rise. However, due to the heterogeneity of tumours, not all patients will benefit from these specific therapies. Therefore, advanced in vitro and in vivo diagnosis is required to pre-select patients to therapy, to monitor therapy response and to optimise doses and combinations of therapeutics. Molecular imaging can be used to characterise pathologies by their particular molecular profile. By this, pre-selection of patients, therapy optimisation and monitoring and sensitive therapy response assessment become feasible. Another important aspect of personalised diagnosis is the enhanced permeability and retention (EPR) effect. Many drugs will only be effective if they sufficiently extravasate in the target tissue to reach the tumour cells. In this respect, theranostic agents (drugs with imaging markers) can help to investigate whether EPR is high enough to justify its use. Even more, there are agents that slowly release drugs from carriers (e.g. liposomes, hydrogels or polymers). In this case, not only EPR is interesting to be monitored but also the release kinetics and the effectiveness of the drugs at the target tissue. In this context, release of drugs can be triggered and controlled by imaging, as it was shown for microbubbles carrying drugs or genes.

Learning Objectives:

1. To become familiar with the role of molecular imaging for disease localisation and characterisation, patient selection to therapy and therapy monitoring.
2. To learn about individualised image-guided drug delivery systems.
3. To understand the concept of theranostics: the combination of targeted imaging and targeted therapy.

Author Disclosure:

F. M. A. Kiessling: Board Member; ESR Research Board, Concl ESMI. Founder; invivoContrast GmbH. Grant Recipient; DFG, BMBF, EU, GIF. Research/Grant Support; Financial Support by Bracco, Bayer, Philips, Astra-Zeneca, Roche.

A-329 16:54

Role of imaging in personalised therapy monitoring

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

Many imaging biomarkers have emerged which individually or collectively provide unique information on tumour behaviour including response to treatment. There are several requirements that must be met before imaging biomarker (s) can be considered as being able to direct a person's management. First, the biomarker should have a known biologic basis with a recognised method for quantification and to be adequately validated. With regard to the latter, it is important that the biomarker reports on/measures biologically meaningful cellular/tissue process such as reporting on cell death, on angiogenesis, proliferation and metabolic shutdown NOT simply conveying information on receptor occupancy or down regulation of pathways that may or may not be important. Data acquisition procedures should have been optimised and the test's performance should have been established. The level of change in the imaging biomarker that can be considered as real should be known (that is, the measurement error). Reproducibility needs to have been determined by appropriately powered test-retest studies. Imaging biomarkers can only be useful if they can detect biologically meaningful effects directly related to treatments (that is, magnitude of biological effects detected must be greater than the reproducibility/measurement error) at appropriate time points to be able to effect patient management. Finally, it must be known how much therapy-induced change is meaningful in terms of patient benefit in terms of hard clinical endpoints such as surgical resectability, organ preservation, progression free and overall survival, etc. These aspects will be considered in detail using practical examples.

Learning Objectives:

1. To become familiar with the general role of imaging in treatment monitoring and drug development.
2. To understand the requirements of imaging biomarker development for treatment monitoring in personalised medicine.
3. To understand how to develop the evidence base so that imaging biomarkers can be used for personalised therapeutic approaches.

Author Disclosure:

A. R. Padhani: Advisory Board; Siemens HealthCare. Speaker; Siemens HealthCare.

Panel discussion:

Is imaging providing an added value to the 'omics' of personalised medicine?

17:10

16:00 - 17:30

Room G/H

Neuro

RC 1111

Brain tumours: advanced imaging techniques in daily practice - do we really need them?

Moderator:

Z. Merhem; Sarajevo/BA

A-330 16:00

A. Diffusion-weighted imaging (DWI) and diffusion tensor imaging (DTI)

M. Law; Los Angeles, CA/US (meng.law@usc.edu)

We have made significant progress in the application of advanced MRI techniques, such as DWI and DTI. DWI has certainly been useful in differentiating acute ischaemic stroke from other pathologies that could mimic stroke, such as demyelinating lesions, tumours and inflammatory disease. DTI has gained popularity in visualisation of the white matter tracts for pre-surgical planning. We will review how DTI can be used in this setting. We will also review what the challenges and pitfalls are for using DTI, fiber tractography (FT) and fractional anisotropy (FA) maps for pre-surgical planning. These include the need for standardization of acquisition techniques (direction, stopping criteria), processing, visualisation and quantitation of DTI metrics. We will also review what errors have been reported with using FT and FA maps when compared with intra-operative electrophysiologic mapping. DWI, functional diffusion maps and DTI have also been used in the pre and post-therapeutic brain. We will review potential applications in characterisation of pseudoprogression, pseudoresponse and radiation necrosis. In addition, how diffusion can potentially help in predicting a favourable therapeutic response to chemo-radiation. Finally, as there are some challenges and limitations, we will review some of the controversies about DTI, FT and whether in fact these tools are ready, reliable or really needed in clinical practice. Perhaps review what needs to be done to make these tools essential and easy to use in everyday practice.

Learning Objectives:

1. To appreciate DWI in the characterisation of focal brain lesions.
2. To understand how to differentiate between tumoural and non-tumoural disease using DWI.
3. To consolidate knowledge on how to combine DWI with other advanced MRI tools.
4. To find out if DTI is really useful in the clinical setting or merely a mathematical algorithm of the tensor.

Author Disclosure:

M. Law: Advisory Board; Bayer Healthcare. Consultant; Fuji Inc, iCAD inc. Grant Recipient; Bayer Healthcare. Shareholder; Prism Clinical Imaging. Speaker; Toshiba America Medical.

A-331 16:30

B. Perfusion imaging

Y. Özsunar; Aydın/TR (yeldaosunar@gmail.com)

Conventional contrast-enhanced CT and/or MR imaging are the current standard techniques for the diagnosis and treatment evaluation of brain neoplasms. However, this method is quite limited in its ability to depict the angiogenesis which is a hallmark of tumour growth and metastases. To characterise the angiogenesis of brain tumours, Perfusion Weighted Imaging (PWI) and Nuclear Medicine Techniques, such as PET and SPECT are used. PWI is an evolving technique proven to be especially valuable and practical for the evaluation of central nervous system neoplasia. Both exogenous and endogenous tracer methods can be used as in ASL and Dynamic Susceptibility Weighted Perfusion Imaging, respectively. Perfusion imaging refers to several recently developed techniques that are used to non-invasively measure cerebral perfusion via assessment of various haemodynamic measurements, such as cerebral blood volume, cerebral blood flow, and mean transit time. These techniques have great potential in becoming important clinical tools in the evaluation of pre and post-treated brain tumours. PWI is used to differentiate tumoural versus non-tumoural brain masses and primary versus secondary brain tumours. The technique helps to grade primary tumours, guide biopsy and surgery, and differentiate recurrent tumour from radiation necrosis.

Learning Objectives:

1. To appreciate the value of perfusion imaging.
2. To understand why perfusion imaging is needed.
3. To become familiar with principles, applications, and pitfalls of various perfusion imaging techniques.
4. To consolidate knowledge of perfusion imaging of various brain masses that can be encountered in daily practice.

A-332 17:00

C. Follow-up after treatment

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

Glioblastoma is the most common primary brain tumour. Due to the ineffective therapy, the prognosis of glioblastoma is poor and has driven the research to find new therapeutic agencies. However, despite advanced neuroimaging techniques, it remains difficult to predict and to monitor tumour response in individual patients. For example, anti-angiogenic therapy may present with decreased contrast enhancement of the tumour and reduced surrounding edema, so called "pseudoresponse" since the decreased enhancement can be secondary to an antipermeability effect rather than the result of reduction in tumour size. The opposite is seen in the treatment with temozolomide and radiation where an increase in area of enhancement is seen that resolves over time - so called pseudoprogression. Both these conditions are well demonstrated on conventional MR imaging as well as on advanced MRI like diffusion and perfusion imaging. However, they still may cause confusion and wrongly results in change of therapy as well as in the interpretation of results of Phase I and Phase II clinical trials. To partially address this issue, the MacDonald criteria have recently been revised. The present lecture will focus on present knowledge and research on the use of advanced imaging to support response or progression during ongoing therapy.

Learning Objectives:

1. To understand the present traditional model for the follow-up and monitoring of brain tumour treatment.
2. To become familiar with different imaging biomarkers for early assessment of brain tumour treatment response.
3. To consolidate presently available knowledge and ideas on brain tumour imaging follow-up for future brain tumour treatment and monitoring of response.

Author Disclosure:

P. C. Maly Sundgren: Board Member; ISMRM, ASNR. Consultant; ICON Medical Imaging.

16:00 - 17:30

Room I/K

Chest

RC 1104

Pulmonary infections: the old and the new

Moderator:

F. Gleeson; Oxford/UK

A-333 16:00

A. Mycobacterial infections

C. Beigelman; Lausanne/CH

Primary TB typically presents with consolidation in the middle and lower lobes, and necrotic lymphadenopathy. Fibrosis, tuberculomas and calcified nodes may result as sequelae. Cavitation and tree-in-bud appearance involving the apical and posterior segments of the upper lobes and the superior segments of the lower lobes are the hallmarks of reactivation TB, typically seen in immunocompetent patients. In immunocompromised patients, primary TB findings are more commonly observed, as miliary or disseminated disease or atypical manifestations in case of severe immunosuppression. Pleural effusion and tracheobronchial involvement may be observed. The "classical" appearance of Non-TB mycobacteria (NTM), less common and more indolent than TB, typically affects males more than 50 years old with pre-existing pulmonary disease or underlying immunologic disorder. Despite a great overlap in the radiologic appearances of both infections, the presence of cavities on sites other than the upper lobes should suggest a NTM infection. The "nonclassical" form related to MAC infection that predominantly affects elderly women with no pre-existing pulmonary disease mainly consists in mild bronchiectasis and centrilobular nodules predominantly located in the lingula and middle lobe. A high rate of lymphadenopathy and disseminated disease are seen in immunocompromised patients. The radiologist has to ensure the diagnosis of active TB and mention scarring before starting specific treatments to suggest NTM infections, immune reconstitution inflammatory syndrome with paradoxical worsening in HAART treated HIV-infected patients as multi-drug resistant TB, to appreciate extent of disease and follow-up, to diagnose the complications and to propose MRI or PET scans in some situations.

Learning Objectives:

1. To appreciate the imaging features of primary and post-primary infections in TB.
2. To learn about the similarities and differences between TB and non-TB mycobacterial infections.
3. To understand the radiologist's role in diagnosis.

A-334 16:30

B. Infectious disease in immuno-compromised patients

C.-P. Heussel; Heidelberg/DE

The appropriate investigation technique, frequently targeted differential diagnosis and the special needs of immunocompromised patients are the needs to be understood by the referring physician as well as by the radiologist. Thus, an intensive interdisciplinary co-operation on a patient basis, as well as on a department basis is essential. Early detection of a focus is the major goal in febrile neutropenic patients. As pneumonia is the most common focus, chest imaging is a special radiological task. The sensitivity of chest x-ray, especially in supine position, is known to be less. Therefore, the very sensitive thin-section multislice-CT became gold standard in neutropenic hosts and might be cost-effective in comparison to antibiotic treatment. The infiltrate needs to be localised, so that this information can be used as guidance for invasive procedures for further microbiological work-up. Furthermore, the radiological characterisation of infiltrates gives a first and rapid hint to differentiate between different sorts of infectious (e.g. typical bacterial, atypical bacterial, fungal) and non-infectious aetiologies. Follow-up investigations need careful interpretation according to disease, recovery, and concomitant treatment. Due to a high incidence of fungal infiltrates, interpretation of the follow-up of an infiltrate must use further parameters besides to the lesion size. Besides the

lungs, also other organs systems such as brain, liver and para nasal sinuses need attention and are to be imaged with the appropriate technique.

Learning Objectives:

1. To appreciate the various types of immuno-deficiencies and their related infections.
2. To become familiar with the role of the radiologist in immuno-compromised patients.
3. To learn how to follow pulmonary infections in immuno-compromised patients.

Author Disclosure:

C. Heussel: Grant Recipient; Novartis, Pfizer. Shareholder; GSK, Stada. Speaker; Schering-Plough, Pfizer, Basilea, Boehringer Ingelheim, Novartis, Roche, Astellas, Gilead, MSD, Lilly, Bracco, MEDA Pharma, Intermune, Chiesi, Siemens, Covidien, Pierre Fabre.

A-335 17:00

C. Emerging infections

T. Franquet; Barcelona/ES (tfranquet@santpau.cat)

Despite advances in diagnosis and treatment, new pulmonary infections have been diagnosed. *Streptococcus pneumoniae* remains the main etiological agent in outpatients with community-acquired pneumonia (CAP). Elderly patients or those with toxic habits, and various comorbidities favour the development of severe CAP. In addition, the development of nucleic acid amplification techniques has emphasized the role of concomitant bacterial and viral pneumonia in the outcome of CAP in elderly patients. Healthcare-associated pneumonia has been recently defined as a different infectious condition by the American Thoracic Society/Infectious Diseases Society of America (ATS/IDSA). The main concern of this new disease is the risk of having an infection due to multidrug-resistant pathogens. With the advent of HAART and increased long-term survival of HIV-positive patients, the range of pulmonary manifestations has also evolved. In patients with haematological malignancies or after HSC transplant, *Aspergillus* is a common infection. Actually, *Aspergillus* spp. isolation from LRT samples in COPD may indicate an increased diagnosis possibility of IPA. New emerging viruses such as Human metapneumovirus (hMPV), SARS-associated coronavirus, and Avian influenza caused by the H5N1 virus have been diagnosed. In 2009, an outbreak of a novel swine-origin influenza A (H1N1) virus was reported. The clinical diagnosis of new pulmonary infections as well as the presence of concomitant bacterial and viral infections has been significantly enhanced by improved laboratory methods. A systematic approach to the radiological evaluation of lung infections is essential and includes not only chest imaging pattern recognition, but also integration of available demographic, clinical and laboratory information.

Learning Objectives:

1. To learn more about emerging infections.
2. To become familiar with radiological patterns and conditions which suggest viral infections.
3. To learn how to improve diagnostic accuracy.

16:00 - 17:30

Room L/M

Physics in Radiology

RC 1113

Cone-beam imaging

Moderators:

O. Ciraj-Bjelac; Belgrade/RS
A. Trianni; Udine/IT

A-336 16:00

A. Fundamentals of cone-beam imaging

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

Traditionally, x-ray CT scanners were equipped with a single or a few detector rows only, image reconstruction was assuming parallel slices, which was a good approximation for these fan-beam systems. About a decade ago, the number of slices increased to 16 or more and the parallel slice approximation was no longer valid. The cone-beam nature of these multi-slice CT (MSCT) scanners had to be taken into account by specific cone-beam reconstruction algorithms. While these MSCT systems -- today they are simultaneously acquiring up to 320 slices -- are cone-beam CT systems in a general sense, the notion of cone-beam CT (CBCT) is also associated with a specific kind of cone-beam CT, namely those equipped with flat detectors, i.e. the non-diagnostic or non-clinical CT systems. MSCT, in contrast, is a cone-beam CT system for diagnostic use, i.e. a clinical CT system.

This distinction between MSCT and CBCT is useful, as there are decisive differences in application, performance, and in image reconstruction. These differences will be reviewed in the presentation, with a particular focus on why image quality in MSCT is so much better than in CBCT.

Learning Objectives:

1. To understand the principles of volumetric image formation with flat detectors.
2. To understand the difference between CBCT and MSCT.
3. To learn about reconstruction techniques and image processing.
4. To become acquainted with the important image quality parameters.

A-337 16:30

B. Medical applications of CB imaging

M. Grass; Hamburg/DE (Michael.Grass@Philips.com)

Tomographic x-ray imaging using flat detectors is used today on a variety of different imaging systems. The most important area is cone beam imaging using interventional C-arm systems. For these systems, the increasing complexity of minimal invasive procedures requires the availability of high-resolution 3D image information for intervention planning, guidance and outcome control. Interventional volume imaging was first applied in neuroradiology using rotational angiography acquisitions. Today, it is used in a wide 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 for image guidance. Other application areas using different scanning systems are on-board imaging in radiation therapy or integration of flat detector tomography and SPECT. The course teaches the generation of 3D volume information from flat detector systems and its utilisation in clinical applications. Image acquisition protocols are introduced and scan modes and system design parameters are explained. Application specific calibration and processing steps are introduced to show how cone beam imaging is tailored for specific clinical applications. Image quality characteristics and their relevance for the different clinical applications are discussed. Examples are presented for angiographic and soft tissue volumetric imaging. Medical applications utilising the reconstructed volume images for diagnosis, intervention planning, guidance or outcome control are discussed. Image-guided interventions are presented for needle and catheter procedures. Examples for medical applications in radiation therapy and nuclear medicine are introduced.

Learning Objectives:

1. To become acquainted with the applications of CB imaging.
2. To learn about systems design 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-338 17:00

C. 3D dentomaxillofacial imaging

K. Horner; Manchester/UK (keith.horner@manchester.ac.uk)

In the last decade, three-dimensional dentomaxillofacial imaging through cone-beam CT (CBCT) technology has become widely available. While uptake amongst dentists in Europe is quite low, it is increasing. Dental CBCT (Digital Volumetric Tomography; DVT) equipment is compact and often affordable. The driver for dental CBCT was implant dentistry, but its use has spread into other areas, including paediatric applications. Radiation doses are variable. Some systems offer a fixed, large, field of view and others fixed exposure factors, obstructing attempts at optimization. Typically, doses are at least an order of magnitude greater than for "conventional" imaging. Image quality is also variable, which means that certain types of equipment may be unsuitable for some clinical applications. A key aspect of using CBCT relates to justification. Imaging in three dimensions may be perceived by dentists as inevitably superior, a view which is often implicitly encouraged by those selling equipment. The research on diagnostic efficacy is limited and often fails to consider differences between laboratory research and the clinical situation. In 2012, The European Commission published "Radiation Protection 172: Evidence-based Guidelines on Cone Beam CT for Dental and Maxillofacial Radiology". This provides a comprehensive set of recommendations, including referral criteria, a quality assurance programme and optimization strategies. Priorities for future research are relating exposures to the necessary image quality requirements for specific clinical applications, along with research on the impact on clinical outcomes of CBCT-based treatments. It is clear that much work remains before the place of CBCT in dentistry can be established.

Learning Objectives:

1. To become acquainted with CBCT systems for dentomaxillofacial imaging.
2. To learn about image quality characteristics and patient dose compared to other techniques.
3. To learn how to access CB images and influence the clinical outcome.

16:00 - 17:30

Room N/O

Interventional Radiology

RC 1109

Update on biliary interventions

A-339 16:00

Chairman's introduction

M. Krokidis¹, A.A. Hatzidakis²; ¹Cambridge/UK, ²Iraklion/GR
(mkrokidis@hotmail.com)

There are some basic IR techniques everybody needs to know before starting to treat biliary diseases. These are Percutaneous Transhepatic Cholangiography (PTC) and Percutaneous Transhepatic Biliary Drainage (PTBD). These basic procedures are essential first for opacification and then for getting access into the biliary tree. After accessing the biliary system, decisions must be made about the need for further interventional procedures. Presence of benign or malignant strictures, stones or other kind of disease are leading us to the necessary actions, such as dilatation, stenting or lithotripsy. Dilatation of stenosed parts of the biliary system is performed after negotiation of the stricture or occlusion with help of high-pressure angioplasty balloons of variant sizes. Balloons of 8-14 mm width can be used alone or two parallel to each other. Stenting is rarely needed in benign biliary disease and usually in cases where multiple dilatations are not responding. Percutaneous lithotripsy with or without cholangioscopic assistance is a wide-used technique for clearance of biliary stones or fragments. Extraction balloons or baskets and special lithotripsy devices are commonly used for impacted or large calculi.

Session Objective:

1. To review the various interventional techniques for the treatment of complex biliary diseases.

A-340 16:05

A. Fistula and benign stenosis

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

Benign biliary strictures (BBS) can be seen with a wide array of non-neoplastic causes. In western countries, iatrogenic stricture accounts for up to 80% of all BBS, with cholecystectomy and orthotopic liver transplantation being the most common causes. Post-surgical BBS often present with biliary fistulas. Various imaging modalities are used in diagnosing fistulas and BBS, the most commonly used being ERCP and MRCP. MRCP has the advantage of non-invasive imaging, allows evaluation of the biliary system beyond a tight stricture with assessment of hepatic parenchyma and other intra-abdominal organs. The cause, number, and distribution of BBS decide the type of management. Other factors to be considered are the degree of inflammation/fibrosis, the presence of ongoing infection or sepsis, and the experience of the surgeon and interventional radiologist/endoscopist at the institution. Balloon dilatation or balloon dilatation with long-term external/internal drainage are generally accepted as the treatment of choice for benign biliary strictures. The percutaneous treatment of these strictures by dilatation has a success rate from 60 to 90 %. The primary insertion of a bare metallic stent is not currently indicated, while, covered metal stents can be placed in selected patients if they can be safely retrieved. Successful outcomes regarding the management of BBS requires careful planning by a multidisciplinary team with regard to thorough diagnostic studies, and appropriate operative approach. Whatever appropriate treatment is selected, the need for careful long-term follow-up must be strongly emphasized, as no therapy is totally free of recurrence.

Learning Objectives:

1. To know about the etiology of fistulas and benign stenoses.
2. To become familiar with the various imaging modalities and findings in benign fistulas and stenoses.
3. To understand the techniques, results, and complications of interventional treatments.

A-341 16:28

B. Interventions after liver transplantation

P.P. Goffette; Brussels/BE (pierre.goffette@uclouvain.be)

Bile tract complications occur in 10-35% of liver transplants. The incidence is highest in the first few months after LT. Type of surgical anastomosis, cold and warm ischaemic liver injury and pre-existing biliary diseases are all the factors influencing the frequency, type and severity of complications which includes strictures, leakage, stones formation and bilomas. Systematic PTC at 6 months after LT is recommended to disclose biliary complications at early stage. Main indications for percutaneous approach include: 1. early anastomotic strictures inaccessible to endoscopy, 2. late non-anastomotic strictures due to arterial occlusion, recurrent sclerosing cholangitis, CMV infection, 3. access for subsequent procedures such as lithotripsy, intrahepatic stones, sludge or biliary cast removal and 4. biliary leaks. The conventional approach to biliary strictures included: 1. repeated prolonged high-pressure balloon biliaryoplasty (3X) at 3 weeks interval. 2. long-term drainage with large bore drains, 3. chronic catheters left in place in patients with recurrent or diffuse strictures. Long-term patency of biliaryoplasty is reported from 50 to 60% at 5 years (80% 6 months patency). Cutting balloons and metallic stents may be useful to treat refractory strictures in non surgical candidates. Retrievable covered stents for resistant stenosis is associated with an 50% restenosis rate at 12 months. The management of biliary leaks (5-15%) includes drainages of both injured biliary duct and biloma. Temporary insertion of covered stent may be necessary to manage hilar or anastomotic leaks. Selective embolisation of intrahepatic leaks or segmental portal vein embolisation is an alternative to surgery to manage refractory non-anastomotic leaks.

Learning Objectives:

1. To know about the appropriate imaging algorithm for the detection of biliary complications after liver transplantation.
2. To become familiar with the techniques of interventional treatment of biliary complications after liver transplantation.
3. To understand the results and complications in comparison with surgical management.

A-342 16:51

C. In tandem with endoscopy

D.F. Martin; Manchester/UK (derrick.martin@uhsm.nhs.uk)

Most biliary intervention are performed endoscopically but endoscopy may fail and the trans-hepatic placement of a catheter into the duodenum assists endoscopic access. Previously, the primary management of malignant bile duct obstruction was with the endoscopic placement of 10 F plastic stents. When ERCP failed, PTC using a 7 F catheter allowed the placement of an endoscopic 10 F stent but kept complications low because of the avoidance of a 10 F trans-hepatic track. Now, with the advent of 6 Fr trans-hepatic delivery systems for 10 mm diameter metal stents, this combined procedure has fallen into disuse. However, endoscopic access for the management of stones can fail, most commonly because of a perampullary diverticulum. In this situation, a trans-hepatic approach allows wire-guided sphincterotomy leading to successful endoscopic management and the avoidance of open bile duct surgery. This presentation will describe the technical aspects of this approach together with illustrative case examples. The technique has a very high success rate with complications of haemorrhage, bile leak and cholangitis in approximately 10% of patients. Poly-a-gastrostomy is declining in its incidence and experienced Endoscopists who can deal with these patients are becoming uncommon. A trans-hepatic approach may allow a guide wire to be passed along the afferent loop for endoscopic access. There is a small but growing experience of EUS-guided biliary drainage for the management of biliary obstruction. Gastroenterologists favour this approach because it appears to generate fewer complications than a trans-hepatic approach and is certainly less uncomfortable for the patient. These newer techniques will be illustrated and discussed.

Learning Objectives:

1. To be aware of the indications for tandem use of percutaneous and endoscopic approach.
2. To learn the tips and tricks of tandem technique.
3. To learn about the results and complications of tandem treatment.

Panel discussion:

Are there new possibilities in the area of biliary interventions?

17:14

16:00 - 17:30

Room P

Radiographers

RC 1114

Hot topics in magnetic resonance imaging

Moderators:

K. Haller; Wiener Neustadt/AT

L. Marti-Bonmati; Valencia/ES

A-343 16:00

A. New trends in MR safety

P. Bauer; Vienna/AT (petra.bauer@akhwien.at)

With the introduction of high-field and ultra-high-field MR scanners operating at 3 T and recently at 7 T and with the development of stronger gradient systems MR safety issues become more and more critical. The specific absorption rate (SAR) produced by the radiofrequency (RF) field of the transmitting coils increases with the square of the field strength that means that the SAR at 3 T is four times higher compared to 1.5 T. This may lead to thermal injuries. The stronger gradient magnetic fields may result in peripheral nerve stimulation which produces paresthesias and pain. With the stronger static magnetic field the attraction forces significantly increase therefore a strict access control to the magnet room is mandatory. Possible access control will be discussed. Another topic in MR safety is the increasing number of patients with different kinds of implants which may pose a problem when an MR examination is planned. Therefore, careful screening of such patients in necessary to detect implant a possible harmful metallic material in the body an when detected or known the compatibility of these implants have to be checked to provide a safe MR examination of these patients. Possible ways to define MR safety of implants will be discussed. The White paper on MRI safety, last updated in June 2007, is the most important scientific paper concerning MRI safety. It can be used as basic concept for building up an own safety concept in your own institute.

Learning Objectives:

1. To become familiar with the standard MRI safety measures (metal check and SAR limits).
2. To understand the new challenges for MRI safety given the technological advances in high-field magnets, faster gradients coils, hybrid MR imaging and new contrast agents.
3. To learn about updated MRI safety guidelines with reference to recent literature, white papers and accredited MRI safety websites.
4. To appreciate the MRI safety implications for pregnant women, neonates and the general paediatric population.

A-344 16:30

B. MR spectroscopy: the role of radiographers in data optimisation

J. McNulty; Dublin/IE (jonathan.mculty@ucd.ie)

Magnetic resonance spectroscopy (MRS) is an advanced quantitative imaging technique discovered by Bloch and Purcell in 1946 which preceded clinical magnetic resonance imaging (MRI). MRS uses the gradient system to selectively excite small volumes of tissue but rather than producing an image, it uses the free induction decay (FID) of specific nuclei to produce a spectrum which contains key information about the chemical/metabolic composition of the volume of interest. MRS has been used clinically for a wide range of disease processes to aid diagnosis, to monitor response to treatment or disease progression and is widely used in research. Clinical applications include lesion characterisation in oncology imaging along with the imaging of neurological and psychiatric disorders. High-quality MRS data have been shown in some cases to reduce the need for further invasive diagnostic procedures such as biopsy. Radiographers have a key role to play in the acquisition of high-quality spectra in order to ensure the acquired data can be used for quantitative purposes and is free of any significant artefacts. Appropriate quality assurance, detailed consideration of sequence parameters, appropriate voxel position in single voxel MRS, the correct application of spatial saturation bands and chemical suppression techniques, shimming, eddy current, motion and susceptibility minimisation will all directly impact on the quality of the spectra and thus radiographers undertaking MRS for clinical or research purposes should be aware of such challenges and the steps that may be taken to ensure quality.

Learning Objectives:

1. To learn about the basic principles of MR spectroscopy contrasting them to the basic principles of MR imaging.
2. To understand the benefits of using MRS in clinical practice.

3. To appreciate how image quality is defined in MRS, to highlight the parameters which affect image quality in MRS and how these can be modified by the radiographer.
4. To become familiar with examples of common MRS artefacts and how these can be corrected by the radiographer.

A-345 17:00

C. Challenges and opportunities in paediatric MR

V. Syrgiamiotis; Athens/GR (syrgiamiotisvasilis@gmail.com)

Magnetic Resonance Imaging paediatric examination requires a particular set of skills and expertise in order to successfully obtain diagnostic images with minimal distress to the patients and their family. Many developments have already been processed, but there is too much space uninvestigated. The four main challenges in imaging children are: anatomical, physiological, behavioural, developmental issues which will be overviewed. Techniques and opportunities, which may overcome daily difficulties, will also be presented. Paediatric MR Imaging can be considered as a series of subspecialties. Each field requires its own specialized skills, knowledge and equipment to be performed. 3 T imaging develops rapidly, but even in 1 and in 1.5 T, there are common challenges and opportunities - techniques that apply to imaging paediatric patients and number of them will be presented. The lack of ionising radiation, simultaneously with the high level of imaging details, has made MRI the examination of choice. There is no "one size fits all" regarding to the children imaging. Awareness of the challenges and pediatric techniques are the key for the success.

Learning Objectives:

1. To learn about the basic anatomical/physiological differences within the paediatric population, contrasting it with the general adult population.
2. To understand the MRI scan parameter modifications required to accommodate these differences and their trade-offs.
3. To become familiar with examples of improved, optimised imaging protocols against standard, preset, commercially available adult imaging protocols.
4. To consolidate knowledge on the optimal use of equipment to achieve a successful and clinically useful paediatric MRI exam.

Sunday, March 10

08:30 - 10:00

Room A

Interactive Teaching Session

E³ 1220

Pitfalls in brain imaging

A-346 08:30

A. CT

L. van den Hauwe¹, S. Pugliese², J.W. Van Goethem¹, C. Venstermans¹, F. De Belder¹, T. van der Zijden¹, M. Voormolen¹, P.M. Parizel¹; ¹Antwerp/BE, ²Rome/IT (lucvdhauwe@mac.com)

The majority of emergency CT studies reported by junior radiologists or general radiologists out-of-hours comprise brain scans. Brain CT studies are often performed to detect acute life-threatening abnormalities, such as stroke, intraparenchymal or subarachnoid haemorrhage, cerebral edema, etc. Misrecognition of these - often subtle - but life-threatening abnormalities can lead to inappropriate patient management and worsen patient outcome. Errors in interpretation can generally be categorized as either perceptual or cognitive in nature. Perceptual errors are those in which the radiologist does not see the abnormality, resulting in a false-negative interpretation (e.g. basilar artery thrombosis, deep cerebral venous thrombosis, PRES,...). Cognitive errors, on the other hand, are those in which an abnormality is identified but the meaning or significance of the abnormality is not recognised. Cognitive errors can result in false-positive interpretation if, for example, a normal anatomic variant is mistaken for a pathologic condition. While the more common normal variants and artifacts often do not present a problem for experienced clinicians and neuroradiologists, less-experienced individuals should beware of these diagnostic hazards. In order to reduce false-negative and false-positive reporting, a check list of the review areas (blind spots) to be verified on any brain CT scan will be offered and most frequent normal variants will be discussed.

Learning Objectives:

1. To learn about common pitfalls in CT evaluation of the brain.
2. To become familiar with anatomical variants, potentially mimicking disease.

A-347 09:15

B. MRI

M. Essig; Erlangen/DE (mediag@me.com)

In this interactive teaching session, the audience will learn about normal anatomic variations as well as common diagnostic pitfalls in neuro-MR imaging commonly encountered in clinical practice. The lecture will cover variants commonly seen on brain and head and neck MRI as well as common vascular variations seen on MR angiography. Further, the use and limitations of the newer diagnostic techniques, such as diffusion-weighted MRI, perfusion-weighted MRI, magnetic resonance spectroscopy will be discussed.

Learning Objectives:

1. To learn about common pitfalls in MRI evaluation of the brain.
2. To become familiar with anatomical variants, potentially mimicking disease.

08:30 - 10:00

Room B

GI Tract

RC 1201

How I report

Moderator:

G.A. Rollandi; Genoa/IT

A-348 08:30

A. MDCT in the post-operative abdomen

D.J.M. Tolan; Leeds/UK (djmtolan@doctors.org.uk)

MDCT offers rapid assessment of the post-operative abdomen in a very complex patient group - an open dialogue with the surgical team allows precise knowledge of procedure performed, any resection performed and anastomoses created (including if bowel has been defunctioned with stoma) and the current clinical status (especially, if there is concern for sepsis or haemorrhage) or any concern for obstruction or ileus. Positive oral contrast can assess anastomotic integrity, either orally/via nasogastric tube or rectally via foley catheter. The authors use 8% non-ionic iodinated contrast with 30-min delay for oesophagogastric (500 ml),

60 min for proximal small bowel (1000 ml) and 2 h for distal small bowel or colonic anastomosis (1000 ml). Rectal contrast should be instilled via a bag using gravity - 200-300 ml is usually sufficient for distal colonic or rectal anastomoses and no delay necessary. In patients with catastrophic post-operative complication is suspected (such as haemorrhage or perforation) IV contrast alone may be used. In a minority of patients with severe renal impairment risk of renal toxicity from IV contrast must be balanced against detection of signs that indicate bowel ischaemia or improve delineation of anatomy in oedematous patients. Specific complications or patterns of complication are recognised in individual operations. However, additional factors complicate interpretation including use of haemostatic compounds (misinterpreted as abscess) or mesh placement (limiting access for interventional procedures). Retained swabs left in error must be notified to the surgeons.

Learning Objectives:

1. To become familiar with an optimised MDCT protocol for the detection of post-operative complications.
2. To learn the normal post-operative appearance of common surgical material including mesh, packing and sutures.
3. To understand the expected findings of peritoneal air, fluid and bowel dilatation in the immediate post operative course.
4. To learn the most common causes of clinical deterioration in the post-operative state and their imaging findings.

A-349 09:00

B. MDCT in a patient with small bowel ischaemia

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

Intestinal ischaemia and infarction are important causes of acute abdominal disease which appropriate diagnosis has to be as more as accurate being of crucial importance for the surgical or medical management of the affected patients. At the basis of an efficient report lays the deep knowledge of the patho-physiologic mechanism leading to arterial, venous or low-flow state vascular injury of the intestines. When the mechanism is clearly understood, from a radiological point of view, it is essential to know how to optimise the MDCT technique in case of suspected intestinal ischaemia and what are main findings and intestinal features of the injured intestine. A further step is represented from the differentiation of various stages of disease from early potential transient ischemia to late infarction. However, it is also strongly important to become familiar with the reperfusion damage of the intestine, frequently observed but as still as a challenge for an effective diagnosis. The accuracy of the various radiological signs of bowel ischaemia should be considered and discussed, whereas presentation of several clinical cases with the description of their respective reports and final diagnosis still represents the "key" to improve an effective diagnosis of intestinal ischemia in daily radiological practise.

Learning Objectives:

1. To understand the patho-physiologic mechanism leading to arterial, venous or low-flow state vascular injury.
2. To learn how to differentiate different stages of disease from early potentially transient ischaemia to late infarction.
3. To become familiar with reperfusion damage of the intestine.
4. To understand the accuracy of the various radiological signs of bowel ischaemia.

A-350 09:30

C. MDCT in a patient with small bowel obstruction

P. Taourel; Montpellier/FR (p-taourel@chu-montpellier.fr)

The questions regarding the CT diagnosis of bowel obstructions are as follows: is there an obstruction? What is the level and the cause? Are there findings of closed loop obstruction and of strangulation? What is the treatment recommended: surgery or follow-up, laparoscopy or laparotomy? To answer these questions, the CT semiology is based on findings validated in the literature that will be described in this lecture, by underlining the potential pitfalls in interpreting a CT exam in bowel obstruction. The technical modalities of the CT will be detailed: thickness of the slices, role of acquisition without contrast and reformatting.

Learning Objectives:

1. To understand a simple classification for the causes of bowel obstruction.
2. To become familiar with CT protocols.
3. To learn a structured approach to the reporting of CT.
4. To understand the accuracy of the various radiological signs of bowel obstruction.

08:30 - 10:00

Room C

Urogenital Imaging

CC 1221

Retroperitoneal anatomy, variants and diseases

Moderator:

U.G. Mueller-Lisse; Munich/DE

A-351 08:30

A. Retroperitoneal anatomy: an embryology based approach

F.M. Danza; Rome/IT (fmdanza@gmail.com)

The classical radiological anatomy of the retroperitoneum (RP) divided into 3 compartments (perirenal, anterior and posterior pararenal spaces). In some instances, it does not fit with the diffusion and appearance of fluid collections or masses, suggesting the need of some anatomical corrections. The embryologic development of the abdomen, with rotations and adhesions of primitive gut and mesia, is the key to understand the real radiological anatomy of retroperitoneum and entire abdomen in adults. This new vision, based on embryo, recognizes acquired and true retroperitoneal compartments and distinguishes the sopramesocolic from undermesocolic ones. In such a way becomes evident that RP compartments are more than 3, have asymmetric and different topographic distribution in abdomen and pelvis and develop different intercommunication with the peritoneal portion of the abdomen. The diagnostic importance of fascial planes, better defined as "peritoneal fascial adhesions", is crucial in determining and recognizing the patterns of diffusion of diseases and their radiological counterpart. The real communications between RP lodges and peritoneal reflections is better understood, leading to identification of five doors of intercommunication, that are crossroads for the spread of diseases. In such a way RP and peritoneum are to be considered as a unique anatomic complex and the so called "subperitoneal space" is the "common denominator" leading to a modern view of the radiological anatomy for a correct reading of pathological pictures. The consciousness of these anatomical landmarks and the application of these new concepts during diagnostic radiological work are a formidable aid in interpreting pathological patterns.

Learning Objectives:

1. To understand the development of the retroperitoneum during the embryo development, introducing the concept of a unique subperitoneal space.
2. To understand the importance of fascial planes in determining the pattern of diffusion of diseases.
3. To apply these new concepts signs during routine diagnostic work.

A-352 08:50

B. Anatomical variants and benign diseases

S. Meran; Paris/FR

This lecture will deal with the imaging findings observed in patients with benign retroperitoneal lesions, including variants of vascular anatomy and of renal position and morphology. Such anomalies are often encountered during imaging studies, and must be recognised before surgery and/or interventional manoeuvres to avoid iatrogenic damage. The role of radiology in the diagnosis of patients with retroperitoneal fibrosis will be discussed, with special attention to findings during follow-up and about criteria which can help to differentiate such condition from retroperitoneal lymphoma. There will be presentation of findings in patients with retroperitoneal abscess, together with discussion of techniques to guide efficiently and safely percutaneous drainage. A large variety of space occupying lesions can be encountered within the retroperitoneum, both benign and malignant. Diagnostic clues to recognise the benign ones will be presented, with discussion on how to reach a differential diagnosis among them.

Learning Objectives:

1. To learn about the most important variants of retroperitoneal vessels and about renal anomalies.
2. To understand the role of radiology in patients with retroperitoneal fibrosis and infections.
3. To become familiar with benign retroperitoneal tumours and learn about the clues for differential diagnosis.

A-353 09:10

C. Malignant tumours

R.H. Oyen; F. Claus, D. Hompes, L. De Wever; Leuven/BE
(Raymond.Oyen@uzleuven.be)

The retroperitoneum can host a variety of malignancies, primary or metastatic. They can cause a diagnostic and therapeutic challenges because of rarity, substantial size, and close relationship with vital structures. Sarcomas comprise a third of retroperitoneal tumours, liposarcoma and leiomyosarcoma predominating. Other include lymphomas and metastases (germ cell tumours, carcinomas, melanomas). CT is the modality of choice to determine the origin, size, relationship to adjacent structures and to evaluate metastases. Low-grade liposarcomas harbour a predominantly fatty component; high-grade lesions show solid attenuation with contrast enhancement. Biopsy is not required with clear radiological diagnosis. When the appearance is not typical of a liposarcoma, other diagnosis must be considered. Lymphoma is not uncommon, displacing or encasing main vessels. Some reluctance remains on FNAC or needle biopsy of retroperitoneal lesions. In selected patients with non-diagnostic imaging, biopsy is safe, rapid, reliable, accurate and inexpensive (1) to identify lesions that may not require resection, (2) when the appearance suggests a mass where neoadjuvant treatment may be appropriate (gastrointestinal stromal tumour, Ewing's sarcoma) and (3) to determine further therapeutic strategies if a tumour is deemed unresectable or with distant metastases. Although parts of the gastrointestinal and/or urinary tracts are often largely displaced, invasion and related symptoms are unusual. However, complete surgical resection is the only potential curative treatment option and clearance of macroscopic disease often requires en bloc resection of the contiguous organs (i.e. colon, kidney, pancreas and spleen). Local recurrence occurs in a large proportion and remains the major cause of death.

Learning Objectives:

1. To learn about the spectrum of malignant retroperitoneal neoplasms.
2. To understand the role of preoperative cytology/histology by needle aspiration/biopsy.
3. To learn about the predictors for survival after resection of retroperitoneal sarcoma.

A-354 09:30

D. Interactive case discussion

U.G. Mueller-Lisse; Munich/DE

The retroperitoneum includes the adrenal glands, the different organs of the urinary tract and the male and female reproductive system, the large blood vessels of the body, and different structures of the lymphatic system, the peripheral nervous system, and the lower gastro-intestinal tract. During embryologic development, the retroperitoneum separates from both the peritoneal cavity and the lung cavities, while it remains connected with the mediastinum. Different fascial planes subdivide the retroperitoneum and separate it from other spaces in the body. Congenital anomaly or acquired disease may alter those separations and, subsequently, bring about secondary disease or disorder. The interactive case discussion will highlight clinically relevant aspects of retroperitoneal anatomy, normal variants, and disease in selected examples that illustrate each of the sub-topics of the categorical course.

08:30 - 10:00

Room D1

CLICK (Clinical Lessons for Imaging Core Knowledge): Never without Arteries

CC 1218

Chest pain: vascular non-cardiac causes

Moderator:

E. Brontzoz; Athens/GR

A-355 08:30

A. Clinical considerations

R. Iezzi; Rome/IT (roberto.iezzi@rm.unicatt.it)

Acute Aortic Syndrome (AAS) describes the acute presentation of patients with characteristic "aortic pain" caused by one of several life-threatening thoracic aortic pathologies. These include aortic dissection, intramural haematoma, penetrating atherosclerotic ulcer, aneurysmal leak and traumatic transection. All disorders giving rise to AAS can be distinguished in terms of their aetiology and radiological appearance. There is, however, considerable overlap with the possibility of progression from one pathological process to another. The need to consider and highlight acute

thoracic pathology as an AAS is clear. In an ageing morbid population and with modern imaging techniques, it is becoming a more commonly encountered clinical phenomenon. Furthermore, thoracic aortic pathology can be a difficult diagnosis to make. Clinical findings are often absent, the chest radiograph may be normal, and symptoms may be confused with acute myocardial infarction. An AAS, therefore, encourages prompt recognition of symptoms heralding an unstable phase in these disease processes indicating imminent aortic rupture. This will hopefully expedite recognition and avoid diagnostic delays. Current diagnostic techniques center around the use of computed tomography (CT), transesophageal echocardiography (TEE), magnetic resonance imaging (MRI), and aortography. These four techniques provide variable informations, in order to obtain a correct diagnosis, an assessment of the localisation and extension of disease, and an accurate planning of treatment. It is mandatory to underline that aortic pathology is often unsuitable for conservative medical treatment and many patients are also poor surgical candidates. As a result minimally invasive endovascular aortic repair is now increasingly being undertaken.

Learning Objectives:

1. To become familiar with clinical diagnostic algorithms in cases of non-cardiac acute chest pain.
2. To learn about the constituents of acute aortic syndrome.
3. To become familiar with prognosis, treatment and outcome and learn about the influence of imaging on treatment decisions in acute chest pain.

A-356 09:00

B. Imaging techniques and typical findings

F. Wolf; Vienna/AT (florian.wolf@meduniwien.ac.at)

Acute chest pain is a very common admission diagnosis of patients entering an emergency department. The sufficient triage of these patients is crucial in order to start the right treatment and to minimize unnecessary hospital stays. Computed tomography is a very important tool in the differential diagnosis of acute chest pain. Aortic pathologies are one of the clinical most relevant differential diagnoses of acute non-cardiac chest pain. There are 5 variants of aortic dissections: classical dissection, atherosclerotic penetrating ulcer (PAU) \pm intramural haematoma, intimal tear without intramural haematoma, intramural haematoma (without intimal tear) and traumatic/iatrogenic dissection. CT plays a major role in the detection and differential diagnosis of these 5 variants as well as in the decision how to treat these patients. Choosing the right imaging protocol is crucial in order to find the right diagnosis. ECG-triggering is a key factor that has positive influence on the image quality especially in the region of the aortic root. Using a so-called "triple-rule-out" protocol is critical due to different reasons and might offer sufficient image quality only with scanners of the newest generation. This presentation will show stable imaging protocols for aortic pathologies in patients with acute chest pain. Moreover, it will discuss the usefulness of the "triple-rule-out protocol". The 5 variants of thoracic aortic dissection will be presented combined with clinical cases.

Learning Objectives:

1. To learn about state-of-the-art CT angiographic imaging in acute chest pain (after ruling out MI).
2. To become familiar with the techniques and advantages of ECG gating in CT angiographies of acute chest pain.
3. To discuss the potential role of additional MR angiography.

A-357 09:30

C. Interactive case discussion: what is really important?

T.R.C. Johnson; Munich/DE (thorsten.johnson@med.uni-muenchen.de)

In chest pain evaluation, a close collaboration with clinicians is essential. An initial workup should include a brief history, clinical exam, ECG and laboratory markers including troponin and d-dimer. TSH and creatinine are not mandatory in acute cases. Chest x-ray is the modality of choice in subacute pain if the clinical presentation is suggestive of, for example, pulmonary edema, pneumothorax, pneumonia, rib fractures or metastases. If clinical history and presentation are suspicious of myocardial infarction or there are ECG findings or a positive troponin, the patient should be referred to cardiology to allow immediate catheterization. In cases of acute, unclear chest pain, CT is the modality of choice. Long bolus techniques can be used to cover pulmonary and aortic system, and high-pitch modes with ECG-triggering are preferable to assess coronary arteries, depending on the available CT technology. In case of acute pulmonary edema with typical presentation, the administration of contrast media can worsen the situation and should be avoided. Depending on the diagnosis, there are different important diagnostic criteria. In pulmonary embolism, number and level of affected arteries, degree of obstruction, and right heart strain should be assessed. In case of aortic dissection, involvement of coronary ostia, entry and re-entry, and organ supply or ischaemia are important criteria. In case of aortic ulcer or aneurysm, signs of rupture or haematoma and

involvement of arterial branches should be evaluated. In coronary artery disease, affected arteries, obstruction and degree of stenosis, areas of infarction and signs of pulmonary congestion are important.

Learning Objectives:

1. To become familiar with typical cases illustrating the role of imaging modalities in the diagnosis and differential diagnosis of acute chest pain.
2. To consolidate knowledge of the selection of the appropriate imaging technique, image interpretation and image based treatment recommendation.
3. To understand the most important information urgently needed for treatment decisions and planning.

Author Disclosure:

T. R. C. Johnson: Research/Grant Support; Bayer, Siemens. Speaker; Siemens.

08:30 - 10:00

Room D2

Oncologic Imaging: Follow-up of Systemic and Local Therapies

CC 1219

Assessing HCC response

Moderator:

R. Lencioni; Pisa/IT

A-358 08:30

A. Systemic therapies

V. Vilgrain; M. Ronot, M. Zappa, S. Faivre, E. Raymond; Clichy/FR (valerie.vilgrain@bjn.aphp.fr)

Sorafenib, a tyrosine kinase inhibitor, has shown clinical efficacy in patients with hepatocellular carcinoma (HCC) and is the standard of care for patients with advanced-stage HCC. Nowadays, many targeted therapies are evaluated in HCC either as sole treatment or in combination with other treatments such as tumour ablation, chemo-embolisation, and surgical resection. Therefore, there is a need to assess efficacy of targeted therapy in HCC. RECIST is the reference method to evaluate treatment efficacy in solid tumours but does not seem appropriate in evaluating targeted therapy as objective responses were seen in very few cases in patients treated with sorafenib or sunitinib. New criteria have been proposed to evaluate treatment efficacy of non-surgical treatments in patients with HCC. The most common ones are the Choi criteria, the EASL criteria, and the modified RECIST criteria. All these criteria mainly focus on internal tumour changes such as appearance of necrosis or disappearance of tumour hypervascularity. Many examples will be shown during the lecture. Another approach is based on functional imaging and especially perfusion-related imaging. Contrast-enhanced ultrasound, CT perfusion and dynamic contrast-enhanced MR imaging have the capability to assess perfusion changes in patients under treatment. Advantages and disadvantages of these modalities will be discussed. Last, other functional tools that are not routinely used will be presented.

Learning Objectives:

1. To learn about difficulties in HCC assessment with local therapy.
2. To become familiar with various evaluation criteria of HCC.

A-359 09:00

B. Endovascular therapies

R. Salem; Chicago, IL/US (r-salem@northwestern.edu)

The mainstay treatment for HCC include ablation and embolisation. Chemoembolisation, the gold standard treatment for intermediate disease, results in response rates ranging from 35-45%. New treatment modalities including drug-eluting beads and radioembolisation appear to improve on this, with responses up to 50% by size and 75% by necrosis criteria. This presentation will focus on the methodologies for response assessment and the specific challenges faced by radiologists when interpreting response following embolotherapy. Response criteria including WHO, RECIST, EASL and mRECIST, as they relate to endovascular therapies, will be discussed in detail.

Learning Objectives:

1. To appreciate the value of different imaging techniques for assessment of intra-arterial therapies of HCC.
2. To become familiar with post-treatment imaging after intra-arterial therapies according to type of therapy.

Author Disclosure:

R. Salem: Advisory Board; Sirtex, Nordion. Consultant; Nordion, Sirtex.

A-360 09:30

C. Ablative therapies

C. Ayuso; Barcelona/ES (cayuso@clinic.ub.es)

The evaluation of treatment efficacy is a key issue with prognostic and patient survival implications. It is crucial to have objective and reproducible criteria for specific groups of patients. The goal of ablative therapies of HCC is to induce tumoural tissue destruction. Complete response (CR) after initial chemical and thermal percutaneous ablation, defined as the absence of contrast enhancement of the treated tumour at CEUS, dynamic CT or MR, has been reported to correlate to long-term survival. Nevertheless, the clinical effectiveness of imaging techniques to assess initial treatment success differs according to tumour size. The success rate of RF has been demonstrated superior to PEI in HCCs > 2 cm, and it depends on the ability to ablate all viable tumour tissue including an adequate tumour-free margin all around the lesion of 0.5 to 1 cm. Thus, the effectiveness of RF directly depends on the tumour location and size. RF is considered an effective treatment in lesions \leq 3 cm and its effectiveness is progressively reduced along tumour size and it is not effective in lesions > 5 cm. CEUS beyond one month may confirm CR or detect residual tumour, deserving a final ablation procedure. CT and MR are more effective in the follow-up to confirm the CR and to detect local recurrence, or additional HCC lesions in the liver parenchyma. The presence of transient hyperaemic inflammatory changes in the periphery of the treated area is a common finding that should be considered to avoid overestimation of the recurrence rate.

Learning Objectives:

1. To learn about the value of different imaging techniques for the assessment of ablative therapies of HCC.
2. To become familiar with post-treatment imaging after ablative therapies according to type of therapy.

08:30 - 10:00

Room E1

Musculoskeletal

RC 1210

Overuse injuries in sport: a multimodality approach

Moderator:

E. Llopis; Valencia/ES

A-361 08:30

A. Overuse injuries in the footballer's ankle

S.J. Eustace; Dublin/IE (eustacesj@gmail.com)

This talk will briefly review normal ankle MRI anatomy and biomechanics. It will then make brief reference to common MR imaging protocols and finally review imaging appearances of common injuries encountered in footballers, including both technical and diagnostic pitfalls. The relative advantages and disadvantages of MRI versus other imaging techniques including ultrasound in both diagnosis and prediction of return to sport will be reviewed.

Learning Objectives:

1. To learn the spectrum of overuse injuries sustained by footballers at the ankle joint.
2. To understand the mechanisms by which these injuries occur.
3. To become familiar with the imaging findings seen in overuse injuries at the ankle.

A-362 09:00

B. Overuse injuries in the gymnast's spine

M.C. De Jonge; Amsterdam/NL (McDonge@zuwehofpoort.nl)

Gymnastics participation has increased in the last years. It is predominantly a sport in which very young children and adolescents participate. It is also an activity that is characterised by one of the highest injury rates. Whereas in the adult, the skeleton is usually much stronger than the supporting soft tissues (e.g. muscles and ligaments) and this is not the case in children and adolescents. They are, therefore, at special risk to sustain injuries to the skeletal structures. It is also the large number of training hours and intensity of the training that is very demanding. Apart from the acute injuries they are particularly vulnerable to injuries caused by this overuse. Not only the appendicular skeleton is at risk due to the use of the upper extremity as a weightbearing structure but also the axial skeleton is under constant strain. The repetitive high-force flexion and (hyper)extension movements together with rotation and compressive loading of the spine puts the thoracic and more commonly the lumbar spine under a lot of stress and force. It is, therefore,

not surprising that especially amongst elite gymnasts low-back pain is a very common phenomenon. It is not always easy to recognize this. They usually accept a certain amount of pain as being normal and consider it more or less normal. There are, however, some potentially devastating diseases and conditions that can be the underlying cause and it is very important to recognize these, so that proper treatment can be applied.

Learning Objectives:

1. To become familiar with the types of chronic injuries seen in the gymnast's spine.
2. To understand the strengths and weaknesses of different imaging modalities for imaging these injuries.

A-363 09:30

C. Upper limb overuse injuries in golfers

P.J. O'Connor; Leeds/UK (philip.o'connor@leedsth.nhs.uk)

Golf is particularly well suited to the development of upper limb overuse injury. Repetitive actions combined with relatively high forces damage soft tissues, joints and bone. This is particularly the case in professional golfers where the swing forces are more clearly reproduced with higher repetition rates compared to amateurs. This lecture details the common upper limb overuse injuries focussing on the elbow, wrist and shoulder.

Learning Objectives:

1. To understand the types and mechanisms of overuse injuries seen in the upper limb in golfers.
2. To understand the advantages and disadvantages of different imaging modalities.
3. To become familiar with the imaging findings seen in overuse injuries of the upper limb.

08:30 - 10:00

Room E2

Neuro

RC 1211

Stroke: is the prognosis getting any better?

A-364 08:30

Chairman's introduction

J.-P. Pruvo; Lille/FR (jean-pierre.pruvo@chru-lille.fr)

Stroke remains a major health burden, the first cause of disability in young adults, the second cause of dementia and the third cause of death in Europe and the US. Brain imaging must be performed very early after symptom onset in order to confirm the diagnosis, to evaluate the infarct size, to assess the salvageable brain tissue and to detect the site of occlusion. The role of each imaging technique, CT or MR, remains widely debated by the scientific community. This specific topic will be developed by PM Parizel during the first lecture. In case of ischaemic stroke which represent more than 80% of cases, several therapeutic options may be chosen according to the delay between symptom onset and patient admission. This includes IV thrombolysis, mechanical thrombectomy or, after the initial phase, craniectomy in case of malignant stroke. In the near future, the use of brain hypothermia during the first 6 h after stroke onset and before brain imaging could potentially reduce brain damage related to ischaemia in large population of patients. This will be discussed in the second lecture by VM Pereira. For the secondary prevention of ischaemic stroke, P Vivela will talk about the exact role of extracranial or intracranial stenting which is another topic widely debated since the recent multicenter studies which did not prove the real benefit of these techniques to prevent a recurrent stroke.

A-365 08:35

A. Initial imaging work-up: CT or MR?

P.M. Parizel, T. Van der Zijden, F. De Belder, C. Venstermans, L. van den Hauwe, R. Salgado, J. Van Goethem, M. Voormolen; Antwerp/BE (paul.parizel@ua.ac.be)

Neuroimaging plays a crucial role in the diagnosis, management, and outcome prediction of patients with acute stroke. Patient history and clinical neurologic examination neither reliably identify the involved vascular territory, nor the etiology, extent or type of stroke. With the arrival of promising new therapies aimed at re-establishing blood flow, reducing the size of the infarction and protecting the surrounding brain at risk (penumbra), the traditional role of neuroimaging has changed. Thanks to multiparametric CT and MRI techniques, our understanding of

the pathophysiology of stroke, in terms of cerebral blood flow and cell metabolism, has greatly improved. Identification of the ischaemic penumbra with MRI and/or CT has entered routine clinical practice. A patient suspected of having suffered an acute stroke should be cleared for thrombolytic therapy, by excluding intracranial hemorrhage and non-stroke causes of the patient's symptoms. The critical 3 to 6 h time window for thrombolytic therapy necessitates rapid and accurate diagnosis. The fundamental goals of neuroimaging in the patient with acute stroke are therefore to rule out intracranial hemorrhage, e.g. by CT or MRI, to show ischaemic brain tissue, e.g. by DW-MRI, to show tissue blood flow and identify the penumbra, e.g. by perfusion CT or MRI, and to assess vessel patency, e.g. by performing CTA or MRA. The purpose of this presentation is to present a comprehensive imaging protocol for patients with suspected stroke, to discuss advantages and disadvantages of CT and MR in the initial work-up of acute stroke patients, and to illustrate imaging patterns.

Learning Objectives:

1. To become familiar with a comprehensive imaging protocol in patients with suspected stroke.
2. To know the advantages and disadvantages of CT and MR in the initial work-up of stroke patients.
3. To recognise the different imaging patterns in stroke.

A-366 08:58

B. Stroke: is there really any therapy?

V. Mendes Pereira, K.-O. Lovblad; Geneva/CH (vitompbr@hotmail.com)

Stroke is a life-threatening condition that affects significant amount of active patients accounting for a large number of disabilities or deaths. The treatment of acute stroke treatment started in 1990s with the use of rtPA intravenously. The NINDS study demonstrated the efficacy this approach in a cohort of patients up to 3 h. The results demonstrated a clinical improvement (mRS 0-1) of 36% on the treated group. The IV therapy demonstrated better results for patient arriving early at the hospital and for distal located occlusions. Proximal occlusions and posterior fossa lesions had still a very bad clinical prognosis. Mechanical thrombectomy was proposed to be an alternative for those proximal occlusions by promoting lyses of clot in situ. The PROACT II was the study that demonstrated a significant improvement (mRS 0-2: 40%) of the IA treatment compared to placebo up to 6 h after the beginning of the symptoms for M1 located lesions. Mechanical thrombectomy was proposed to enlarge the therapeutic window and to be used in cases with contra-indications to the use of thrombolytics. The first studies reported recanalization rates higher than previous studies with a variable effect on patient's outcome: 25% for an aspiration system (penumbra device) to 36% for the Merci device. More recently, retrievable intracranial stents started to be used in stroke and have demonstrating a remarkable efficiency on recanalization and on clinical improvement.

Learning Objectives:

1. To learn the natural evolution of untreated stroke.
2. To understand the advantages and disadvantages of the different therapeutic options in stroke patients.
3. To recognise imaging patterns that may determine therapy in stroke patients.

A-367 09:21

C. Stenting: does it prevent stroke?

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

Angioplasty and stenting has been increasingly used to treat extra/intracranial stenosis aiming to prevent future strokes. Extracranial atherosclerotic stenosis trials were focused in comparing the results of stenting and surgery, especially for carotid artery. Most of these trials have shown higher rate of periprocedural complications, especially stroke, with carotid artery stenting (CAS). However, the CREST trial results have showed a similar 30-day overall complication rate and equivalents rates of future strokes and restenosis. For the intracranial atherosclerotic stenosis, the SAMMPRIS trial has demonstrated that aggressive medical treatment was safer and had better long-term results compared with endovascular treatment. The benefits and risks of each treatment may differ between patients. It has been demonstrated that older patients have worse outcomes with CAS than with CAE. Moreover, arterial stenosis may cause a stroke by different mechanisms, such as haemodynamic failure, direct occlusion of perforating arteries or thrombosis at the site of the atheromatous plaque, and distal thromboembolism. It is reasonable to accept that angioplasty and stenting may not have the same protective effect in these different situations. Patient selection based on the subgroup analysis taken from the published and future trials, in the plaque vulnerability or in the cerebrovascular reserve status may depict which patients will benefit most from each type of treatment modality. The author will review natural history of extra and intracranial

atherosclerotic and non-atherosclerotic diseases, make a critical appraisal of the literature, discuss the current indications for endovascular treatment and give a glimpse into the future challenges for stenting.

Learning Objectives:

1. To understand the natural history of extracranial and intracranial carotid and vertebral artery atherosclerotic and non-atherosclerotic diseases.
2. To become familiar with the endovascular treatment indications of extracranial and intracranial arterial disorders.
3. To understand the endovascular treatment strategies aimed at stroke prevention.
4. To recognise the present and future challenges for PTA and stenting of extracranial and intracranial arteries.

Panel discussion:

What is the future of stroke prevention and treatment?

09:44

08:30 - 10:00

Room F1

Special Focus Session

SF 12

Quantitative imaging biomarkers in cardiac radiology

A-368 08:30

Chairman's introduction

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

Biomarkers are increasingly important in clinical practise and research as they reflect normal and pathological biological processes. Imaging biomarkers have the advantage of being non-invasive, spatially located, and temporally resolved. Quantification is of utmost relevance for imaging biomarkers to fully exploit the morphological and/or functional information in the images. Accurate quantification in medical imaging relies on standardised data acquisition and data analysis. Although tremendous progress has to be made in the coming years, some imaging biomarkers have already reached the clinical and research domain. The ESR has released a white paper on imaging biomarkers (Insights into Imaging 2010; 1:42-45), prepared by the ESR Working Group on Imaging Biomarkers. That document aims to contribute to further exploitation of the enormous wealth of biomarker information available in imaging. In this session, the concept of imaging biomarkers is explained and applied to the field of cardiac radiology. It will make clear what the prerequisites are for qualification as imaging biomarker and which imaging biomarkers are currently being developed.

Session Objectives:

1. To appreciate the increasing role of imaging biomarkers in radiological research and clinical practice.
2. To understand the importance of quantification and standardisation of imaging biomarkers.
3. To become familiar with the spectrum of quantitative imaging biomarkers in cardiac radiology

A-369 08:33

Imaging biomarkers

J.-P. Vallée; Geneva/CH (jean-paul.vallee@hcuge.ch)

A biomarker is "a characteristic that is objectively measured and evaluated as an indicator of normal biological processes, pathogenic processes, or pharmacological responses to a therapeutic intervention". There is a tremendous interest of both industry and the scientific community to develop and validate new biomarkers as they can be used for risk and disease assessment as well as being efficient surrogates of clinical endpoints to decrease study sizes. Biomarkers are derived from either biospecimens or imaging. Imaging biomarkers are mainly represented on parametric maps, where the intensity of each pixel corresponds to an anatomical, functional or molecular parameter measured from the images. As a unique feature, imaging biomarkers are able to analyze the whole organ rather than just a sample. However, the measurement process of imaging biomarkers that rely on some kind of signal emitted from the human body is usually more complex and less standardised than the measurement of biomarkers obtained from biospecimens. The qualification of imaging biomarkers is therefore of utmost importance. This includes the acceptance of standardised and reproducible procedures for both the image acquisition and processing, a correlation with pathology, as well as with other validated biomarkers,

and a demonstration of an impact on patient outcome or estimation of the size of the effect in clinical trials or experimental studies. In an standardization effort, the structured reporting of imaging biomarkers is likely to expand and affect the clinical practice of radiologists. Imaging biomarkers, therefore, provide a tremendous opportunity for Radiology to move toward an integrative discipline.

Learning Objectives:

1. To understand the concept of imaging biomarkers.
2. To learn about the different types of biomarkers (anatomical/functional/molecular).
3. To understand the different applications of imaging biomarkers (detection, prediction, response).
4. To learn about the standardisation and validation of imaging biomarkers.

A-370 08:45

Imaging biomarkers for myocardial function

J. Bogaert; Leuven/BE (Jan.Bogaert@uz.kuleuven.ac.be)

As the heart generates the driving force to propagate the blood through the vascular system, assessment of its performance ("cardiac function") is crucial since many diseases have an impact on the performance of the heart. Though the patient's complaints and clinical examination provide valuable information regarding the functional status of the heart, quantitative measures of cardiac function ("imaging biomarkers") have been established in the last decades, and are nowadays routinely used in daily clinical practice. The ease of these measures is that age- and gender-adjusted normalised values can be used as reference to determine whether a patient's cardiac function is still within normal limits, and thus allow to assess severity of dysfunction and to categorize patients. Moreover, functional parameters such as ejection fraction (EF) have shown to yield prognostic value and are therefore often used as surrogate for hard end points such as cardiac death in many studies. Though ejection fraction, expressing the relative amount of blood ejected by a ventricle during each cardiac contraction, is definitely the functional parameter with whom we are most familiar with, it is important to emphasize that cardiac function assessment cannot be reduced or simplified to one single parameter, and that several other parameters need to be considered. It has become clear over the last decades that unraveling and assessment of cardiac function is extremely complicated. This presentation will deal how MRI and CT can be used to quantify the most important imaging biomarkers on cardiac function.

Learning Objectives:

To become familiar with the quantitative imaging biomarkers of:

- 1) cardiac mass (MRI/CT)
- 2) ventricular volume (MRI/CT)
- 3) ventricular function (MRI/CT)

A-371 09:05

Imaging biomarkers of myocardial viability

P. Croisille; Saint-Etienne/FR (pierre Croisille@me.com)

Direct imaging of myocardial necrosis and/or fibrosis is now possible with the use of delayed-enhancement MRI (DE-MRI) that show abnormalities in the distribution of gadolinium chelates and demonstrates nonviable tissue as "hyper enhanced" of bright regions. It is related to various mechanisms including delayed wash-in and wash-out kinetics of non-viable tissue that contains replacement fibrosis and different volumes of distribution of gadolinium in viable and nonviable regions. Accurate quantification of areas of scar and viable tissue is now of outmost importance in predicting mortality, as the benefits of revascularization rise steeply when this area reaches a critical size. When combined with low-dose dobutamine challenge that can assess either using cine-MRI or quantitative strain imaging with motion encoding techniques such as MR-tagging, CMR provides a unique tool that can not only assess the amount of irreversibly damaged myocardium but also its mechanical impact and further help to predict the potential benefits of revascularization. After acute myocardial infarction, oedema is believed to be an important biomarker that can be uniquely assessed using CMR. More than an estimate of the area at risk, T2 imaging provides an overall marker of both ischaemic and reperfusion injuries that may be used to monitor reperfusion strategies.

Learning Objectives:

To become familiar with the quantitative imaging biomarkers of:

- 1) infarct size using delayed enhancement (MRI/CT)
- 2) areas at risk in myocardial infarction using T2w MRI
- 3) cardiac contractility using cine or tag MRI after low dose dobutamine challenge

A-372 09:25

Imaging biomarkers of myocardial ischaemia

L. Natale; Rome/IT (lnatale@rm.unica.it)

Quantification of myocardial perfusion is typically obtained by nuclear medicine; both MRI and CT are relatively new techniques in this field, and the major limitation for their application as imaging biomarkers is represented by lack of standardization and a not so high reproducibility for MRI, while for CT the experience is still limited. Furthermore, there is a lack of clinical trials and data on patients outcome. Nevertheless, new dual bolus techniques for perfusion MRI seems to be promising as well as new applications of CT, as fractional flow reserve measurements demonstrated by the Discover Flow study. However, semiquantitative approaches, such as upslope of time/intensity or time/density curves, have been validated and can represent a valid surrogate of myocardial blood flow quantification. From their normalisation, the perfusion reserve index can be obtained, and this has been standardised in some studies. Atherosclerosis biomarkers with CT have been represented for a long time only by Coronary Calcium Score. Standardization of Agatston Score has been achieved with EBCT and now also with MDCT, while less data are available for volume and mass indexes. New possible biomarkers of plaque composition, such as density measurements of plaques, need further studies for standardization and reproducibility, both for acquisition and post-processing. Concerning quantitative assessment of dobutamine stress MRI, there are still no significant published data. In clinical practice only qualitative assessment is used, with a very poor reproducibility reported in many papers.

Learning Objectives:

To become familiar with the quantitative imaging biomarkers of:

- 1) myocardial perfusion (MRI/CT),
- 2) cardiac contraction after high dose dobutamine challenge (MRI)
- 3) coronary atherosclerosis (CT)

Panel discussion:

How should we implement quantitative biomarkers in clinical practice?

09:45

08:30 - 10:00

Room F2

Breast

RC 1202

Multi-modality breast imaging

A-373 08:30

Chairman's introduction

M. Lesaru; Bucharest/RO (mlesaru@hotmail.com)

Multi-modality breast imaging appears as a natural result of the radiologist's implication in the multidisciplinary clinical team. The classical role in the diagnosis of breast malignancies is improved by multimodality lymph node imaging by this helping to better determine targets for biopsy in preoperative staging. The oncoplastic reconstructive techniques became another challenge for breast-imaging specialists, especially when local recurrence is suspected. For a correct follow-up of these patients, the need of "imported" information from other specialties is obvious and this should be coupled with a correct imaging protocol. In our days, the role of the radiologist expands from diagnosis to therapy using innovative image guided procedures, aspect which is also true for the breast. In this integrated RC, experts will present a clinical update of these new techniques and there will be an opportunity to discuss about how the evolution of such techniques is changing the nature of the modern multi-disciplinary team meeting.

A-374 08:35

A. Conventional, functional and interventional lymph node assessment

P.D. Britton; Cambridge/UK (peter.britton@addenbrookes.nhs.uk)

Patients with newly diagnosed breast cancer require their axillary lymph node status to be histologically established. Standard practice is to perform this surgically with sentinel lymph node biopsy (SLNB). Those patients whose nodes are free of disease require no further treatment. However patients with metastatic deposits usually undergo a second operation to remove all their remaining nodes [axillary lymph node dissection (ALND)]. If such patients can have their lymph node metastases diagnosed pre-operatively, they will be spared an (unnecessary) preliminary SLNB operation. Consequently all patients eligible for SLNB now undergo pre-operative

ultrasound of the axilla and needle biopsy of any morphologically abnormal node. This enables 40% of patients with lymph node metastases to be diagnosed pre-operatively and these patients are saved an unnecessary SLNB operation. The author will describe examination technique and the appearances of normal and abnormal lymph nodes. Biopsy criteria and the auditing of results will also be discussed. Current ultrasound and biopsy techniques are imperfect and 60% of patients with lymph node metastases are still diagnosed surgically. Reduction of this false negative rate will require both improved targeting and improved sampling of the sentinel node. The author will discuss how this might best be achieved by breast radiologists in the future.

Learning Objectives:

1. To learn about normal lymph node morphology.
2. To understand criteria suggestive of morphological abnormality.
3. To become familiar with factors affecting overall sensitivity of pre-operative lymph node assessment.

A-375 08:58

B. Multi-modality assessment of the breast following oncoplastic surgery

M. Torres-Tabanera, S. Perez-Rodrigo; Madrid/ES
(mtorrestabanera@gmail.com)

Oncoplastic breast procedures were introduced to fill the gap between comprehensive oncologic surgical treatment of breast cancer, and the achievement of cosmetic results that fulfill patient expectations in both, body imaging and psychological wellbeing. Due to its complexity and relevance for the patient, the decision of performing these procedures must be made as part of the multidisciplinary approach of breast cancer treatment. As a consequence, the role of breast radiologists has expanded beyond the anatomic region of the breast and the usual imaging techniques. A basic knowledge of oncoplastic techniques is mandatory in order to understand the spectrum of findings from a multi-modality approach. Implants and/or autologous reconstruction techniques (based on pedicle, free or perforator flaps, as well as lipofilling techniques) are widely applied. The role of the radiologist in the multidisciplinary team is twofold: assessment during the planning stage, and imaging evaluation at follow-up. The assessment during the planning stage includes the determination of the local extent of the disease, that make it possible the choice of the appropriate surgical technique, and the imaging study of the donor site in those cases where autologous reconstruction is elected. Imaging evaluation at follow-up comprises the recognition of changes and potential pitfalls after reconstruction, the identification of short/mid/long-term reconstruction complications, and the detection of recurrent/second carcinomas. Controversial aspects will be reviewed, as the probability of recurrence after oncoplastic surgery, the need to establish multimodality follow-up protocols and the interrelations between the autologous tissues and the mastectomy bed or remaining breast.

Learning Objectives:

1. To learn about the range of oncoplastic breast procedures in current clinical practice.
2. To become familiar with imaging features resulting from oncoplastic surgery.
3. To appreciate the potential pitfalls encountered while imaging such cases.

A-376 09:21

C. Image guided therapy in breast lesions: indications and techniques

G. Manenti, G. Simonetti; Rome/IT (guggi@tiscali.it)

Breast conservation therapy has become the treatment standard for early-stage breast cancer. There is increasing demand for minimally invasive and non-surgical treatment methods for patients with small breast cancer. With the improvements in imaging techniques that have allowed the earlier detection of smaller breast cancers and the desire for improvements in cosmetic outcome, a number of minimally invasive techniques for the treatment of early-stage breast cancers are being investigated. The challenge is that these therapies can be used as a routine adjunct in the treatment of selected breast cancers. Percutaneous tumour excision, radiofrequency ablation (RFA), interstitial laser ablation, focused ultrasound ablation (FUS) and cryotherapy provide interesting alternatives to open breast surgery. These techniques may offer complete tumour ablation with less psychological morbidity, better cosmetic results and reduced inpatient care compared with traditional surgery. The challenge will lie in the ability to identify multifocal disease and in situ carcinoma as well as to ensure complete and effective eradication of the breast cancer. Additional research is needed to determine the efficacy of these techniques when they are used as the sole therapy and to determine the long-term local recurrence rates and survival. In this course, we give an overview of minimally invasive approaches for the therapeutic management of benign breast lumps and early-stage breast cancer, related to indications and techniques.

Learning Objectives:

1. To understand indications for therapeutic interventions in malignant and benign lesions.
2. To learn about current image guided therapeutic techniques in malignant and benign lesions.
3. To appreciate possible future developments of therapeutic interventions.

Panel discussion:

How is the evolution of multi-modality breast imaging changing the nature of the multi-disciplinary meeting (MDM)?

09:44

08:30 - 10:00

Room G/H

Genitourinary

RC 1207

How I report

Moderator:

G.M. Villeirs; Gent/BE

A-377 08:30

A. Female pelvis MRI

A.G. Rockall; London/UK (a.rockall@imperial.ac.uk)

In this refresher course lecture, a systematic approach for reporting MRI in the female pelvis will be presented. Reports will be tailored to the clinical details and the information required by the clinician for further patient management. Critical findings that need to be included in the report will be reviewed. Items to be included on a 'check-list' will be also presented. Examples will include cases of cervical and endometrial cancer and complex adnexal masses. Proforma reporting styles for cervical and endometrial cancer will be presented and discussed.

Learning Objectives:

1. To learn a structured reporting approach to MR imaging.
2. To learn a structured reporting approach to uterine and cervical cancer staging.
3. To learn a structured reporting approach to adnexal masses.

A-378 09:00

B. Prostate MRI

J.J. Fütterer; Nijmegen/NL (j.futterer@rad.umcn.nl)

In this presentation, a standardised reporting system for multiparametric prostate MRI examinations will be presented (PI-RADS). Furthermore, the imaging assessment of prostate cancer, with emphasis on information useful for surgical and focal treatment planning, will be discussed. Emphasis will be placed on functional MR imaging techniques in conjunction with clinical staging nomograms and tumour localisation. The major teaching points of this exhibit are knowledge of the role of multi-parametric MR imaging in the detection, localisation, and characterisation of prostate cancer. Knowledge of standardised reports will enable us to overcome current limitations in communication with the referring physicians.

Learning Objectives:

1. To learn a structured reporting approach to MR imaging.
2. To learn the most essential points and details to be reported in prostate cancer patients.
3. To understand the major weaknesses of a prostate MR report.

Author Disclosure:

J. J. Fütterer: Consultant; Galil Medical, Inivivo.

A-379 09:30

C. CT urography

N.C. Cowan; Birmingham/UK (nccowan.uro@gmail.com)

The principal reason for the existence of CT urography is for diagnosing upper urinary tract urothelial cancer (UUC), which most often presents with haematuria. Studies providing a breakdown of the prevalence of disease in patients presenting with haematuria show UUC to be a rare but important cause of disease. Examples of the typical and atypical UUC and bladder cancers will be demonstrated so the radiologist will become familiar with the spectrum of radiological signs in order to make the diagnosis. A structured method for reporting CT urography will be demonstrated using a template and examples worked through. Aspects of CT urography technique especially those influencing image acquisition and processing will be explored and technical tips relating to protocol design given to optimise reporting.

In adults, CT urography is now the preferred initial examination for patients with haematuria at high risk for UUC. A practical method for risk stratification will be discussed. For patients with haematuria, early and accurate diagnosis helps optimise prognosis but conventional investigative pathways are complicated and lengthy, utilising multiple imaging tests and many diagnostic algorithms exist without rigorous evaluation. CT urography offers a single imaging test of high-diagnostic accuracy with the potential to replace multiple alternative imaging tests in the diagnostic pathway, improve patient experience, improve diagnostic performance and accelerate diagnosis. A system for imaging haematuria involving use of CT urography, unenhanced CT of the kidneys, ureters and bladder, urinary tract ultrasound and cystoscopy will be proposed.

Learning Objectives:

1. To learn how to read and report CT urography.
2. To understand how to optimise CT urography for haematuria and urothelial cancer.
3. To report specimen cases and self-assess your own performance.

08:30 - 10:00

Room I/K

Chest

RC 1204

Lung cancer staging in 2013

A-380 08:30

Chairman's introduction: the latest TNM classification

J. Biederer; Heidelberg/DE (Juergen.Biederer@med.uni-heidelberg.de)

Based on comprehensive evaluation of clinical outcomes, the latest 7th TNM classification of lung cancer has brought significant changes compared to the former editions. For the first time, non-small cell and small cell lung cancer are covered by one system. Local tumour size (M-staging) is now categorized in 5 steps with diameters of 2, 3, 5 and 7 cm. The classification of lymph node involvement (N-staging) has been refined, now integrating findings from PET, if available. Staging of distant metastases differentiates between metastases inside the contralateral lung (M1a) and lesions inside other organs (M1b). Lung metastases on the same side of the chest are now called T3 (within the same lobe) or T4 (within other lobes). The recommended imaging technology for lung cancer staging comprises CT (T, N, M), PET (N-staging) and MRI (M-staging). The diagnostic scope of all modalities individually, in combination or as hybrid technology for T/N/M-staging will be presented and discussed against the background of the current guidelines. The role of other important methods (endobronchial ultrasound) and thoracic interventions will be addressed.

Author Disclosure:

J. Biederer: Speaker; Siemens.

A-381 08:35

A. Local tumour staging

L. Bonomo; Rome/IT (lbonomo@rm.unicatt.it)

Main changes in the 7th edition TNM classification are reflected in the T-staging. These changes are largely related to the re-classification of the size and location of the primary tumour and satellite nodules. In particular, the new staging system distinguishes five size-based categories (with cut-off points at 2, 3, 5 and 7 cm), despite the two size groups of the former classification (divided by a 3 cm cut-off point). Therefore, inside the old T1 and T2 groups, the new classification distinguishes T1a, T1b, T2a and T2b, according to a significantly different survival rate among the subgroups. For the same reason, additional ipsilateral nodules are now classified as T3 if located in the same lobe as that of the primary tumour and T4 if located in a different lobe. Multidetector computed tomography (MDCT) is the standard imaging technique for assessing the T-staging of patients with lung cancer. Due to the increased image quality compared to the conventional CT, MDCT scanners can depict with greater confidence an invasion in surrounding tissues (pleura, mediastinum and chest wall or a transfissural tumour growth) and can detect more and smaller lesions. To investigate T-staging other non-invasive imaging techniques, including FDG-PET scanning and MRI, are now available. However, they offer only a little extra benefit in the T-staging of lung cancer, owing to the limited ability of PET for precise anatomic location and size measurement and to the significant challenges of MRI in the study of the lungs, mainly due to inhomogeneity of magnetic field and cardio-respiratory motion artifacts.

Learning Objectives:

1. To learn about the T staging of lung cancer.
2. To become familiar with the current state of the different imaging technique to assess the T stage.
3. To appreciate limitations and pitfalls.

A-382 08:58

B. Lymph node staging

W.F.M. De Wever; Leuven/BE (walter.dewever@uzleuven.be)

Accurate lung cancer staging is essential. Mediastinal lymph node metastases determine patient outcome. Non-invasive radiological mediastinal staging investigations (CT, PET, PET/CT) have their limitations and yield false negative and positive results, so tissue sampling is needed. This must be done in a more invasive way (mediastinoscopy, mediastinotomy, endobronchial ultrasound-guided transbronchial needle aspiration (EBUS-TBNA), endo-oesophageal ultrasound-guided fine needle aspiration (EUS-FNA). EBUS-TBNA is a minimally invasive mediastinal staging tool. It allows the bronchoscopist to visualize airway structures and surrounding processes. The main indications for EBUS-TBNA are 1. staging the mediastinum in suspected non-small cell lung cancer, 2. diagnosis of lung cancer when there is no endoluminal tumour but mediastinal or hilar adenopathy, 3. diagnosis of unexplained mediastinal lymphadenopathy and 4. tissue banking samples for research studies. EBUS-TBNA samples the same lymph node stations as mediastinoscopy but also stations 10-11. Based on data from systematic reviews and meta-analysis, results for sensitivity, specificity and negative predictive value with EBUS-TBNA for mediastinal staging are 88-93%, 98-100% and 60-86%, respectively. At this moment, mediastinoscopy should still be done to confirm negative EBUS-TBNA results and when the pre-test clinical probability of lung cancer is high. EBUS-TBNA is well tolerated. Pneumomediastinum, pneumothorax, haemomediastinum and infectious complications can occur very rarely. A post-procedure chest radiograph is not usually needed.

Learning Objectives:

1. To learn about N staging in lung cancer.
2. To learn the current state of endobronchial ultrasound for intrathoracic intervention.
3. To become familiar with limitations and pitfalls.

A-383 09:21

C. Distant metastasis and whole body imaging

G. Antoch; Düsseldorf/DE (antoch@med.uni-duesseldorf.de)

Staging lung cancer patients includes whole-body assessment to exclude distant metastases. Detection of distant metastatic spread has an impact on patient management. Currently, a variety of different guidelines and staging algorithms are available from different countries and different societies. The most important of these guidelines will be summarized to give the audience an overview concerning current recommendations. In addition, state-of-the-art imaging with whole-body PET/CT and MRI have been available for some time. These imaging modalities offer tumour staging including T-stage, N-stage, and M-stage in a single session. Taking into account both, time and budget, "one-stop shopping" may be considered desirable when staging lung cancer patients. But do whole-body MRI and PET/CT really offer staging in a single session at comparable accuracy? This talk addresses current recommendations for staging of distant metastases in lung cancer patients and discusses the accuracies of whole-body imaging modalities in this indication.

Learning Objectives:

1. To appreciate the role of PET/CT and whole-body MRI.
2. To learn about the sensitivity and specificity.
3. To become familiar with the role of imaging in early response evaluation and in follow-up.

Author Disclosure:

G. Antoch: Speaker; Bayer Healthcare, Nordion, Siemens.

Panel discussion:

Facts and controversies in lung cancer staging

09:44

08:30 - 10:00

Room L/M

Physics in Radiology

RC 1213

Risk assessment and risk communication

A-384 08:30

Chairmen's introduction

M.M. Behani¹, P. Vock²; ¹Vienna/AT, ²Berne/CH (madan.rehani@gmail.com)

Risk free society is utopian. Every action in life entails some risk. What matters is the balance between risk and benefit. Wherever benefit to the person outweighs risks, it is easy to accept. Situations become critical when the risk is unknown, is unsubstantiated but still probable sometime in future, is well known at higher level but cannot be demonstrated at the levels at which action is taken or is disputed in the scientific community. Some of these features match with radiation risk. Besides scientific aspects of extent of risk, there are issues of perception of risk. Medical radiation risk reminds many professionals of the risks observed after the Hiroshima and Nagasaki incident. Moreover, many get deterred by an extremely small amount of radiation emitted by radioisotopes whereas thousands of times higher x-radiation in radiology practice does not cause any flutter. Rational understanding of risk, its estimation, perception and communication is needed. Current knowledge of radiation risks provides clear ground for safe practice of radiology and effective communication of risks to patients, public and referring doctors. It is the duty of the radiology, medical physics and radiological technology professional to communicate risks appropriately so as to avoid misinformation. In this session, the first two speakers will analyse the risks of imaging using ionising radiation and MRI, and the third speaker will introduce the delicate task of communication that we will then discuss in the panel.

Session Objectives:

1. To learn about risk, risk estimation, risk perception and communication.
2. To become familiar with radiation risk: past and present.
3. To appreciate why we need to inform patients and the public about the risks and how.
4. To understand what referring doctors should know about risk.

A-385 08:35

A. Radiation risks for patients and staff

E. Vaño; Madrid/ES (elivano@terra.es)

The International Commission on Radiological Protection (ICRP) made a revision of the risk factors for stochastic effects in 2007. No substantial changes in the global factors of cancer risk occurred in comparison with the previous ones from 1990. But relevant changes were proposed for some organs as breast and lung. ICRP insisted on the important differences on the higher risk factors for children compared to adults and on the caution to apply the quantity effective dose in medical exposures. For deterministic effects (tissue reactions), the most relevant changes (proposed in 2001) are the new threshold doses for radiation opacities (cataracts) in the lens of the eyes and for circulatory disease to the heart or brain. These changes, especially the one on the lens opacities, should have a relevant impact on the radiation safety aspects of professionals involved in fluoroscopy-guided interventional procedures. The ICRP released a statement in April 2011, alerting the medical community on these changes and recommending a change in the dose limit for the lens of the eye for occupationally exposed persons. The immediate consequence was a change in the International and European Basic Safety Standards to adopt this new limit. Concerning radiation induced cataracts, it appears that the rate of dose delivery does not modify the incidence. Radiation cataracts develop in a characteristic sequential and progressive fashion. The rate at which these changes develop, is strongly dose-dependent with an age-modulating component. The latent period for radiation cataracts seems to be inversely related to dose.

Learning Objectives:

1. To get the latest information on stochastic risks in radiology.
2. To understand the risks for children compared to adults.
3. To get the latest information on tissue reaction to medical procedures.
4. To learn about radiation cataract and its dose dependence.

A-386 08:58

B. Risk in MRI

R.R. Peeters; Leuven/BE (ronald.peeters@uzleuven.be)

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

Learning Objectives:

1. To learn about the risks for patients from MRI procedures.
2. To be informed about the contraindications for MRI scan.
3. To learn about risks for staff in an MRI department.

A-387 09:21

C. Communication of risk to patients and public

G. Gamhewage; Geneva/CH (gamhewage@who.int)

Communicating risk to key stakeholders is core work in both public health and clinical medicine. While most professionals understand instinctively and culturally, how risk should be communicated. But few use a systematic tool to determine the best strategy for risk communications. The first critical step in communicating risk is to clarify the change we want to see in our target audiences as a result of our communications. Step two looks in depth at the different audiences and looks at their position on the issue being communicated against the energy they will invest in either agreeing or disagreeing with the change you want to see. The third step deals with choosing a risk communications strategy for the target group. One practical model builds on Peter Sandman's framework for communicating risk. The model, which has been tested extensively and adapted by the World Health Organization, places emphasis on the perception, beliefs and emotional reaction of the target audience. Perception is influenced by many factors including controllability of the hazard, impact on children, novelty and magnitude, and cultural beliefs. The emotional response of the target audience is then analyzed against the extent of the hazard as determined by technical experts. Based on this analysis, one of four risk communications strategies can be used to communicate risk: education and surveillance; precautionary advocacy; crisis communication; or outrage management. As changes occur in the perception or the magnitude of the risk over time, and changing circumstances, the analysis is repeated and the best current strategy applied.

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 perception of parents regarding imaging for their child.
4. To learn how to select an appropriate risk communications strategy suited to parents and children.

Author Disclosure:

G. Gamhewage: Advisory Board; Sarvodaya Shramadana Samithiya, Sri Lanka. Author; authorship of any material I have produced in the last 12 years is the property of my employer. Board Member; Formerly Vice-Chair of the Co-existence Initiative based in the USA. Employee; World Health organization. Founder; Amazing Teens Project, Switzerland. Grant Recipient; through employer only. Speaker; too many to list, all within public health or community development.

Panel discussion:

How to communicate risk to patients and the public?

09:44

08:30 - 10:00

Room N/O

Interventional Radiology

RC 1209

Gynaecological and obstetrical haemorrhagic emergencies

A-388 08:30

Chairman's introduction

A.-M. Belli; London/UK (Anna.Belli@stgeorges.nhs.uk)

Interventional Radiology (IR) is increasingly being applied in the management of obstetric and gynaecological haemorrhage. National reviews of maternal deaths from post-partum haemorrhage have recognised that maternal deaths may be prevented by IR and that all obstetric units should have protocols and arrangements in place to ensure appropriate and timely referral to IR. The important role that IR's play in the management of fibroids has also highlighted how these techniques can be applied to other gynaecological conditions which may result in haemorrhage. This session will start by describing which gynaecological disorders may result in haemorrhage, and the technical aspects of treatment followed by the published evidence for embolisation. The session will then focus on obstetric haemorrhage, with an emphasis on prophylaxis and how women deemed at high risk from haemorrhage might be managed safely. The techniques used for prophylaxis of haemorrhage will be described in detail and the published data presented. The final presentation will concentrate on the technical aspects of embolisation when haemorrhage has occurred to ensure the best results by knowing the relevant anatomy and appropriate technique of embolisation. The published evidence of the results of embolisation in PPH will be presented. These presentations will be followed by a panel discussion on how IR's can reduce the radiation dose whilst simultaneously ensuring successful outcomes for their therapies, an important issue in a young and fertile group of women.

A-389 08:35

A. Etiology and treatment of gynaecological benign and malignant causes of massive bleeding

A. Keeling; Dublin/IE (aoifekeeling@hotmail.com)

Following this presentation, one should be familiar with causes of massive bleeding due to gynaecological disorders, diagnostic imaging of gynaecological bleeding, clinical indications for embolisation, technique employed for embolisation, potential procedure-related complications and management and existing literature and embolisation results. Uterine fibroids and post-partum haemorrhage are the most common causes of vaginal bleeding treated with uterine artery embolisation (UAE). However, a myriad of other benign and malignant aetiologies for massive vaginal bleeding are less commonly discussed. As vaginal bleeding can be life-threatening, it is paramount that Interventional Radiologists are familiar with its diagnosis, aetiology and the pivotal role of UAE. Traditionally, surgery, usually hysterectomy, was performed. The minimally invasive technique of transcatheter embolisation has become a viable alternative due to speed of haemostasis and its uterus preserving, thus fertility preserving nature. Technology advancement with advent of microcatheters and choice of embolic material, along with refinement of procedure skill have enabled the widespread practice of embolisation. Pelvic arterial anatomy, including possible arterial communications will be revised. Aetiology of non-obstetric massive vaginal haemorrhage, along with typical clinical presenting features are outlined. Imaging appearances of the aetiologies are presented. Selection of patients, procedure technique, pitfalls and procedure complications are discussed. Importance of clinical involvement of Interventional Radiologists in patient follow-up is emphasized. Massive gynaecological haemorrhage is life-threatening and Interventional Radiologists are well positioned to successfully treat this with transcatheter arterial embolisation. Overview of aetiology, radiological appearances, embolisation technique and literature is provided.

Learning Objectives:

1. To know more about causes of massive bleeding due to gynaecological disorders.
2. To learn about diagnostic imaging and therapeutic embolisation.
3. To review published results obtained through embolisation.

A-390 08:58

B. Can we prevent post-partum haemorrhage in high-risk patients?

J.-P. Pelage; Caen/FR (pelage-jp@chu-caen.fr)

Post-partum hemorrhage remains a major cause of maternal mortality and morbidity worldwide. Prevention of post-partum haemorrhage should be promoted to reduce the incidence and the severity of this complication. Identification of high-risk patient such as women with abnormal placentation is necessary. Placenta accreta is mainly related to the increased use of cesarean section. This condition is often diagnosed after failed attempts to manually remove the placenta. However, placenta accreta can be suspected before delivery with the use of ultrasound and Doppler. Confirmation of the diagnosis should be obtained with pelvic MRI. Placenta percreta is defined as the trophoblastic invasion of the whole myometrium and serosa of the uterus. This invasion may also involve adjacent structures such as the bladder or the digestive tract. Placenta percreta carries a high risk of complications and its management may ultimately require hysterectomy and partial resection of adjacent organs. Placental abnormalities present a formidable clinical challenge and interventional radiologists play a major role. Among the various options, two types of procedures have been popularized in tertiary care centers. Placenta accrete should be left in place and prophylactic embolisation of the uterine arteries can be performed. In patients with placenta percreta, prophylactic placement of angiography balloons or compliant occlusion balloons in the common or internal iliac arteries can be discussed. These balloons should be inflated at the time of delivery only in case of haemorrhage. Additional embolisation of the uterine arteries may be needed. Some authors recommend non-resorbable microspheres instead of gelatin sponge to obtain better devascularization.

Learning Objectives:

1. To learn how to identify a high-risk patient.
2. To become familiar with preventive measures and medication.
3. To know more about techniques for invasive prevention.
4. To learn about the results obtained through preventive techniques.

Author Disclosure:

J.-P. Pelage: Advisory Board; Keocyt. Consultant; Cook, Terumo, Merit Medical. Research/Grant Support; Cook, Terumo, Merit Medical.

A-391 09:21

C. Treatment of post-partum haemorrhage

M. Szczepko-Trojanowska; Lublin/PL (ewamak@MRI.am.lublin.pl)

Post-partum haemorrhage (PPH) is a life-threatening complication of approximately 1% of deliveries. Is defined as blood loss of more than 500 ml during a vaginal delivery, more than 1000 ml with a caesarean delivery or a reduction of haematocrit level by at least 10% between admission and the post-partum period. Bleeding which appears during the first 24 h following delivery is recognised as a primary PPH. Delayed or secondary bleeding may occur after the first 24 h up until the sixth week following delivery. Active bleeding can be detected most frequently from vaginal, pudendal or uterine arteries with an approximate flow rate of 0.5-1 ml/min. Uterine atony or diminished myometrial contractility account for 80% of PPHs. Embolisation of the pelvic arteries represents an attractive alternative procedure for management

of post-partum bleeding. In unstable patients with massive bleeding embolisation can be performed from the anterior division of the internal iliac artery. Selectivity of catheterisation and subsequent embolisation depends on the haemodynamical and clinical status of the patient. Several embolic materials can be used: pledgets of absorbable gelatin sponge, microspheres, fibred steel coils or fibred platinum microcoils. Success rates for embolisation have been reported to exceed 90%. Secondary embolisation is required in 9-14% of cases and is usually satisfactory. Complications of are rare and do not exceed 6-7% of cases. The most common are pelvic infections and non-target embolisations. The postembolisation syndrome, including pain and fever, typically resolves in 2-3 days. Return of normal menses is observed 3-4 months after embolisation.

Learning Objectives:

1. To learn about clinical evaluation of post-partum haemorrhage.
2. To become familiar with relevant anatomy.
3. To understand catheterisation and embolisation techniques.
4. To become familiar with results of embolisation

Panel discussion:

How to reduce the radiation doses of these methods?

09:44

08:30 - 10:00

Room P

Radiographers

RC 1214

Dose optimisation in computed tomography

Moderators:

G. Frija; Paris/FR

D. Pekarovic; Ljubljana/SI

A-392 08:30

A. Innovations in dose optimisation

S. Foley; Dublin/IE (shane.foley@ucd.ie)

Computed Tomography (CT) use has grown dramatically in recent years especially with the advent of multidetector technologies. Although providing non-invasive high-quality cross-sectional images of the body, concerns exist given the relatively large radiation doses involved and the rising number of referrals. In keeping with the ALARA principle, efforts continue apace to optimise radiation doses throughout radiology but within CT in particular, to minimise risks to both patients and populations, while maximising the diagnostic yield. This refresher course considers CT dose optimisation techniques and especially recent innovations within the modality. First, it looks at the knowledge base pertaining to radiation dose within CT, the influencing factors, and how these are routinely combined within clinical practice. Recent developments in scanner design and software have greatly assisted CT users in optimising radiation doses and allowed the consistent individualisation of doses. The principles of these technologies, such as automatic exposure control, cardiac gating and innovative reconstruction algorithms will be introduced and discussed. A variety of non-scanner based approaches to optimisation will also be examined, such as the use of superficial shielding, heart rate control medication and patient positioning as well as some useful tips from the literature that can help users optimise doses within their own CT departments. Finally, as numerous CT manufacturers aim to provide routine sub-millisievert scanning, possibilities for future optimisation methods will be presented

Learning Objectives:

1. To consolidate knowledge in the area.
2. To become familiar with recent developments based on scanner design features and to be aware of the evidence base that supports these developments.
3. To become familiar with recent developments based on non-scanner based approaches such as shielding and to be aware of the evidence base that supports these approaches.
4. To learn more about the potential for future developments in the area.

A-393 09:15

B. Developing patient specific examination protocols

H. Precht; Odense/DK (hepr@ucl.dk)

The CT technology has developed rapidly during the last years and facilitates multiple technical settings, such as dose, collimation, pitch and more advanced possibilities as Iterative Reconstructions, Dual Energy and contrast protocol. All these technical opportunities can be used to optimise the CT examination focusing on image quality and/or dose. Optimization strategies addressing patient groups and/or anatomic protocols to start optimising image quality involves consideration of patient's age, radiation sensitive area, suspected pathology or volume of a given anatomy according to ICRP. On this basis, the level of information about the patient and purpose of the examination is essential. Hereby requested image quality will differ regarding the specific patient and case. Image quality involves both objective and subjective parameters and will always be based on individual preferences. To optimise image quality, close cooperation between radiologists, radiographers with technical capabilities and physicists is required. This interaction can serve as leverage for the possibility to make the CT examination present the expected pathology more precise at the lowest possible radiation dose and use the full potential of the CT scanner. Sample clinical cases representing optimization focusing on the individual patient will be presented to support reflection on radiation dose and image quality. An ongoing research project implementing technical optimization in Cardiac CT aiming on the newly developed technical factors including a subproject of post-mortem cardiac CT compared to histopathology will be presented as an example to how these techniques could have a future applicability in the Medical Imaging departments.

Learning Objectives:

1. To understand the importance of employing patient specific examination protocols in computed tomography by exploring the benefits of such protocols.

2. To understand the categories of patients for which specifically tailored protocols must always be employed.
3. To appreciate the potential impact of patient specific protocols on image quality and patient dose through the use of sample cases.
4. To discover a simple framework which could assist radiographers in introducing patient specific examination protocols to their departments.

08:30 - 10:00

Room Q

Paediatric

RC 1212

Oncologic imaging: how to image, follow-up and report

A-394 08:30

Chairman's introduction

D. Roebuck; London/UK (derek.roebuck@gosh.nhs.uk)

Cancer is a major cause of death and disability in children. Radiologists have an important part to play in the paediatric oncology multidisciplinary team. Our potential roles include screening (in children at high risk of developing a tumour), initial diagnosis and staging, biopsy, treatment, supportive care (for example central venous and/or enteric access procedures), detection and characterisation of complications of treatment, surveillance for recurrence and palliative care. Despite the relative rarity of each type of paediatric cancer, radiologists have tried hard to develop imaging protocols, working in collaboration with colleagues in oncology. The approach is more standardised in some tumour types than others. This session will help the practicing paediatric radiologist develop methods for reporting imaging studies in children with tumours of the liver, adrenals, kidneys, and central nervous system.

A-395 08:35

A. Renal and adrenal tumours in children

A.M.J.B. Smets; Amsterdam/NL (a.m.smets@amc.uva.nl)

Primitive malignant renal tumours comprise 6% of all childhood cancers. Wilms' tumour (WT) is the most frequent type accounting for more than 90%. Imaging alone cannot differentiate between these tumours with certainty but it plays an important role in screening, diagnostic workup, assessment of therapy response, preoperative evaluation and follow-up. The outcome of WT after therapy is excellent with an overall survival around 90%. This allows for a risk-based stratification maintaining excellent outcome in children with low-risk tumours while improving quality of life and decreasing toxicity and costs. The imaging issues for WT from the European perspective will be discussed as well as the characteristics of other paediatric malignant renal tumours. Primary adrenal neoplasms can be categorized according to their origin. Adrenocortical neoplasms are rare in children. A size greater than 5-10 cm suggests malignancy as well as signs of local invasion or distant metastasis. The most frequent malignant medullary tumour is neuroblastoma. It accounts for 7-10% of all childhood cancers and has a survival rate between 5 and 80% depending on age at diagnosis, tumour spread, genetic markers, etc. It is related to borderline malignant ganglioneuroblastoma and benign ganglioneuroma. Imaging cannot distinguish between these tumours but it is essential in the diagnostic workup and during follow-up. Currently, 2 systems are used to stage neuroblastoma: The International Staging System (INSS) is based on surgery; the International Neuroblastoma Risk Group (INRG) has developed image-defined risk factors (IDRF) used for staging. Both staging systems will be discussed.

Learning Objectives:

1. To appreciate the role of US, CT, MRI and scintigraphy.
2. To become familiar with the imaging findings and the main differential diagnoses.
3. To learn about the imaging strategies for diagnosis and staging.

A-396 08:58

B. Paediatric liver malignancies

D. Roebuck; London/UK (derek.roebuck@gosh.nhs.uk)

The main aims of imaging are confirmation of the hepatic origin of the tumour, diagnosis and staging. Differential diagnosis is facilitated by combining imaging findings with clinical parameters, such as serum alpha-fetoprotein (AFP). Children with malignant liver tumours often require three modalities (US, chest CT and MRI) for optimal imaging. Vascular tumours of infancy (congenital and infantile haemangiomas) and mesenchymal hamartoma should be diagnosed on imaging

grounds if possible, and biopsy is rarely required. The major malignant primary tumours are hepatoblastoma, hepatocellular carcinoma, rhabdoid tumour, undifferentiated (embryonal) carcinoma, and hepatocellular carcinoma variants (transitional liver cell tumour and fibrolamellar carcinoma). Malignant vascular tumours (epithelioid haemangioendothelioma and angiosarcoma) are rare. The distinction between multifocal primary liver tumours and metastases from an extrahepatic primary tumour (or multifocal infantile haemangioma) can almost always be made on a combination of imaging and clinical features. There are two major staging systems in current use. The Children's Oncology Group (COG) use a surgical staging system, in which the main role of radiology is the detection of extrahepatic spread and preoperative surgical planning. The other major trials group, SIOPEL, uses the PRETEXT system, in which the role of imaging is much more important because surgery is delayed and chemotherapy is stratified according to clinical and radiological risk factors. Because COG now also collect PRETEXT data, there is an intercontinental consensus that the ideal radiology report should include a description of each of its parameters.

Learning Objectives:

1. To understand the role of US, CT and MRI.
2. To become familiar with the imaging findings and the main differential diagnoses.
3. To learn the imaging strategies for diagnosis and in staging.

A-397 09:21

C. Oncologic imaging in the paediatric brain

G. Hahn; Dresden/DE (gabriele.hahn@uniklinikum-dresden.de)

Brain tumours of children account for 15% to 20% of all primary brain tumours. Posterior fossa tumours and supratentorial tumours occur in nearly equal frequency. However, supratentorial tumours are more common in the first two to three years of life, whereas infratentorial tumours predominate from ages 4 to 10. The symptoms of children with brain tumours depend upon the age at the time of presentation and the location. MR is today the study of choice for diagnosis of intracranial neoplasms because the multiplanar imaging capability is extremely useful in determining the exact extent of the tumour and its relationship to surrounding normal structures. For MR evaluation, the standard sequences are T2-, T1-, FLAIR-sequences in axial, sagittal and coronal planes. Neuronavigation sequences are important for planning tumour surgery. The most common posterior fossa tumours of childhood are medulloblastomas, astrocytomas and ependymomas. Brainstem tumours should be separated into four separate major categories with different diagnostic pathway, prognosis and therapy. Supratentorial tumours involve the parenchyma of the brain or grow intra- or suprasellar, intraventricular and in the pineal region. Tumours arising from the calvarium are rare in childhood.

Learning Objectives:

1. To understand the role of CT, MRI and MRS.
2. To become familiar with the imaging findings and the main differential diagnoses.
3. To learn about the imaging findings of post-chemo/radiation therapy conditions and complications.

Panel discussion:

How far should the radiologist go in suggesting tumour recurrence or post-treatment complications?

09:44

08:30 - 10:00

Room Z

Professional Challenges Session

PC 12

Legal matters related to multimodality techniques

A-398 08:30

Chairman's introduction

K. Åhlström Riklund; Umea/SE

Multimodality imaging is rapid increasing and with this combined imaging radiology and nuclear medicine meet in a new way. The hybrid techniques give new combined information of both structural and molecular or biochemical type of the patient. The two principally different types of information should not compete but complement each other. It is however a challenge to use the combined information in the best way and not least the legal issues of for instance training and allowance are sensitive issues needing to be discussed. There are several ways to take care of hybrid imaging. PET/CT and SPECT/CT are so far the most common used hybrid imaging techniques but also PET/MR is recently introduced. In the beginning the CT was used only for attenuation correction and some anatomical guidance. Today's PET/CT-scanners are equipped with high performance CT and the challenge to use them in a proper diagnostic way has to be solved. There are educational issues both for radiology and nuclear medicine. The development of hybrid imaging influences guidelines and a restricted update will be presented. The radiation safety is also an issue and the different modalities engaged in hybrid imaging have different demands for buildings, personnel and patients. All these demands have to be taken into consideration and educational activities have to be done. A wide range of legal issues are involved in imaging and some of them are different for CT and PET. This symposium will give an introduction to the situation but the discussion must continue.

Session Objectives:

1. To learn about legal matters in multimodality imaging in different parts of Europe, in radiology and nuclear medicine.
2. To understand the challenges in hybrid imaging, with respect to both radiology and nuclear medicine.
3. To consolidate knowledge of the situation in different parts of Europe.

Author Disclosure:

K. Åhlström Riklund: Research/Grant Support; Research contract at my department, for 3T from General Electric and Philips and for PET/CT from General Electric. Speaker; invited speaker at single educational occasions for General Electric (no fees).

A-399 08:35

Radiological legal matters in eastern Europe

M. Studniarek; Gdansk/PL

Comparison of organisation in departments equipped with hybrid imaging units were performed on the basis of questionnaires sent to National Societies of 15 countries. Installation of PET/CT, PET/MRI and SPECT/CT in the departments of nuclear medicine provides the possibility to produce, prepare and inject adequate activities of any radiopharmaceuticals. We did not find any such installation outside the Nuclear Medicine Unit. 4-5-year specialisations of radiology and nuclear medicine are separated and independent in majority of national education systems. NM specialisation provides more clinical settings and frequently only few months (3-6) in radiology unit. Organisation of reporting system is different, but the main rule is acceptance of National Health Organisation and Funds. There are some conditions of insurance companies for payment: at PET/CT scanner there have to be employed both NM specialist and radiologist. Responsibility for the report is also shared. But if CT part is only for attenuation correction the report is frequently prepared by NM specialist alone. Specialist fully reporting (with diagnostic CT and MRI) in most of countries needs supplementary education, but usually a nuclear medicine specialist needs longer training in radiology. Anywhere symmetric conditions exist, basing on personal experience (more than 600 PET/CT procedures elaborated under supervision). In PET/MRI diagnostic potential of MRI needs better experience. In this new modality neither experience based solutions nor separated procedures are elaborated yet. Guidelines for hybrid procedures are prepared by

national societies including indications of European societies, except of SPECT/CT procedure. In Poland only SPECT is paid.

Learning Objectives:

1. To learn about legal matters in multimodality imaging in eastern Europe.
2. To understand the specific role and diagnostic applications of PET/CT imaging as a result of national guidelines in eastern Europe, with the example of Poland.
3. To consolidate knowledge of the limits of the application of diagnostic CT in PET/CT units in radiology and nuclear medicine procedures listed (officially identified) in Poland.

A-400 08:53

Legal matters in nuclear medicine

G.K. von Schulthess; Zurich/CH (gustav.vonschulthess@usz.ch)

Multimodality imaging using PET faces two main obstacles in Switzerland. First, a combined tariff had to be devised after the government no longer accepted billing as PET and CT separately. After long negotiations a new flat tariff has been accepted which is subdivided into technical, NM and radiological reading fees and cost for PET-tracers. It is assumed that eventually a similar tariff can be used for PET/MR and for SPECT/CT. One additional optional tariff applies for either CM-CT, dual isotope or dual time point imaging with PET, and is billable only once. Second, the major legal issues arises from the introduction of new tracers. FDG is largely reimbursed for oncological procedures, but not for other indications, nor are other tracers reimbursed. Swissmedic approval (Swiss FDA approval) exists for FDG, Fluoride and F-Choline, but the latter two are not reimbursed as the government thinks that there is not enough evidence for the cost-effectiveness of their use. Currently the largest nuisance concerns tracers such as F-ethyltyrosine, Ga-Dotate and F-DOPA, as similar very costly procedures with inferior PET- or SPECT tracers (e. g. FDG in brain tumors) are fully reimbursed. This results in the dilemma for the physician to either apply an inferior method and get reimbursed or an excellent method without reimbursement.

Learning Objectives:

1. To understand issues facing tracer development and clinical use of tracers.
2. To understand the process of getting new tracers approved for clinical use.
3. To understand the process of getting reimbursement for integrated imaging procedures.

Author Disclosure:

G. K. von Schulthess: Consultant; Icon Medical Imaging plc. Equipment Support Recipient; GE. Grant Recipient; GE, Bayer. Research/Grant Support; GE. Speaker; GE.

A-401 09:11

Legal matters in Scandinavia

K. Åhlström Riklund; Umea/SE

Recently, the medical specialties in Sweden have undergone comprehensive changes. Radiology was the base for all radiology specialties, with a possibility to obtain additional specialty license in pediatric radiology, or neuroradiology. In 2006, a new specialty was introduced. All three radiology specialties together with basic training in nuclear medicine and clinical physiology were merged into a common specialty. After achieving this specialty in imaging it was possible to proceed with modular training in clinical physiology, neuroradiology or nuclear medicine to qualify for additional licenses. Recently, a new national review of the specialties decided to revert to the old system where the training in radiology and clinical physiology are separated and with a possibility to add on training to achieve additional licenses in neuroradiology or nuclear medicine. It is not possible to get a license only in nuclear medicine. The updating of national guidelines is an ongoing work and increasing recommendation of PET/CT in several diagnoses can be seen. A few examples will be presented. To operate a cyclotron and PET/CT facility requires several permits from national authorities. For the cyclotron a permit from the Radiation and Nuclear Safety authority is demanded. To produce PET tracers permits from the National Medical Products Agency is needed. All tracers have to be produced in accordance with good manufacturing practice and a marketing approval is required for each tracer. For FDG, which is marketed in Sweden a manufacturing authorization is also required. The process to receive these permits is time consuming.

Learning Objectives:

1. To learn about the educational situation in multimodality imaging in northern Europe.
2. To learn about national guidelines for multimodality imaging in northern Europe.
3. To learn what you need to run a PET/CT and cyclotron facility in northern Europe.

Author Disclosure:

K. Åhlström Riklund: Research/Grant Support; Research contract at my department, for 3T from General Electric and Philips and for PET/CT from General Electric. Speaker; invited speaker at single educational occasions for General Electric (no fees).

A-402 09:29

International, regional, national and local framework requirements

A. Perkins; Nottingham/UK

The installation of clinical PET-CT, SPECT-CT and PET-MR scanners has placed additional demands on organisations and staff with respect to safety and training. Adequate training of the clinical and radiographer/technologist (practitioner) workforce in dual modalities is still not in place in many countries. Throughout the world medical exposures continue to constitute the major source of radiation exposure to the population, hence it is essential to minimize such activity whilst ensuring appropriate medical benefit. Radiological protection frameworks originate from the ICRP, however the final requirements at national and local level vary depending on the different regulatory systems in place. Even with regulatory structures in place, there is much scope for improvement at local level. In the US the "Image Gently" campaign was an example of medical communities striving to reduce radiation doses, especially in paediatric patients. In order to ensure requirements it is essential to have appropriate scientific support. In the EU the European Directive 97/43/Euratom (1997) on the health protection of individuals against the dangers of medical exposures, introduced the term "Medical Physics Expert". Directive 97/43 defines the Medical Physics Expert as an expert in radiation physics or radiation technology applied to exposure, whose training and competence is recognised by the competent authorities. These individuals are required to have expertise in all modalities relating to the safety of patients, staff and the general public. The object of this presentation is: to provide information about the origin of the radiation protection framework; to describe the framework for radiation protection at international, regional and national levels; to explain the responsibilities of different parties and staff groups within the working environment. Examples of suitable educational and professional resources will be provided.

Learning Objectives:

1. To learn about the origin of the radiation protection framework.
2. To appreciate the framework for radiation protection at international, regional and national levels.
3. To understand the responsibilities of different parties within the working environment.

Author Disclosure:

A. Perkins: Author; Multiple. Board Member; Gamma Technologies Ltd. UK. CEO; Gamma Technologies Ltd. UK. Consultant; Quotient Bioresch, UK. Employee; University of Nottingham. Founder; Gamma Technologies, UK. Grant Recipient; Multiple. Investigator; Multiple. Research/Grant Support; Multiple. Speaker; Multiple.

Panel discussion:

A discussion with questions from the audience about the differences across Europe

09:47

10:30 - 12:00

Room B

ESR meets Chile

EM 4

Topics of ongoing radiological research from the Andes

Welcome by the ESR President:

G.P. Krestin; Rotterdam/NL

Presiding:

J.I. Bilbao; Pamplona/ES

M.A. Pinochet; Santiago/CL

A-403 10:30

Introduction: Radiology in Chile: reality and challenges

P. Soffia, M.A. Pinochet; Santiago/CL (psoffia@alemana.cl)

Chile is a long and narrow strip of land between the Andes and the Pacific Ocean. Due to its length, it has a wide variety of climates, from the driest desert in the world, located in the northern part of the country, to the ice-covered Patagonia in the south.

Approximately 17 million people live in Chile, mainly distributed in the central region where a Mediterranean climate predominates. From a total of 25,000 physicians, only 600 are radiologists. Radiology was one of the first medical specialties in the history of Chilean medicine. In 1896, only 3 months after Roentgen's discovery of x-rays, Professors Zegers and Salazar took the first radiograph in Latin America, at the University of Chile. The Chilean Society of Radiology was founded in 1941 and has approximately 400 members. Eight radiology residency programs are offered to medical graduates, 6 of them in Santiago, the main city. Chile has a mixed health system, 75% of the population belong to the public system and 25 % to the private system. Most public hospitals have Radiology Departments with CR, state of the art US and multi-slice CT. Only 6 public hospitals have 1.5 T MR systems, in contrast, more than 70 MR scanners are available in private centers. About half of the main public hospitals have RIS-PACS systems, and several teleradiology services have been established. The main challenges faced by Chilean radiology are related to the shortage of radiologists, implementation of teleradiology systems and turf battles.

Session Objectives:

1. To learn about some interesting recent and ongoing Chilean radiological research projects in the field of diagnostic imaging.
2. To get a glimpse of unique radiological and non-radiological topics in Chile.

A-404 10:35

TI-RADS: a US classification of thyroid nodules related to cancer risk

E. Horvath; Santiago/CL (eleonora.horvath@gmail.com)

There is a high prevalence of thyroid nodules on ultrasonographic (US) examinations. However, most of them are benign and may be subjected to excess FNAB. We propose a new, useful classification called TIRADS that is based on the concepts of the Breast Imaging Reporting and Data System of the American College of Radiology. Our TIRADS classification is based upon ten characteristic US patterns that allow us to approach the likelihood of malignancy regardless of nodule size. This classification was developed based on a prospective series of 1097 nodules studied by FNAB, allowing us to classify these patterns into one of five categories: TIRADS 1 = normal thyroid; TIRADS 2 = benign findings (0% malignancy); TIRADS 3 = probably benign findings (< 5% malignancy probability); TIRADS 4 = suspicious findings (5 to 80% malignancy probability) and TIRADS 5 = highly suspicious findings (> 80% probability of malignancy). In a similar fashion to the BIRADS system, TIRADS 4 or 5 nodules require a diagnostic procedure such as FNAB, while those classified as TIRADS 2 or 3 are subject to follow-up. TIRADS classification is a powerful tool to classify thyroid nodules regarding their likelihood of malignancy, allowing to correctly select those that require puncture given their suspicious US pattern, and sort out those low-risk nodules to be followed-up. This reduces patient-related stress, and provides a better administration of resources involved. It also provides a standardized report, allowing a fluid communication with clinicians.

Learning Objectives:

1. To learn about an ultrasonographic-based pattern classification that enables a cancer risk approach to an accurate selection of thyroid nodules that require fine needle aspiration biopsy (FNAB).
2. To understand the description of the 10 US pattern for thyroid nodule classification.
3. To correctly classify the pattern into the TIRADS categories.
4. To learn how to determine those patterns most closely related with malignancy.

A-405 10:55

Interlude: Chile, land of geographical and cultural contrasts

G. Soto Giordani; Santiago/CL (gloria.soto@gmail.com)

Chile is one of the slimmest countries in the world, 4,265 km long and just 356 km wide at its widest point. It has the driest desert in the world along with enormous glaciers, fjords, beaches, lakes, forests, volcanoes, as well as spouting geysers. Imposing natural barriers mark the nation's boundaries, isolating the country from the rest of South America. The Atacama Desert separates the country from Peru, the Andes Mountains create a frontier with Bolivia and Argentina, and the chilly waters of the Drake Sea point to Chile's proximity with Antarctica in the south. The immensity of the Pacific Ocean to the west completes the country's geographic isolation. The diversity of climate along its length and the differences in ethnic background result in a variety of cultural expressions, each with its own traditions of music, dance, and mythological tales. In the north, Aymara Indians have been able to preserve many aspects of their Andean culture. Central Chile, a fertile land well known for its fine vineyards, has strong European influence. In the south, the Mapuche Indians are a cultural group who strongly contributed to the formation of Chilean culture. On the other hand, 3680 km off the coast of Chile, the remote Easter Island is inhabited by native islanders who keep alive many of their Polynesian

cultural traditions. Chile is a magic land with contrasting cultural manifestations and geographical landmarks, a unique country to live, visit and enjoy.

A-406 11:00

Neuroimaging in epilepsy: in search of invisible lesions

M. Galvez; Santiago/CL (mgalvezm@gmail.com)

Evaluation of patients with refractory epilepsy includes review of clinical manifestations, electroencephalography and brain MRI findings. Brain images attempt to localize and characterise the epileptogenic lesion that can correspond to cortical dysplasia, mesial temporal sclerosis, brain tumour or vascular lesion. Nevertheless, it is possible to identify a structural lesion in patients with focal epilepsy in only approximately 85% of the cases, even when utilising imaging protocols optimised for epilepsy. The group of patients with refractory partial seizures and a normal conventional MRI has a worse post-operative prognosis. This is the reason why it is necessary to have alternative imaging techniques to better visualize these brain lesions. Brain segmentation and cortical dysplasia: Cerebral cortex and white matter brain segmentation obtained from post-processing analysis of the images can determine subtle areas of alteration of the cortical - subcortical differentiation, which is a characteristic finding for cortical dysplasias. MRI brain volumetry and mesial temporal sclerosis: volumetric quantification of different brain structures has significantly improved the sensibility and specificity of the diagnosis of hippocampal atrophy. This is a useful tool specifically to identify subtle unilateral alterations and atrophy or for identifying mild bilateral hippocampal atrophy which are difficult to identify by expert visual evaluation. Functional MRI (fMRI) resting state and brain connectivity: epilepsy corresponds to electrical alterations of neuronal brain circuits that can be visible today with fMRI using resting state technique, which in initial reports shows alterations of brain connectivity in these patients.

Learning Objective:

1. To learn about solutions to improve visualisation of epileptogenic lesions not visible on conventional MRI.

A-407 11:20

Interlude: Chile, land of wine and poets

G. Soto Giordani; Santiago/CL (gloria.soto@gmail.com)

Chile is a land of poets and wine, a land where wines are a matter not just of taste but also of economic performance - it's the world's fifth largest exporter of wine - a land and where poets, like Neruda and Gabriela Mistral, are not just inspirational, but Nobel laureates. Nicanor Parra, the Chilean self-named anti-poet, introduces Chilean wine to the world by saying: "Wine is everything, it's the sea, the twenty-league boots, the magic carpet, the sun, the seven-tongued parrot". At the same time he asks, "Is there anything more noble than a bottle of wine and a good conversation between two twin souls?" Neruda's devotion to Chilean wine, considered a national treasure, is magnificently related in his poem Ode to Wine: "I like on the table, when we're speaking, the light of a bottle of intelligent wine. Drink it, and remember in every drop of gold, in every topaz glass, in every purple ladle, that autumn labored to fill the vessel with wine; and in the ritual of his office, let the simple man remember to think of the soil and of his duty, to propagate the canticle of the wine". Poetry and wine are part of Chilean identity, they form part of the profound soul of the country.

A-408 11:25

MDCT patterns in mesenteric ischaemia: usefulness in predicting clinical outcome

A. Huete; Santiago/CL (hueteahg@hotmail.com)

Mesenteric ischaemia has high morbidity and mortality. Intestinal necrosis is a major determinant of poor outcome. Patterns of bowel abnormality on MDCT predicting necrosis and patient death are evaluated in patients with superior mesenteric artery embolism (SME). Bi-phasic MDCT angiography was obtained in 31 patients with SME. Consensus evaluation by 2 readers depicted 5 patterns of abnormal bowel wall: absent enhancement on both phases (wAV), absent enhancement only on arterial phase (wA), "target" appearance (wT), homogeneous thickening (wH) and hyper-enhancement (wE). Correlation was made with surgical findings and medical charts. Intestinal resection was used as marker of bowel necrosis and mortality was based on in-hospital death. 13/31 patients had intestinal necrosis (42%). Mortality was 29% (9/31). 22 patients had an abnormal bowel wall, 13/22 with necrosis. aAV was seen in 11 patients, 10 with necrosis ($p < 0.01$). No other pattern correlated significantly with intestinal necrosis. wAV demonstrated 77% sensitivity (0.46-0.94 95%CI), 94% specificity (0.71-1.00), 91% PPV (0.57-1.00), 85% NPV (0.61-0.96), +LR 13.85 (2.01-95.19) and -LR 0.24 (0.09-0.66) as imaging marker predicting bowel necrosis. Normal bowel was seen in 9 cases, none with

intestinal necrosis (p:0.004). wAV also showed a strong correlation with mortality as 8/9 patients with wAV died (89%) and 3/14 (14%) survived the embolic event (p < 0.001). Absent mural enhancement of bowel wall in arterial and venous phase depicted on MDCT angiography correlates strongly with the presence of bowel necrosis and mortality in SME.

Learning Objectives:

1. To learn to identify the most frequent patterns of ischaemic bowel wall damage in patients with arterial mesenteric ischaemia using MDCT angiography.
2. To correlate patterns of bowel wall ischaemia on MDCT with clinical outcome.
3. To identify secondary, non-specific findings of bowel ischaemia on MDCT that signal a potential adverse clinical course.

Panel discussion:

Creating networks between Latin American and European radiology: a unique opportunity for collaborative research projects 11:45

10:30 - 12:00

Room C

Urogenital Imaging

CC 1321

The female pelvis

Moderator:

E. Sala; New York, NY/US

A-409 10:30

A. Imaging congenital anomalies of the female genital system

K. Kinkel; Chêne-Bougeries/CH (karen.kinkel-trugli@wanadoo.fr)

Diagnostic circumstances of congenital anomalies of the female reproductive system correspond to repeated pregnancy loss or dysmenorrhoea due to obstruction at the onset of menstruation during childhood. A septated or unicornuate uterus may benefit from subsequent surgery, whereas no surgical solution exist so far for bicornuate or didelphus uterus. The 3D capabilities of ultrasound allow differentiation of septated versus bicornuate uterus but remains challenging for associated uterine pathologies. To confirm uterine aplasia, the thickness and length of a uterine septa and any functionality of a remnant uterine horn unenhanced MRI is indicated. The protocol includes native sagittal T2, oblique axial and coronal T2 and T1-weighted sequences with and without fat suppression to identify associated endometriosis or ovarian poly cystic disease. Hysterosalpingography helps to verify tubal patency and communication between cavities. Associated renal tract anomalies are seen in 30% and can be classified with either ultrasound or MRI.

Learning Objectives:

1. To understand Mullerian duct anomalies through embryology and its classification.
2. To learn about the indications of MRI or 3D US according to clinical and sonographic findings.
3. To understand imaging technique and report requirements and the impact of imaging results on treatment options.

A-410 10:50

B. Benign ovarian masses

R. Forstner; Salzburg/AT (r.forstner@salk.at)

The goal of imaging adnexal masses is to identify patients with definitely benign lesions from those that require further evaluation for ovarian cancer. Sonography has been established as first-line imaging modality allowing characterisation in 80-90% of adnexal lesions. Complementary MRI is a powerful diagnostic tool and renders specific diagnosis of a spectrum of benign lesions, e.g. of dermoids, haemorrhagic cysts, endometriomas, hydrosalpinx, and of inflammatory masses. Compared to CT, it is particularly superior in assessment of haemorrhagic and solid adnexal lesions. In the latter, diffusion-weighted MRI aids in the differentiation of benign from malignant masses, e.g. of solid metastases. Challenges in imaging adnexal masses include rare benign mimicks of ovarian cancer, e.g. cystadenofibroma, rare types of dermoids and sometimes ovarian torsion. Important discriminators for management of a patient presenting with an adnexal mass include age, menopausal status, imaging findings (size, complexity of lesion, vascularization), change in follow-up, clinical information including symptoms, laboratory data and CA-125. An algorithm how to evaluate adnexal masses including incidental adnexal lesions will be provided.

Learning Objectives:

1. To become familiar with common and rare benign adnexal lesions.
2. To appreciate the added value of CT and MRI in the differential diagnosis of benign adnexal masses.
3. To learn about an algorithm for evaluating incidental adnexal masses with imaging.

A-411 11:10

C. Imaging the infertile couple

J. McHugo; Birmingham/UK

Investigating the subfertile couple: Infertility is a common problem said to affect between 9 and 20% of couples; defined as an inability to conceive following 2 years of unprotected intercourse. Modern technologies now allow the majority of couples to achieve a successful pregnancy. Imaging plays a major part in the investigation particularly of the female allowing an individualised cost effect approach to therapy in this situation. This lecture will allow the participant to understand the common causes of infertility, understand the role of imaging in the investigation of the infertile couple, be able to update their knowledge of imaging techniques in the assessment of tubal patency and integrate an imaging strategy to provide a cost effective service.

Learning Objectives:

1. To understand the incidence and causes of infertility in female and male patients.
2. To learn about cost-effective strategies for imaging in cases of female and male infertility.
3. To understand the rationale for best outcomes.

A-412 11:30

D. Interactive case discussion

E. Sala; New York, NY/US (salae@mskcc.org)

10:30 - 12:00

Room Q

RTF - Radiology Trainees Forum

TF 1

Highlighted Lectures

Moderators:

D. Bulja; Sarajevo/BA

V.H. Koen; Harleem/NL

A-413 10:30

Emergency radiology management in patients with polytrauma

U. Linsenmaier, L.L. Geyer, S. Wirth;

Munich/DE (Ulrich.Linsenmaier@kliniken-pasing-perlach.de)

Polytrauma results in patients suffering from multiple injuries and is the leading cause of death below the age of 45. Adequate handling of these complex patients and their injuries is a major challenge for any trauma hospital and deserves an interdisciplinary approach in which emergency radiology plays a key role. Even for advanced trauma centers running designated emergency radiology units, it is a challenge to integrate advanced radiology services in an interdisciplinary team treating patients with multiple injuries. Besides diagnostic imaging, the management of the patient in an interdisciplinary environment is crucial. This lecture will focus on 1st management and logistics, 2nd what must be diagnosed and what can be diagnosed with advanced state of the art radiological imaging. The lecture will comprehensively cover: the use of conventional radiography, ultrasound, MDCT; logistics and management of the patient; MDCT in the primary patient survey, the ATLS concept; advanced scanning protocols for MDCT; volume image reading V/R and handling large datasets; metastable and unstable patients undergoing CT; MDCT during or after CRP Imaging protocol for the initial workup. WBCT comprises nCCT, CMCT of thorax, neck and c-spine (arterial) and (pv) abdomen. CRs were mostly replaced, US is only used as FAST (focused abdominal sonography in trauma). WBCT can be modified by CTA (@35-45s; for e.g. extremity injuries), late CT scans (@120s; e.g. for bleeding dynamic, pseudoaneurysms) and delayed CT urography (CTU @400-500s, for pelvic and GU injuries) and also retrograde CT cystography. CT scout views and clinical findings determine the extent.

Learning Objectives:

1. To understand the complex up to date radiological management of patients with polytrauma/multiple trauma.
2. To become familiar with basic concepts, MDCT protocols and major findings in patients with polytrauma/multiple trauma.

A-414 11:00

Imaging of non-traumatic intracranial haemorrhage

Z. Merhem; Sarajevo/BA (merhem.zulejha@gmail.com)

Non-traumatic intracranial haemorrhage can be classified according to its localisation as subarachnoid haemorrhage (SAH), intracerebral haematoma (ICH), intraventricular haemorrhage (IVH), and subdural haematoma (SDH). In 80-90% of cases, the cause of non-traumatic haemorrhage is an aneurysm rupture. In young individuals, the most common cause is bleeding in vascular malformation, and in elderly patients high blood pressure or haemorrhagic transformation of a cerebral infarct will be more commonly seen. Less frequently, coagulopathy, or intratumoural bleeding will be the underlying pathology. The accurate identification and characterisation of an intracranial haemorrhage has important and immediate implications for further diagnostic workup, clinical management, and patient outcome. In emergency situation, the diagnosis of intracranial hemorrhage is usually obtained by NECT scan. CT angiography (CTA) will usually follow demonstrating aneurysm or vascular malformation. MRI has proved to be more accurate in identifying the underlying aetiology of non-traumatic haemorrhage. Selective intra-arterial subtraction angiography (DSA) will be necessary in some cases.

Learning Objectives:

1. To review different underlying pathologies of non-traumatic intracranial haemorrhage.
2. To learn how to use CT/CTA, MRI/MRA, and DSA in patients with non-traumatic intracranial haemorrhage.
3. To discuss the value of T2* (GRE/SWI) in evaluation of causes of intracranial haemorrhage.

A-415 11:30

Case-based learning in radiology

P. Pokieser; Vienna/AT (peter.pokieser@meduniwien.ac.at)

To learn directly from routine cases by observation of professional work is by far the most established and time-tested learning method. "Case-based learning (CBL)" is a widely used term of modern medical education for learning techniques including "real world settings" to facilitate collaborative, interactive and student-centred exploration of different clinical situations. Case-based learning strategies can give the opportunity to see theory in practice. In diagnostic radiology, the case materials are easy to use for case-based eLearning. This advantage has led to many institutional, national and international teaching activities, supporting case-based learning in many ways. Materials like case collections can be helpful to design CBL courses. CBL courses often include blended learning scenarios, where the direct contact of participants is enriched by collaborative online learning between meetings. This lecture will provide an overview about CBL followed by dedicated examples of successful CBL.

Learning Objectives:

1. To learn about the basics of case based learning.
2. To understand the pedagogic potentials of "real world settings".
3. To become familiar with case based ESR learning facilities.

12:15 - 12:45

Room A

Plenary Session

HL 3

Santiago Ramón y Cajal Honorary Lecture

Presiding:

J.I. Bilbao; Pamplona/ES

A-416 12:15

Research and science: from individuals to societies - the Ramón y Cajal background

L. Martí-Bonmati; Valencia/ES (marti_lui@gva.es)

Santiago Ramón y Cajal (1852-1934) was a Spanish histologist, neuroscientist, and Nobel laureate. His pioneering investigations on brain microscopic structure made him the father of modern neuroscience. He was a solitary researcher involved

in observing isolated neurons and discussing their connections. Research at this time was an individual activity. Soon, however, knowledge widened and became multidisciplinary, demanding working in groups. Research groups constituted the new minimal structure. Only groups were able to develop multidisciplinary projects with enough quality to survive. However, as in biology, the functional explanation of excellence shows that only international networks can explain a successful development. As the brain is structured in a network of connections, research is also organized today as a network of groups with a common interest, varying in time. The connectome, considered as the complete set of nerve cells and their connections, will change over time as new connections form and old ones die. This plastic networking allows groups and individuals to participate in worldwide high quality research. Similar to neural centres and connections, only research networks with a well-defined structure, formed by successful groups of qualified scholar researchers advance science. This lecture will focus on the concept of science and research, and how communication, grouping and socialisation do influence both. As young researchers are the basis of science, they should know and follow the path and rules of scholars such as Ramón y Cajal and Humboldt. Some interesting facts and controversies about science, research, advices, personalities and countries will be presented.

Learning Objectives:

1. To learn about Santiago Ramón y Cajal, a Spanish histologist, neuroscientist, and Nobel laureate.
2. To appreciate the change from individual research to multidisciplinary working groups.
3. To understand the concept of science and research, and how communication, grouping and socialisation do influence both.

12:30 - 13:30

Room P

The Beauty of Basic Knowledge: Musculoskeletal Imaging

MC 25D

Neoplastic/non-neoplastic lesions

A-417 12:30

Neoplastic/non-neoplastic lesions

F.M.H.M. Vanhoenacker; Antwerp/BE (filip.vanhoenacker@telenet.be)

Analysis of clinical features (age, location, concomitant diseases) is a prerequisite for characterisation of bone tumours. For imaging characterisation, plain films are the mainstay, as they accurately depict matrix, cortical permeation or disruption, and periosteal reaction. MRI has an additional role as most tumours have low SI on T1-WI and high SI on T2-WI. In certain cases, however, a combination of distinctive findings (SI, enhancement patterns) allows for an accurate diagnosis or narrows the differential diagnosis. Intratumoural fluid-fluid levels are often seen in ABC, but also in fibrous dysplasia, chondroblastoma, (telangiectatic) osteosarcoma, and GCT. Ring-and-arc enhancement is seen in chondroid tumours. Intraosseous lipomas, haemangioma and nontumoural lesions (Paget's disease, irradiation) are of high SI on T1-WI. GCT and dense bone islands are of low SI on T1-WI and T2-WI. Flow voids may be seen in metastasis of renal cell carcinoma. Characterisation and grading of Soft Tissue Tumours (STT) based on imaging remains even more limited and histology is usually required for a definitive diagnosis. Ultrasound is mostly nonspecific but may be used for superficially located cystic STT. On MRI, analysis of multiple parameters (shape, presence of signal voids, fluid-fluid levels, SI, intratumoural necrosis, multiplicity, pattern/degree of enhancement) yields the best results. The highest confidence is reached in benign lesions, such as lipomas, vascular lesions, benign neural tumours, periauticular cysts, hematomas, PVNS, GCTTS, and abscesses. The major role of MRI consists -however- of local tumour staging and monitoring of treatment. Whole body MRI and PET-(CT) may evaluate distant tumour spread.

Learning Objectives:

1. To understand the basic principles of diagnosing bone and soft tissue tumours.
2. To become familiar with the most important entities and their typical imaging presentations.
3. To learn about the specific advantages and weaknesses of the different imaging modalities.

12:30 - 13:30

Room Q

The Beauty of Basic Knowledge: Head and Neck

MC 24D

The suprahyoid neck: anatomy and diagnostic algorithm of the neck mass

A-418 12:30

The suprahyoid neck: anatomy and diagnostic algorithm of the neck mass
A. Trojanowska; Lublin/PL (agnieszka30@yahoo.com)

Three layers of the deep cervical fascia define the suprahyoid neck compartments, which include prevertebral, retropharyngeal, carotid, masticator, parapharyngeal and pharyngeal mucosal space. Knowledge of the structures inherent to these spaces will provide the radiologist with an accurate basis for differential diagnosis, since allocation of a tumour to a certain compartment limits the number of diagnostic possibilities. Expanding lesions usually distort or displace adjacent structures and fascia in predictable fashion, which is crucial in defining the site of origin. Both MRI and CT are frequently used in the imaging of suprahyoid neck lesions. The introduction of functional imaging has also given some benefits. Primary and secondary, benign and malignant processes occupying major suprahyoid neck spaces will be discussed, with regard to crucial findings necessary for appropriate treatment selection and treatment planning. Since correct diagnosis requires close collaboration with ENT surgeons, clinical findings will also be discussed, together with practical information needed for surgery.

Learning Objectives:

1. To become familiar with the compartmental anatomy of the suprahyoid neck.
2. To understand the central role of the parapharyngeal space in the localisation of suprahyoid neck masses.
3. To be able to localise and provide a useful differential diagnosis of a SHN mass.
4. To learn the best imaging approach to the suprahyoid neck.

14:00 - 15:30

Room A

Interactive Teaching Session

E³ 1420

Common and uncommon errors in plain film and CT imaging of the chest: how to improve your performance

A-419 14:00

Common and uncommon errors in plain film and CT imaging of the chest: how to improve your performance

D. Tack¹, N. Howarth²; ¹Baudour/BE, ²Chêne-Bougeries/CH (denis.tack@skynet.be)

Missed lung lesions are one of the most frequent causes of malpractice issues. Chest radiography plays an important role in the detection and management of patients with lung cancer, chronic airways disease, pneumonia and interstitial lung disease. Among all diagnostic tests, chest radiography is essential for confirming or excluding the diagnosis of most chest diseases. However, numerous lesions of a wide variety of disease processes affecting the thorax may be missed on a chest radiograph. The chest radiograph will also help narrow a differential diagnosis, help to direct additional diagnostic measures, and serve during follow-up. The diagnostic usefulness of the radiograph will be maximized by the integration of the radiological findings with the clinical features of the individual patient. CT has a tremendous spatial resolution that helps detecting lesions in the chest, and has proven to be more sensitive and specific than chest radiographs. However, missing lesions or misinterpreting lesions in CT of the chest is not uncommon. In this session, we will provide interactive cases of chest examinations (radiographs and CT) in which lesions have been missed and/or misinterpreted, with a special focus on how correlation with MDCT of missed lung lesions can help improve interpretation of the plain chest radiographs.

Learning Objectives:

1. To learn about the common reasons for errors in interpretation of plain film and CT imaging.
2. To understand how a side-by-side comparison of chest x-rays and MDCT of missed lesions can help reduce the busy radiologist's error rate.

3. To improve the skills required for accurate interpretation of plain film and CT imaging of the chest.

14:00 - 15:30

Room B

New Horizons Session

NH 14

Imaging of the mind

A-420 14:00

Chairman's introduction: New insights into the state of consciousness through neuroimaging

S. Sunaert; Leuven/BE (Stefan.Sunaert@uz.kuleuven.ac.be)

The past 15 years have seen a major change in the scientific understanding of comas, with the main advances being made using EEG, positron emission tomography and MRI. Experts are now able to prove that some patients who seem comatose are in fact conscious, but their ability to communicate with the outside world has been damaged, for instance following a traumatic or anoxic event. This session addresses how locked-in syndrome patients are able to communicate through MRI, showing that they still feel, hear and understand what is going on around them, a development which could dramatically improve their fate.

Session Objectives:

1. To become familiar with recent advances in functional brain imaging, and how these lead to 'the imaging of consciousness' and 'reading the mind'.
2. To understand how imaging contributes to the study of the functional connectivity and network topology of the human brain.
3. To understand how these new techniques and insight lead to (pre-) clinical applications.

A-421 14:05

Brain wiring: resting state fMRI

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

Functional MRI employs the contrast between oxygenated and deoxygenated blood to create the so-called "BOLD" contrast using T2*-sensitive sequences like EPI. Classically, functional MRI is used to determine the effect of task using a variety of motor and cognitive paradigms, for example, to map hand and language function in preoperative work-up. However, in the absence of an overt task, continuous low-frequency oscillations in the BOLD signal occur, very much like in EEG. These resting-state fMRI changes show temporo-spatial coherence and can be analysed using a variety of methods, including seed-based correlation analysis and independent component analysis (ICA) or graph analysis. Resting-state fMRI studies in normal subjects consistently show around 10 networks, including the so-called default-mode network (DMN), but also primary visual and auditory networks, and more complex salience, working memory and executive networks. These major networks are extremely consistent across subjects and can be determined from fMRI runs as short as 5-10 min while lying still in the scanner. In a variety of diseases, alterations in resting-state networks have been reported, often leading to lower DMN activity (e.g. in Alzheimer's disease, coma and advanced multiple sclerosis), but increased activity can also be found early in the disease course. Graph analysis techniques are developing quickly and reveal complex alterations in hierarchical connectivity across the brain, with for example rewiring from posterior to a more anterior dominance in Alzheimer's disease.

Learning Objectives:

1. To understand the basics of resting-state fMRI.
2. To become familiar with the organisation of intrinsic connections as detected with resting state fMRI in the human brain.
3. To consolidate the current knowledge of brain networks in aging and dementia, and pharmacology research.

A-422 14:28

fMRI in disorders of consciousness: diagnostic and legal challenges

C. Di Perri; S. Laureys; Liège/BE (caroldiperr@hotmail.com)

When patients in "vegetative state" (recently coined unresponsive wakefulness syndrome) show minimal signs of consciousness but are unable to reliably communicate the term minimally conscious state (MCS) is used. MCS was recently subcategorized in MCS+ (i.e., presence of command following) and MCS- (i.e., presence of non-reflex movements). Patients who show non-behavioral evidence of consciousness or communication only measurable via ancillary testing (e.g., functional MRI,) can be considered to be in a functional locked-in syndrome. Taken

together, our studies show that awareness is an emergent property of the collective behavior of frontoparietal top-down connectivity. Within this network, external (sensory) awareness depends on lateral prefrontal/parietal cortices while internal (self) awareness correlates with precuneal/mesofrontal midline activity. Of clinical importance, this permits to improve the diagnosis, which remains very challenging at the bedside. Current technology now also permits to show command-specific changes in fMRI signals providing motor-independent evidence of conscious thoughts and in some cases even of communication. We will conclude by discussing related ethical and legal issues and the challenge of measuring and improving quality of life in these challenging patients with disorders of consciousness.

Learning Objectives:

1. To understand the role of structural MRI, DTI and spectroscopy in severe brain injury.
2. To become familiar with the role of resting state and activation fMRI in diagnosis and prognosis after coma.
3. To understand which fMRI paradigms are "consciousness tests" in coma and related condition.

A-423 14:51

fMRI of cognitive functions: discriminating normal aging, minimal cognitive impairment and Alzheimer's disease

A. Falini; Milan/IT (falini.andrea@hsr.it)

The earliest pathologic abnormalities associated with Alzheimer's disease (AD) develop in the brain decades before the onset of the first memory symptoms. Such alterations include misfolded proteins aggregating into extracellular amyloid plaques and intracellular neurofibrillary tangles, followed by inflammatory damage, oxidation, excitotoxicity, and cell death in the central nervous system. The prospect of experimental treatment to slow or prevent disease progression has prompted an increased interest in the identification of individuals with AD early in the course of the disease. The primary end points in current trials for AD are dictated by cognitive outcomes; owing to their reduced variability compared with clinical measures surrogate biological and imaging outcomes are of great interest. Recent years have witnessed impressive advances in the use of MR imaging with varying success either to contribute to establish a diagnosis of AD and to monitor disease progression, as well as to test the efficacy of disease-modifying agents. New MR techniques such as Diffusion Tensor Imaging (DTI) and functional imaging (fMRI) are likely able to fill voids and improve our ability to discover early the pathologic process associated with dementia. Detecting such preclinical changes could imply a major role for neuroimaging in risk stratification and early disease prevention. Some of the brain changes occurring in dementia can also be seen in middle-aged and elderly individuals who are cognitively intact, and are considered part of the normal aging process. The possibility to distinguish normal from abnormal aging is another fundamental issue in which neuroimaging may play a role.

Learning Objectives:

1. To consolidate knowledge of dementia and Alzheimer's disease clinically.
2. To become familiar with common imaging features of dementia and Alzheimer's disease.
3. To appreciate the results from fMRI and DTI and other advanced neuroimaging techniques used in research of dementia and Alzheimer's disease.

Panel discussion:

New insights into the state of consciousness through neuroimaging.

Where are we and where should we go?

15:14

14:00 - 15:30

Room C

Urogenital Imaging

CC 1421

The male genital system

Moderator:

J.O. Barentsz; Nijmegen/NL

A-424 14:00

A. Imaging of prostate cancer: an update

J.J. Fütterer; Nijmegen/NL (j.futterer@rad.umcn.nl)

Prostate cancer is a major health issue in ageing men. No treatment is required in less-aggressive prostate cancer but there is consensus that radical treatment is needed in aggressive prostate cancer. Radical treatment has to start while the tumour is still confined to the gland and has not spread beyond. Potential side effects of radical treatment, such as impotence and incontinence, have a substantial

impact on quality of life. This is of special importance because more than 25% of patients eligible for radical treatment are in the age range of 40 to 65 years. Conventional anatomical T2-weighted MRI is the mainstay in prostate cancer imaging. On T2-weighted images, normal prostate tissue displays an intermediate to high-signal intensity while the transition-zone has lower signal intensity than the peripheral zone. Currently, several MR imaging techniques are being explored. These include 1H-MR spectroscopic imaging, dynamic contrast-enhanced MR imaging, and diffusion-weighted imaging. Multiple studies have explored optimal parameter settings for the diagnostic MR-protocol, which allows accurate tumour localisation. Although reported accuracies of the different separate and combined MP-MRI techniques vary for diverse clinical prostate cancer indications, MP-MRI has shown promising results and may be of additional value in prostate cancer localisation and local staging. To increase MR imaging accuracy for the different clinical prostate cancer indications, one or more functional MR imaging techniques should be combined with T2-weighted MR imaging in a MP-MRI of the prostate. The optimal strength of MP-MRI is yielded by combining the information of the various techniques.

Learning Objectives:

1. To understand multiparametric MR imaging techniques.
2. To learn how to interpret prostate MRIs.
3. To understand the potential of new MRI developments.

Author Disclosure:

J. J. Fütterer: Consultant; Galil Medical, Invivo.

A-425 14:20

B. Scrotal tumours

P.S. Sidhu; London/UK (paulsidhu@btinternet.com)

Ultrasound remains the imaging modality of choice for the assessment of any form of scrotal pathology. The resolution capabilities of the technique and the superficial nature of the scrotal contents allow ultrasound examination to deliver optimal imaging. Testicular tumours may be imaged and characterised with ease, without need for further imaging techniques. The addition of colour Doppler ultrasound allows for the interrogation of the vascularity of any lesion seen, and the addition of newer techniques such as contrast-enhanced ultrasound and tissue elastography has beneficial effects to aid interpretation and diagnosis. Nearly all focal abnormalities of the testis in the adult patient are malignant lesions, with primary germ cell tumours a frequent abnormality in the younger patient, and lymphoma or a secondary malignancy common in the older patient. However, benign abnormalities such as a focal infarction, haematoma or an epidermoid cyst may mimic malignancy. It is important to be able to differentiate benign from malignant causes, with testis sparing the ultimate goal. Non-germ cell tumours present a specific conundrum, with the newer imaging techniques likely to be of benefit in distinguishing these tumours from germ cell tumours. Extra-testicular tumours are nearly always benign and include lipoma and adenomatoid lesions. Inflammatory disease may also simulate a tumour and presents an unexpected pitfall. A careful scrotal ultrasound examination, using all the available ultrasound techniques should allow the examiner to make a confident assessment of any scrotal tumour, and allow for the correct management without need for further imaging.

Learning Objectives:

1. To understand the pathological types of primary and secondary tumours of the testis.
2. To appreciate the US features of the various histological types of testicular tumours.
3. To appreciate the role of newer US imaging techniques, and the role of further imaging.

Author Disclosure:

P. S. Sidhu: Author; Multiple peer reviewed papers on testicular abnormalities.

Speaker; Bracco, Hitachi and Siemens.

A-426 14:40

C. The penis

M. Bertolotto; Trieste/IT (bertolotto@univ.trieste.it)

Ultrasonography (US) is the first-line imaging modality in patients with penile disease. Using high-end equipment, after pharmacologically induced erection penile anatomy is well defined and virtually all clinically significant penile vessels can be evaluated in normal and in impotent men. The superior soft-tissue contrast resolution afforded by MR imaging provides an opportunity to advanced imaging evaluation of the penis in selected cases. In the clinical practice, erectile dysfunction is the most frequent penile abnormality which is investigated with Doppler US. The clinical role of this evaluation, however, reduced after the introduction of

oral medications for impotence. Differentiation among different forms of erectile dysfunction is mainly based on evaluation of Doppler waveform changes in the cavernosal arteries. Peyronie's disease is the most frequent cause of penile induration. Imaging is often required to evaluate the extension of the plaques, involvement of the penile septum, and relationship between the plaques and penile vasculature. In patients with penile traumas, imaging allows accurate evaluation of albugineal tears, extra-albugineal and cavernosal hematomas, vascular lesions producing high-flow priapism and other pathological changes. Compared to US, MR imaging has some advantages in identification of small albugineal tears, and is more accurate in identification of urethral or spongiosal involvement. Other situations in which penile imaging can be required are circumscribed or diffuse cavernosal fibrosis, tumours, priapism, severe inflammation, and evaluation of postsurgical complications. Most of these conditions are first investigated with US; MR is the imaging modality of choice for tumour staging.

Learning Objectives:

1. To learn about the most relevant penile diseases that can be diagnosed by imaging.
2. To know the diagnostic roles of US, MRI and other imaging techniques.
3. To understand how imaging influences treatment and follow-up.

A-427 15:00

D. Interactive case discussion

J.O. Barentsz; Nijmegen/NL (J.Barentsz@rad.umcn.nl)

14:00 - 15:30

Room D1

CLICK (Clinical Lessons for Imaging Core Knowledge): Never without Arteries

CC 1418

Angina, non-occlusive mesenteric ischaemia (NOMI) and friends: vascular causes of acute abdomen

Moderator:

O. Chan; London/UK

A-428 14:00

A. Clinical considerations

P. Rogalla; Toronto, ON/CA (Patrik.Rogalla@uhn.on.ca)

Mesenteric ischaemia is a medical condition in which inflammation and injury of the small intestine result from inadequate blood supply. Causes of the reduced blood flow can include changes in the systemic circulation (e.g. low blood pressure) or local factors such as constriction of blood vessels or a blood clot. Mesenteric ischaemia leads to mediator release, inflammation, and ultimately infarction. Abdominal pain is out of proportion to physical findings. Early diagnosis is difficult, but early conventional angiography and exploratory laparotomy are believed to have the highest sensitivity, however, angiography represents a fairly invasive imaging technique and surgical intervention has its own limitation, in particular if clinical suspicion is vague or repeatedly expressed. Mortality of the disease is dramatically high, ranging between 32% and 77%. In fact, the prognosis depends on prompt diagnosis (less than 12-24 h and before gangrene) and early surgical intervention. Multislice CT with its ultra-fast acquisition modes, isotropic image resolution and multiplanar reconstruction capabilities, its widespread availability and ubiquitous applicability may be regarded as the imaging modality of choice in patients with suspected mesenteric ischaemic disease.

Learning Objectives:

1. To learn about the frequency and importance of the vascular causes of an acute abdomen.
2. To learn about the differential diagnosis as well as the different vascular causes of acute abdomen.
3. To learn about prognosis, treatment and outcome of acute abdomen caused by vascular diseases.

Author Disclosure:

P. Rogalla: Research/Grant Support; Toshiba Medical Systems.

A-429 14:30

B. Imaging techniques and typical findings

M. Prokop; Nijmegen/NL (M.Prokop@rad.umcn.nl)

Vascular causes of acute abdomen are best examined using computed tomography. Ultrasound and MR are able to visualize some of the relevant findings but ultrasound

has a high chance of missing ischaemia, active bleeding or focal abnormalities while MR is logistically more challenging, more time consuming and artefact-prone. Invasive angiography is a technique that is best suited for evaluating the smaller vessels and for combination with endovascular treatment. CT is best performed using biphasic techniques that include a late arterial phase that also serves as CT angiography (CTA) and a portal phase that is used to look at bowel perfusion. Both phases can be combined in a split bolus technique, which saves one scan and is thus suitable for saving radiation dose in younger individuals. The course will discuss the most appropriate protocols and will explain under which conditions catheter angiography will remain necessary. Typical findings of vascular causes of acute abdomen will be discussed. Direct signs on CTA include stenosis, occlusion, vasospasm, aneurysms and extravasation. Indirect signs such as reduced bowel perfusion, bowel necrosis, post-ischaemic hyperperfusion, and collateral perfusion will be illustrated. The typical findings of NOMI and other rarer vascular cause of acute abdomen will be demonstrated. By integrating clinical setting and imaging findings a final diagnosis can be made in the vast majority of cases.

Learning Objectives:

1. To learn about the importance of selecting the appropriate imaging technique in cases of acute abdomen to detect vascular causes.
2. To become familiar with the typical imaging appearance of the different vascular causes of acute abdomen and their most important differential diagnosis.
3. To become familiar with potential pitfalls and problems of identifying vascular causes of acute abdomen.

Author Disclosure:

M. Prokop: Research/Grant Support; Toshiba Medical Systems. Speaker; Bracco, Bayer, Toshiba.

A-430 15:00

C. Interactive case discussion: how to proceed?

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

The goal of this problem-oriented, case-based presentation is to involve the audience in an interactive communication aimed at clarifying and clearly understanding the role and clinical significance of imaging and image-guided intervention in the diagnosis and treatment of abdominal vascular emergencies. We will discuss and solve not only typical but also unusual cases in order to introduce the proper diagnostic algorithm providing the fastest possible treatment to the patient in these most frequently very severe, potentially lethal conditions; in which time elapsing between onset of symptoms and correct diagnosis is critical from the point of view of successful therapy and chance of survival.

Learning Objectives:

1. To become familiar with typical cases, illustrating the role of imaging modalities in the diagnosis and differential diagnosis of acute abdomen.
2. To consolidate knowledge of the selection of the appropriate imaging technique, image interpretation and image based treatment recommendation.
3. To understand the most important information urgently needed for treatment decisions and planning.

Author Disclosure:

A. Palkó: Advisory Board; Euromedic Intl. Consultant; Covidien.

14:00 - 15:30

Room D2

Oncologic Imaging: Follow-up of Systemic and Local Therapies

CC 1419

Follow-up of thermal ablation (part I)

Moderator:

W. Prevoo; Amsterdam/NL

A-431 14:00

A. The zone of cell death and collateral phenomena on cross-sectional imaging: from histopathology to the standardisation of terms

A. Denys, P. Bize; Lausanne/CH (Alban.Denys@chuv.ch)

The field of image-guided ablation has expanded recently with new ablation techniques like micro-wave, irreversible electroporation, cryoablation. Nevertheless, after each treatment, whatever the technique used, we will leave in place in the treated organ, a scar instead of the tumour. Follow-up of these treated areas are done by radiologists using CT or MR or contrast enhanced ultrasound. Standardization of terms has been done in 2003 by an international committee presided by Dr Goldberg. This allows reporting criteria identical from one center and from

one country to another. Furthermore, it allows a more homogeneous literature and evaluation of success. Nevertheless, techniques are not all the same and the cellular and tissue damage in the tumour and around it in the healthy parenchyma are not identical and does not have the same evolution over time.

Learning Objectives:

1. To understand histopathologic changes after various ablation techniques.
2. To become familiar with post-ablation imaging based on histo-pathologic correlation of ablation zones in various organs.
3. To learn about the adequate terms for reporting and publishing on post-ablation imaging.

A-432 14:30

B. PET/CT for the evaluation of ablative therapy: Who? Where? When? Does it help?

D. Deandreis; Villejuif/FR (Desiree.DEANDREIS@igr.fr)

Tumour ablative therapy is frequently used in clinical practice because of its safety and good tolerability. One issue is the lack of reliable imaging modality to assess efficacy. The purpose is to define the impact of FDG-PET/CT in this field. The following items will be discussed: the typical post-therapeutic aspect on PET/CT, the best PET criteria to define recurrence, the best candidate for PET/CT follow-up and the best timing point to assess response. Published data until now show that FDG-PET/CT is a useful tool in ablated liver tumours follow-up, detecting residual disease easily and earlier than conventional imaging. Only limited reports evaluating the usefulness of FDG-PET/CT in lung lesions are available but the results are promising, showing a high negative predictive value of the technique during the follow-up. Few data are available on bone lesions. In general, diffuse, peripheral, homogeneous FDG uptake in the treated lesion is related with inflammatory processes; on the other hand, heterogeneous and focal uptake is more frequently related to disease relapse. SUVmax (Standardised Uptake Value) is higher in case of persistent tumoural disease than in completely ablated lesions, but in some cases it is not a reliable indicator. Finally, the good timing after treatment still remains to be defined but FDG-PET/CT should be performed at least 3-6 months after treatment to avoid dubious or inconclusive findings due to inflammatory reaction that frequently occurred during the first months.

Learning Objectives:

1. To understand who are the best candidates for a PET/CT follow-up of ablation therapies.
2. To learn about what is the optimal timing of PET/CT in the follow-up of ablative therapies.

A-433 15:00

C. Everyday practice: MR and CT for evaluating response to thermal ablation

C. Dromain, C. Caramella, L. Vilcot, S. Bidault, F. Bidault, F. Deschamps; Villejuif/FR (dromain@igr.fr)

The aim of thermal ablation treatment is to generate an area of thermocoagulation whose diameter is larger or at least equivalent to that of the tumour. This necrotic scar usually shrinks with time, but most often very slowly. Therefore, criteria of response based on size measurement cannot be applied. The pattern of thermal ablation area is similar whatever the thermo-ablation technique used. On CT imaging thermal ablation area are well circumscribed and oval shaped. An extending ground-glass opacification, a cavitation or bubble lucencies can be observed after thermal ablation of lung tumours. The criterion commonly used to assess the efficacy is the absence of enhancement in the thermal ablation necrosis which corresponds to tissue devoid of viable tumour. On MR imaging the thermo-ablation areas is typically hyperintense on unenhanced T1, due to the presence of proteinaceous material, and hypointense on T2, explained by the dehydrating effect of thermal damage. Residual tumour is typically round shaped and located at the periphery of necrotic area or in contact with large vessels. MR imaging allows earlier detection of residual liver tumour than CT imaging. Indeed, unenhanced MR images offer an excellent contrast between residual tumour with low signal on T1 and high signal on T2 and between thermal ablation necrotic area with high signal on T1 and low signal on T2.

Learning Objectives:

1. To become familiar with the imaging aspects of successful ablation.
2. To learn about the main pitfalls of post-ablation imaging.
3. To consolidate knowledge of the imaging aspects of most common complications.

14:00 - 15:30

Room E1

Musculoskeletal

RC 1410

How I report

Moderator:

M. Padrón; Madrid/ES

A-434 14:00

A. Soft tissue mass: US/MR

C. van Rijswijk; Leiden/NL (C.S.P.van_rijswijk@lumc.nl)

Ultrasonography (US) is a readily available non-invasive technique that can be used for the detection of a soft tissue mass. It gives a first impression of the size, location in relation to the fascia and consistency of soft tissue lesions. An important ability of US is the potential to differentiate between cystic and solid lesions; however, specificity in further characterising a soft tissue mass is low. MR is the next imaging modality to perform for the evaluation of soft tissue lesions. MR is accurate in determining size, confinement to or extension beyond the anatomic compartment of origin and the relationship to the neurovascular bundle and adjacent bone and joints. Although histopathological examination remains the gold standard, differentiation between malignant and benign soft tissue masses, indication of the grade of malignancy and prediction of the histological diagnosis are challenging goals of MR imaging. As such, characterisation of soft tissue masses starts with interpretation of signal characteristics on T1- and T2-weighted sequences. Combinations of signal intensities reveal the different tumour components (e.g. fat, water, and blood), and thus provide indirect information about the nature of soft tissue masses. Additional imaging parameters combined with clinical parameters, such as age, gender, etc. should be evaluated for defining a differential diagnosis, such as multiplicity, location, origin (e.g. subcutaneous, intramuscular), size, shape, margins, peritumoural oedema, bone involvement and rate of growth.

Learning Objectives:

1. To become familiar with the strengths/weaknesses of US/MRI in assessing soft tissue tumours.
2. To understand the US/MRI specific findings that aid diagnosis.
3. To learn a structured approach to reporting.

A-435 14:30

B. MR of vertebral body collapse

R. Lalani; Oswestry/UK (radhesh.lalani@rjah.nhs.uk)

It is not uncommon for a reporting radiologist to come across vertebral body collapse in day-to-day practice. A number of imaging options are available to the radiologist to assess the nature of the vertebral body collapse. Vertebral body collapses are broadly divided into benign and malignant depending on the aetiology. Benign collapses are most often due to metabolic diseases such as osteoporosis and trauma. It is vital to be able to differentiate these two categories of vertebral involvement to initiate appropriate therapy. Radiographs have a low sensitivity and specificity in differentiating these categories of vertebral body collapse. MRI, on the other hand, is excellent at differentiating between benign and malignant lesions on standard imaging sequences. A number of features including retropulsion, T1 signal characteristics, clefts, soft tissue abnormalities, posterior element involvement and contrast enhancement help in this differentiation. Advanced imaging protocols including diffusion and in/out of phase imaging are rarely needed. In some clinical circumstances where the differentiation is not possible despite all these measures, CT scan, follow-up imaging and/or a biopsy may be necessary.

Learning Objectives:

1. To be able to differentiate benign from malignant causes.
2. To learn about the changes of the vertebral body with time, disease progression and therapy.
3. To learn a structured reporting approach.

A-436 15:00

C. MR of the unstable shoulder

M. Zanetti; Zurich/CH (marco.zanetti@hirslanden.ch)

Static instabilities are defined by the absence of classic symptoms of instability and are associated with rotator cuff or degenerative joint disease. Dynamic instabilities are subdivided in two main categories. The first category is characterised by a history of trauma resulting in unidirectional anteroinferior instability, commonly associated with a fibrous or osseous Bankart lesion that requires surgical repair

(TUBS). The second category is known as atraumatic multidirectional bilateral rehabilitation inferior capsular shift (AMBR). This pattern of multidirectional instability is believed to be the result of atraumatic ligamentous and capsular laxity. Treatment is rehabilitation initially, followed by inferior capsular shift if indicated. The anterior instability is characterised by avulsion of the labroligamentous complex from the anteroinferior aspect of the glenoid, which, with complete disruption of the scapular periosteum, is termed a fibrous Bankart lesion. The presence of an associated adjacent glenoid rim fracture is referred to as an osseous Bankart lesion. Osseous Bankart lesions can easily be missed on MR images; therefore, CT arthrography is preferred by some authorities. In post-traumatic posterior dislocation, tears occurring in the posterior labrum are referred to as a reverse Bankart lesion and impaction of the anterosuperior humeral head are called reverse Hill-Sachs defect. Recurrent (atraumatic) posterior shoulder instability has to be distinguished from acute and chronic (locked) posterior dislocation. Recurrent (atraumatic) posterior instability is not related to trauma, but rather to laxity of supporting capsular and muscular structures and/or to the shape of the bony glenoid or the labrum.

Learning Objectives:

1. To learn about the specific imaging findings of instability.
2. To become familiar with the different types of shoulder instability.
3. To learn a structured approach to reporting.

14:00 - 15:30

Room E2

Oncologic Imaging

RC 1416

The essentials of lymph node imaging of solid tumours: what the radiologist needs to know

A-437 14:00

Chairman's introduction

R.G.H. Beets-Tan; Maastricht/NL (r.beets.tan@mumc.nl)

Positive lymph node status is an important predictor for a poor prognosis. Accurate nodal staging often influences the choice of treatment and outcome of these patients. However, detection of nodal infiltration by non-invasive imaging has been challenging and to date FNA or biopsy has remained important to dictate treatment. Nowadays, the combination of morphological and functional or metabolic information with modern imaging technology offers us new perspectives. In this session, we will learn about the present status of lymph node imaging using new generation CT, MRI or PET and become familiar with the strength and weaknesses of each.

A-438 14:05

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 important 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, often a universal size threshold of 10 mm is used in abdominal imaging. In chest CT, an upper limit of normal of 10 mm is universally applied. However, size criteria alone are unreliable: CT for lung cancer staging has a pooled sensitivity of 51% (i.e., false negative diagnoses of metastatic deposits in normal-sized nodes), and a specificity of 86% (i.e., false positive diagnoses due to enlarged reactive nodes). With MRI, the same size criteria apply. However, additionally features such as central necrosis (T2w fatsat or gadolinium-enhanced images) are suggestive of metastasis (or suppurative infection). Lymph node-specific USPIO MR agents can depict tumour deposits in subcentimeter pelvic nodes. Unfortunately, they did not reach market approval. DWI is helpful in identifying in lymph nodes as they exhibit high SI with higher b-values. However, diffusion pattern of benign and malignant nodes overlap, so that ADC values do not aid in characterisation. Despite the use of modern MDCT and MRI techniques, lymph node characterisation needs further improvement.

Learning Objectives:

1. To become familiar with current criteria.
2. To learn about imaging features which are highly specific for nodal disease.
3. To understand the diagnostic performance of cross-sectional imaging.

Author Disclosure:

W. Schima: Advisory Board; GE Healthcare. Speaker; Siemens.

A-439 14:28

B. DWI MR: what does it contribute?

H.C. Thoeny; Berne/CH (harriet.thoeny@insel.ch)

Up to date, lymph node staging is based on size and shape criteria only, however, micrometastases can also be present in normal sized lymph nodes and nodes can be enlarged due to inflammatory changes. New contrast agents in MRI such as ultrasmall particles of iron oxide (USPIO) have substantially improved the diagnostic accuracy of lymph node staging compared to conventional MRI. Unfortunately, USPIO are not commercially available, and therefore, new approaches to differentiate benign from malignant lymph nodes are required. Diffusion-weighted MRI (DWI) is a non-invasive 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 79-87% and specificities of 74-93% using the underlying apparent diffusion coefficient (ADC) value; lower ADCs were reported in malignant nodes as compared to benign ones. In these studies, lymph nodes with short axis diameter greater than 5 mm were included. It should be noted that there is an overlap between ADC values of benign and malignant nodes; no significant difference in ADC was found in some studies. Further investigations on the use of ADC in lymph node diagnosis including histopathological validation are needed to reduce the high rate of false positive nodes. The combination of USPIO with DWI might facilitate and improve lymph node staging in the future, provided, that USPIOs will become available for clinical use.

Learning Objectives:

1. To understand the principles of DWI of nodes.
2. To recognise the imaging appearance of nodes on DWI MRI.
3. To become familiar with studies evaluating the diagnostic performance of DWI MRI.

A-440 14:51

C. Nuclear medicine: PET and other nuclear medicine techniques

P.L. Choyke; Bethesda, MD/US (pchoyke@nih.gov)

Radionuclide methods have become increasingly important in the assessment of nodal disease. Broadly speaking, radionuclide methods can be characterised as those involving sentinel node detection and those that image nodes throughout the body. Sentinel node imaging is an established method of detecting nodes draining tumours (e.g. breast, melanoma). FDG PET has recently become increasingly important in nodal staging of cancers, particularly lung cancer, thyroid cancer and lymphoma. Increased uptake in lymph nodes is highly predictive of nodal involvement and portends a worse prognosis. The ability to localize nodes on the CT portion of the study makes biopsy relatively straightforward. However, FDG PET is not infallible. For instance, false positive activity is seen in diseases, such as sarcoid and false negatives can occur in tumours such as prostate cancer and renal cancer. Thus, there has been interest in the development of new PET agents. For instance, FLT PET has been useful for distinguishing inflammation from tumour within nodes and various agents such as F-Choline and F-ACBC have been used to identify nodal metastases in prostate cancer. Additional agents have been proposed, however, FDG remains an excellent first imaging test for lymph node staging and this is highly complemented by the use of FLT PET.

Learning Objectives:

1. To learn which tumours are typically FDG-avid.
2. To understand the factors that contribute to the diagnostic performance of FDG-PET.
3. To become familiar with other nuclear imaging techniques for lymph node imaging.

Author Disclosure:

P. L. Choyke: Other; Research Agreements: GE, Siemens, Philips.

Panel discussion:

When and how could imaging make diagnostic biopsy unnecessary? 15:14

14:00 - 15:30

Room F1

Special Focus Session

SF 14a

Palliative interventional techniques in cancer

A-441 14:00

Chairman's introduction

K.A. Hausegger; *Klagenfurt/AT (klaus.hausegger@lkh-klu.at)*

This session will focus on palliative cancer treatment. Four different topics (treatment of lytic bone lesions, treatment of malignant pleural effusions, treatment of malignant urinary obstruction and treatment of malignant biliary strictures) will be discussed. In addition to that we also plan to discuss the ethical aspect of palliative treatment strategies.

Session Objectives:

1. To learn about different palliative techniques in cancer.
2. To understand when to indicate different palliative techniques.
3. To become familiar with the limitations of palliative techniques.
4. To learn when palliation does not help the patient.

A-442 14:03

Cementoplasty of lytic bone metastasis

A. Gangi, J. Garnon, G. Tsoumakidou, I. Enescu; *Strasbourg/FR (gangi@rad6.u-strasbg.fr)*

Osteolytic destruction of the vertebral body by metastasis from breast, renal, lung and bladder cancers, multiple myeloma and lymphomas are a source of debilitating pain and disability. Due to the multifocal nature of these lesions, surgical treatment in the form of vertebrectomy and strut grafting is rarely undertaken. Radiation therapy does not provide consolidation, is not always effective in relieving pain and its effects are generally delayed by 1-2 weeks after commencement of therapy. Percutaneous vertebroplasty with injection of cement allows for consolidation and restoration of vertebral body strength resulting in effective pain relief and stabilisation of the spine. The procedure is palliative and does not address tumour progression and ablation. Hence, it should be used as a complement to other treatment modalities for cancer. Only painful metastasis and lesions affecting the stability of the spine should be treated. In patients with destruction of the vertebral body with paravertebral tumour extension, vertebroplasty can be combined with thermal ablation (RFA, Cryoablation) for reduction of tumour mass and consolidation of the vertebral body. Further, the procedure can be performed at multiple levels thus addressing the multifocal nature of the disease process. However, it must be stressed that vertebroplasty is specially indicated for management of local pain from metastatic disease and not for diffuse back pain with multiregional involvement of the spine. Cementoplasty is used in other location of tumours with compression fracture. The best examples are: acetabular lytic tumours, femoral or tibial condyle pathological fractures.

Learning Objective:

1. To learn about the indications, techniques, clinical results and complications of cementoplasty.

A-443 14:21

Pleural drainage, pleurodesis

F. Gleeson; *Oxford/UK (fergus.gleeson@orh.nhs.uk)*

A significant number of patients present with and/or are symptomatic from pleural effusions. It is important for radiologists to be familiar with the means of assessing effusion size and aetiology, and the methods available for their drainage, including pleurodesis. There are recognised complications from pleural drainage, and knowledge of the pleural anatomy and cause of these complications may help reduce their incidence. Following pleural drainage and pleurodesis, follow-up scanning may be necessary, and knowledge of post-intervention appearances may help determine treatment success and disease relapse. This presentation will discuss the aetiologies of effusions, their imaging appearances and the techniques used for drainage and pleurodesis.

Learning Objectives:

1. To become familiar with the indication for drainage of malignant pleural effusion.
2. To learn about the indications, technique and clinical results of pleurodesis.

A-444 14:39

Percutaneous nephrostomy (PCN) and ureteral stenting

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

Percutaneous minimally invasive interventions in the urinary tract needs a renal access by means of percutaneous nephrostomy. Indications for percutaneous nephrostomy include urinary diversion for hydronephrosis, treatment of nephrolithiasis, ureteral intervention (stent placement) and ureteroscopy. The most common extension of percutaneous nephrostomy is placement of an ureteral stent for treating the obstructions. Transient haematuria is very common after percutaneous nephrostomy, but severe bleeding requiring transfusion or intervention is rare. Complications can be minimized by using the ultrasound guidance for the percutaneous renal approach, meanwhile the rest of the procedure should be guided by fluoro imaging. Technique for percutaneous nephrostomy and antegrade ureteral stent placement will be presented.

Learning Objectives:

1. To become familiar with the indication for percutaneous nephrostomy in patients with malignant urinary obstruction.
2. To learn about the technique, clinical results and complications of PCN and antegrade ureteral stenting.

Author Disclosure:

F. Orsi: Research/Grant Support; CELONOVA. Other; PROCTOR FOR DELCATH SYSTEM.

A-445 14:57

Biliary procedures

M. Krokidis¹, A.A. Hatizidakis²; ¹Cambridge/UK, ²Iraklion/GR (mkrokidis@hotmail.com)

Palliative Percutaneous Transhepatic Biliary Drainage (PTBD) is a therapeutic procedure leading to drainage of the obstructed bile duct system. If endoscopy is not possible and if patient is inoperable, then the percutaneous treatment is indicated. Drainage of the bile ducts is performed with a small plastic multiple hole pigtail catheter. Self-locking catheters are preferred in order to minimize the dislocation risk. The percutaneous catheter is pushed through the malignant stricture, so that bile is draining through the catheter towards the bowel loops. Technical success rate of percutaneous biliary drainage can reach nearly 100% in experienced hands, while the major complications rate is usually lower than 5%. Clinical efficacy is usually lower, but still over 90%. The drainage procedure can be extended with the placement of a permanent metallic stent, which keeps the stenosed biliary duct patent, without need for a catheter. Metallic biliary stents have been proved as the best palliative treatment of non-resectable malignant obstructive jaundice, allowing longer patency rates than plastic endoprotheses. The technique is safe, with low-complication rate and procedure-related mortality between 0.8 and 3.4%. Still controversial remains in the timing between initial drainage and metallic stent placement, as well as the question of balloon dilatation before stent insertion. There is evidence that if the initial transhepatic drainage is completed without causing any severe complications, especially bleeding in form of haemobilia, primary metallic stenting can follow as a single-step procedure.

Learning Objectives:

1. To become familiar with the indications for drainage in malignant biliary obstruction.
2. To learn about the technique, clinical results and complications of percutaneous cholangiography and biliary stenting.

Panel discussion:

How invasive can palliation be? When to say no to palliative treatment?

15:15

Sunday

14:00 - 15:30

Room F2

Breast

RC 1402

How I report

Moderator:

A. Tardivon; Paris/FR

A-446 14:00

A. Mammography

E. Azavedo; Stockholm/SE (edward.azavedo@ki.se)

The purpose is to plan a structured report of a Mammography Examination so that the reader gets a clear message to make a clinical decision for management of the case. Examples will be presented of different types of findings of which some will be actionable and others will not warrant any action from a clinician. Relevant findings will be reported in detail in order to get the message across to the reader. Questions from the referring clinician must be answered with the help of the obtained images. Findings that are seen but do not warrant any actions may not be reported in detail and in some cases not reported at all or reported together within a group of non-actionable findings. In cases of lesions that will warrant surgery, it is necessary to describe the extent of the disease to plan adequate type of surgery. Examples will be shown so that the audience can reflect on the important aspects to be noted and reported. Examples of rather concise reports that answer the referring clinician's questions and substantial information on actionable imaging findings must be reported with a clear message possibly without risks for misinterpretation.

Learning Objectives:

1. To become familiar with the basic parts of a structured report.
2. To understand which information a clinician needs in a report of a breast cancer patient.
3. To learn how to compose a report on a patient with a BI-RADS 3 lesion.

A-447 14:30

B. Breast US

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

Breast ultrasound is one of the main imaging modalities in breast radiology, it allows us to characterise lesions and also guide interventional procedures. The BI-RADS categorisation of ultrasonographic findings facilitates the diagnostic approach and also helps the radiologist to use a common language, understood not only by the rest of the radiological community, but also by other breast cancer professionals. Ultrasound can be a diagnostic procedure in its own, but is mainly a modality that characterises the findings of other modalities (mammography and MRI) and, as such, correlation between all these techniques is the mainstay of everyday clinical practice. This act of correlating and integrating the information of all modalities is what makes a breast radiologist a key actor in the diagnosis, staging and follow-up of breast cancer and other benign or high risk entities. The final product of this integration will be the radiological report, the means by which we convey all the information we have gathered through all the procedures to our clinical colleagues. This report shall also follow some composition rules in order to be clear and concise.

Learning Objectives:

1. To become familiar with BI-RADS categories of breast US.
2. To learn how to integrate clinical information and radiological findings.
3. To learn how to compose a US report in a breast cancer patient.

Author Disclosure:

J. Camps Herrero: Advisory Board; Bayer.

A-448 15:00

C. Breast MRI

R.M. Mann; Nijmegen/NL (r.mann@rad.umcn.nl)

Breast MRI is a dynamic examination that evaluates contrast extravasation within breast tissue. The technique has a high sensitivity (> 95%) for breast cancer. It requires both high-spatial resolution and reasonable temporal resolution as the combination of morphological and dynamic assessment of lesions yields the highest specificity. Because breast MRI is not a first line technique, mammography and ultrasound are generally available. Findings from these examinations can thus be used in the interpretation of breast MRI examinations and vice versa. It is also essential to be aware of the medical history of the woman scanned as this may affect the interpretation. For example, a probably benign breast nodule with all

characteristics of a fibroadenoma can be followed in virtually every patient, but not in high risk patients. A biopsy is then mandatory. In general, breast MRI findings are reported using the BIRADS breast MRI lexicon. This lexicon provides a list of terms that can be used for the description of breast lesions. When familiar with the terms, a certain set of descriptors will lead to a more or less specific lesion classification, although this is still not easily reproduced between different readers as interreader variability is rather high. In any case, it is essential to keep in mind for what purpose the MRI is made. It does no good to assess a 3 cm nodule in the breast as probably malignant, if it is biopsy proven cancer. Moreover, tumour size for a surgeon is different than for a medical oncologist.

Learning Objectives:

1. To understand how to integrate conventional (mammography and US) findings in a breast MRI report.
2. To learn how to include morphological and kinetic information and why this needs to be done thoroughly.
3. To become familiar with the necessary skills to compose a report on a breast cancer patient (staging, follow-up, relapse, etc).

Author Disclosure:

R. M. Mann: Speaker; Bayer Healthcare.

14:00 - 15:30

Room G/H

Special Focus Session

SF 14b

Comprehensive CT cardiothoracic imaging: a new challenge for radiologists

A-449 14:00

Chairman's introduction

L. Bonomo; Rome/IT (lbonomo@rm.unicatt.it)

Over the past few years, the use of CT in cardiovascular imaging has dramatically increased, since technological developments have made it suitable for the two- and three-dimensional visualisation of the heart, and of large and small vessels, e.g. coronary arteries. Further development in terms of temporal resolution and anatomical coverage has allowed the simultaneous study of systemic arterial circulation and pulmonary circulation on the same scan, with gradual reduction of exposure dose. There are several outcomes of this technological revolution. Morpho-functional information obtained for the entire chest in a single scanning makes it possible to simultaneously assess the heart and the lungs. Investigating interactions between these two systems, linked through embryological, anatomical, mechanical, physiological, physiopathological, and therapeutic relations, is among the challenges of imaging today. In this Special Focus Session, three presentations will be given: the first presentation will discuss strategies that enable minimising the radiation exposure imparted by dedicated ECG-synchronised image acquisition protocols of the entire thorax, but still allow comprehensive diagnostic evaluation of all aspects of heart-lung axis disorders; the second presentation will demonstrate that different clinical indications requiring a chest CT imaging may have underlying coronary or cardiac causes that are not clinically evident, while patients scheduled for thoracic surgery may present unexpected heart or coronary artery findings detectable at pre-operative CT; the third will give examples of chest CT using a variety of protocols, ranging from a non-contrast screening study to a highly sophisticated contrast-enhanced CT perfusion study.

Session Objectives:

1. To understand the importance of looking at the heart on a CT scan of the chest.
2. To learn how to optimise integrated cardiothoracic imaging with CT.
3. To become familiar with the key imaging findings and learn how to report.

A-450 14:05

How to optimise integrated cardiothoracic imaging with CT

U.J. Schoepf; Charleston, SC/US (schoepf@muscc.edu)

The advent of advanced, latest generation CT systems enables rapid image acquisition of the entire chest with ECG synchronisation. This ability has substantially expanded our ability to non-invasively study the heart-lung axis and diseases thereof. Historically, the relatively high radiation exposure associated with retrospectively ECG-gated techniques on older generation CT systems had limited the more widespread application of this approach, especially in younger patients. This presentation will discuss strategies that enable minimising the radiation exposure imparted by dedicated ECG-synchronised image acquisition protocols of the entire thorax, but

still enable comprehensive diagnostic evaluation of all aspects of heart-lung axis disorders. These include general measures such as individual adjustment of the x-ray tube voltage by manual or automated means, automated anatomical tube current modulation, and image reconstruction using iterative algorithms. Strategies specific to ECG-synchronized acquisitions consist in ECG-dependent tube current modulation, use of prospectively ECG-triggered techniques, and ultra-high pitch image acquisition, where clinically appropriate. Lastly, suitable approaches for image post-processing and display will be discussed that aim at maximising the diagnostic benefit for the comprehensive CT assessment of the heart-lung axis.

Learning Objectives:

1. To learn how to select CT protocols that enable assessment of the heart-lung axis with the lowest possible radiation dose.
2. To become familiar with the ECG-synchronisation protocols for cardio-thoracic CT image acquisitions.
3. To understand strategies for image post-processing and displaying for evaluating diseases affecting the heart-lung axis.

Author Disclosure:

U. J. Schoepf: Consultant; Bayer, Bracco, GE, Medrad, Siemens. Grant Recipient; Bayer, Bracco, GE, Medrad, Siemens. Investigator; Bayer, Bracco, GE. Research/Grant Support; Bayer, Bracco, GE, Medrad, Siemens. Speaker; Bayer, Bracco, GE, Medrad, Siemens.

A-451 14:28

Coronary artery imaging from a chest CT examination: when and how
R. Marano; Rome/IT (riccardo.marano@rm.unicatt.it)

The continuous technological evolution of multi-detector CT scanner characterised by larger detector array with increased anatomical coverage per rotation, faster rotation and table speed, and shorter acquisition time have made reliable to perform chest imaging with reduced cardiac motion artifacts, improving the assessment of heart and contiguous structures in the course of routine thorax CT. Further, the larger anatomic coverage of detectors and the availability of scan protocols with lower radiation dose have also made reliable to apply ECG-synchronization to chest CT study, and therefore to couple cardiac/coronary imaging with chest imaging. Different clinical queries requiring a chest CT imaging may underlie cardiac or coronary source that is not clinically evident; similarly, patients scheduled for thoracic surgery, staging or studied in emergency setting may present unexpected heart or coronary artery findings that can be detected in the course of pre-operative CT or may change the treatment and prognosis. Therefore, the capability to perform the assessment of both the heart and chest by a single diagnostic tool is becoming progressively significant because the evaluation of the heart often can provide clinically relevant information in the course of routine or emergency chest CT that is not otherwise easily available.

Learning Objectives:

1. To become familiar with the main clinical indications that could require assessment of the heart and coronary arteries in the course of chest CT.
2. To learn how to recognise the normal and abnormal appearance of heart and coronary arteries commonly observed on chest CT.
3. To learn about the acquisition protocol to couple chest CT with ECG-gated cardiac CT.

A-452 14:51

Cardiopulmonary functional imaging from a chest CT examination: when and how

E.J.R. van Beek; Edinburgh/UK (edwin-vanbeek@ed.ac.uk)

The use of CT for chest diseases has rapidly expanded and now covers both pulmonary and cardiac diseases. However, it is also increasingly realised that these two organ systems have a direct impact on one another, and therefore we need to address the fact that pathology in one system may well lead to changes in the other. This presentation will give examples of chest CT using a variety of protocols, ranging from a non-contrast screening study to a highly sophisticated contrast-enhanced CT perfusion study. It will give examples of findings in one system and its impact on the other. Furthermore, it will demonstrate the capability to gain information from standard CT examinations related to pulmonary function, cardiac function and how these may be used.

Learning Objectives:

1. To understand the feasibility of CT based cardiopulmonary functional imaging.
2. To be able to grasp clinical scenarios where cardiopulmonary functional CT imaging may be helpful.
3. To be able to set the use of CT within a larger framework of imaging modalities.

Author Disclosure:

E. J. R. van Beek: Advisory Board; Siemens Lung MRI. CEO; Quantitative Clinical Trials Imaging Services, Inc. Speaker; Toshiba Medical Systems, Vital Images.

Panel discussion:

Is a single CT scan technique and protocol feasible for all the cardiothoracic problems?

14:14

14:00 - 15:30

Room I/K

Genitourinary

RC 1407

Contrast media safety: update

A-453 14:00

Chairman's introduction

P. Reimer; Karlsruhe/DE (Peter.Reimer@klinik.uni-karlsruhe.de)

The speakers in this course will update the audience on contrast media safety. The first speaker is covering new concepts of non-renal reactions to contrast media. Acute reactions within 1 h following contrast administration and late reactions after 1 h up to 7 days following contrast administration typically occur more often after administration of iodinated contrast media. Acute reactions are treated according to their symptoms while most late skin reactions are mild or moderate and self-limiting. Data will be presented that patch and delayed reading intradermal tests may help guide patients. The second speaker will address NSF. The presentation will review clinical features, risk factors and prevention of NSF. Patients with GFR less than 30 ml/min/1.73 m² have increased risk of developing NSF. Low stability gadolinium contrast media show the strongest association with NSF. Following existing guidelines on use of gadolinium contrast agents minimizes the risk of NSF. Potential long-term harm from gadolinium accumulation in the body is discussed. The last speakers will cover contrast medium-induced nephropathy with more recently published guidelines related to that issue. The presentation will include the definition of CIN, the choice of contrast medium, and prophylactic measures. A recent change in ESUR guidelines will be explained. The risk of CIN is considered significantly lower following i.v. CM administration and patients referred for enhanced CT are genuinely at risk if they have an eGFR < 45 ml/min/1.73 m². Both, volume expansion with isotonic saline or sodium bicarbonate may be used for preventing CIN in at risk patients.

Session Objectives:

1. To discuss the safety steps to be taken before contrast administering.
2. To present the newest safety guidelines.

A-454 14:05

A. Acute non-renal reactions to contrast media: new concepts

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

Acute immediate hypersensitivity reactions occur within the hour following the administration of contrast media. They can be seen with either iodinated and Gadolinium-based contrast agents. Over the last ten years, new concepts have been emerged in the way to understand, manage and explore hypersensitivity reactions. The clinical appearance is best classified by the Ring and Messmer scoring, from Grade 1 (cutaneous and subcutaneous signs) to Grade 4 (cardiovascular arrest). The mechanisms involve either true IgE-mediated hypersensitivity or non-allergic hypersensitivity. The differential diagnosis in favour of allergy is made on a triad: clinical signs (the more severe, the more chances to be allergic); elevated Tryptase levels in the plasma (indicating mastocyte triggering); and positive skin tests performed one month after the reaction. These new concepts induce important consequences on the way to manage hypersensitivity reactions: be prepared to treat adequately the patient, be prepared to draw blood after the reaction to dose tryptase levels, send the patient to a dedicated allergologist, forget about the preventive role of premedication against severe reactions.

Learning Objectives:

1. To understand what are allergic and non-allergic hypersensitivity reactions.
2. To learn the clinical symptoms according to the Ring and Messmer classification.
3. To understand the importance of tryptase sampling and skin testing in the follow-up.

Author Disclosure:

O. Clément: Board Member; French Society of Radiology.

A-455 14:28

B. Nephrogenic systemic fibrosis: from pathophysiology to recommendations

H.S. Thomsen; Herlev/DK (henrik.thomsen@regionh.dk)

Gadolinium (Gd) belongs to the lanthanides in the periodic table, which all affect collagen. The ability to hold Gd varies from chelate to chelate, non-ionic linear chelates being the weakest binders. Transmetalation (exchange of Gd with another ion, e.g. zinc) leads to NSF, a horrifying very late adverse reaction to some Gd-CM. Since 2007, the various Gd-CM have been classified into 3 groups: high risk (of NSF), intermediate risk and low risk. The authorities have introduced several restrictions on the use of high risk agents which be followed by every physician in EU. The agents are contraindicated in 1) patients with severely reduced renal function including dialysis, 2) acute renal insufficiency, 3) neonates and 4) pregnant women. They may only be used with caution in patients with moderately reduced renal function and children less than 1 year old. There must be at least 7 days between 2 injections in those patients. Renal function must always be determined by laboratory methods before use of high risk agents. Women should stop lactation for 24 h. These agents should never be given in higher doses than 0.1 mmol/kg per examination in any patient. For the intermediate and low-risk agents, the restrictions are significantly less; they should only be used with caution in patients with severely reduced renal function including dialysis. If a physician does not follow these rules, he or she will have legal problems as they have - by the authorities - been introduced into the summary of product characteristics.

Learning Objectives:

1. To understand the underlying pathophysiology.
2. To learn about the clinical implications of the recent recommendations/guidelines.
3. To become familiar with legal issues.

A-456 14:51

C. Contrast medium-induced nephropathy and new guidelines

F. Stacul; Trieste/IT (fulvio.stacul@aots.sanita.fvg.it)

The Contrast Media Safety Committee of the European Society of Urogenital Radiology has updated its 1999 guidelines on contrast medium-induced nephropathy (CIN). Topics reviewed included the definition of CIN, the choice of contrast medium, and the prophylactic measures used to reduce the incidence of CIN. The definition of CIN is a complex topic and understanding of it continues to evolve. The CMSC considered appropriate to keep the definition agreed in 1999. However, nephrologists recently agreed on a new definition. In the previous guideline, a number of risk factors were listed (raised S-creatinine levels, particularly secondary to diabetic nephropathy, dehydration, congestive heart failure, age over 70 years, concurrent administration of nephrotoxic drugs). The significance of these risk factors has been confirmed and new risk factors were added. The CMSC agreed that the risk of CIN is significantly lower following intravenous CM administration and concluded that patients referred for enhanced CT are genuinely at risk if they have an eGFR < 45 ml/min/1.73m². The previous CMSC guideline suggested the use of low or iso-osmolar CM in patients with risk factors for CIN and the CMSC considered that this previous guideline should not be changed. The CMSC considered that there is enough evidence to recommend that either volume expansion with isotonic saline or sodium bicarbonate may be used for preventing CIN in at risk patients, while the efficacy of NAC and other drugs in reducing the incidence of CIN remains unproven.

Learning Objectives:

1. To become familiar with newest guidelines on contrast induced nephropathy (CIN).
2. To understand the future clinical implications of the new guidelines.

Author Disclosure:

F. Stacul: Advisory Board; GE Healthcare. Speaker; Bracco, GE Healthcare.

Panel discussion:

What is the most appropriate radiological approach to patients with falling eGFR and when should contrast media be administered and when should it not?

15:14

14:00 - 15:30

Room L/M

Physics in Radiology

RC 1413

Hybrid imaging systems

Moderators:

D.G. Sutton; Dundee/UK

J. Votruba; Prague/CZ

A-457 14:00

A. Clinical SPECT/CT and PET/CT

T. Beyer; Zurich/CH (thomas.beyer@cmi-experts.com)

Over 16 years ago, Hasegawa (UCSF) and colleagues presented a prototype SPECT/CT-system comprising a clinical SPECT-camera in tandem with a clinical single-slice CT. The combined SPECT/CT was used to perform a small number of clinical studies, such as for quantitative estimation of radiation-dosimetry in brain cancer, whereby the CT data were used also to generate the SPECT attenuation-correction-factors (ACF). Since then, SPECT/CT has benefited a great deal from the advances in CT-technology and several commercial combination designs are available today. The clinical adoption of SPECT/CT in oncology and cardiology has been rapid. The proposal to combine PET with CT was made in the early 1990s by Townsend, Nutt et al. In addition to intrinsic image alignment, the anticipated benefit of PET/CT was to use the CT-images to derive the PET-ACF's. The first clinical prototype-PET/CT became operational in 1998 at the University of Pittsburgh. Since then, PET/CT-technology has grown rapidly by incorporating new concepts of PET and multi-slice CT. Today almost all PET systems are sold with a CT attached with an installed base of over 5,000 PET/CT-systems worldwide. The improvement in accuracy of PET/CT compared with PET or CT for re-staging averages 10-15% across all cancers. Acquisition protocol standardization and cross-specialty training are two of the most important pre-requisites for adopting dual-modality imaging as part of state-of-the-art patient management.

Learning Objectives:

1. To review the origins of SPECT/CT and PET/CT imaging systems.
2. To understand the basic principles and general clinical applications.
3. To speculate on trends in dual-modality PET- and SPECT-based imaging technology.

Author Disclosure:

T. Beyer: Employee; cmi-experts GmbH. Founder; cmi-experts GmbH.

A-458 14:30

B. Clinical MR/PET

G. Antoch; Düsseldorf/DE (antoch@med.uni-duesseldorf.de)

MR/PET imaging has recently been introduced into clinical routine. Apart from addressing technical challenges, such as MR-based PET attenuation correction, potential indications for MR/PET are currently defined. These indications include oncology, neurology and cardiology. Considering oncologic indications, MR/PET is - most probably - not going to replace PET/CT as the workhorse but will rather serve as an imaging modality for specific indications. As an example, the combination of high soft-tissue contrast from MRI coupled with functional data from PET is beneficial in imaging of soft-tissue tumours where local tumour assessment can be combined with whole-body tumour staging in a single session. Indications such as breast tumours or prostate cancer potentially benefit from the combined MR/PET approach and studies evaluating these questions are underway. In neurology and cardiology, functional data from both imaging modalities, MR and PET, may complement one another and this is currently investigated for different indications. This talk will address current indications of MR/PET imaging in the clinic based on the available literature and own experience.

Learning Objectives:

1. To become acquainted with the origins and evolution of MR/PET.
2. To be informed of the current applications.

Author Disclosure:

G. Antoch: Speaker; Bayer Healthcare, Nordion, Siemens.

A-459 15:00

C. Preclinical hybrid imaging

N. Belcari; Pisa/IT (belcari@df.unipi.it)

During the past decade, we have observed a growing interest in in-vivo imaging techniques for small animals. On the shadow of the successful application of dual-

modality imaging in the clinical environment, such as combined PET-Computed Tomography (CT) or SPET/CT, the hybrid imaging modalities have been recently transferred to small animal scanners. Nowadays, the possibility of easy integration of nuclear imaging techniques with other modality such as PET/SPECT/CT or PET/MR or has become a mandatory requirement in the design of small animal imaging systems. The combination of different imaging modalities in the same scanner offers the possibility to perform experiments more effectively than with a single modality only. This is especially true when two modality scans are performed sequentially or simultaneously and without moving the animal. Present technologies for the construction of hybrid systems for small animals will be presented together with examples of commercially available hybrid scanners. Looking at the next future, small animal PET/MR seems to be one of the most appealing perfect choice for hybrid imaging, combining the exquisite sensitivity of PET with the morphological/functional/spectroscopic high-resolution imaging of MR. The present major limitation on the development of simultaneous PET/MR scanners is the non-insensitivity of PMTs to magnetic fields. A reliable solution could be the development of magnetic field insensitive position-sensitive photodetectors. A brief overview of the present status of development of the detector technology for PET/MRI will be also presented.

Learning Objectives:

1. To learn about hybrid imaging tools in animal imaging/pre-clinical research.
2. To understand possible clinical applications.

14:00 - 15:30

Room N/O

Head and Neck

RC 1408

Laryngeal cancer and radiology

A-460 14:00

Chairman's introduction

J.E. Kabala; Bristol/UK (Julian.Kabala@UHBristol.nhs.uk)

Around 89% of laryngeal cancer cases are estimated to be related to the combined effects of alcohol and smoking. The prevalence of these two risk factors strongly influences the incidence of laryngeal cancer. This is highest in Central and Eastern Europe, around 8 per 100,000 population compared to around 5 per 100,000 in Western Europe. The disease is more common in males than females throughout Europe, with the highest ratio where the incidence is highest (around 25 males to 1 female in Lithuania and Portugal) and lowest ratio where the incidence is lowest (around 6 males to 1 female in the UK, France and The Netherlands). The mucosal surface of the tumour is staged by direct inspection. MRI or CT is utilised to assess deep extension of the tumour (e.g. cartilage invasion) and inaccessible sites (e.g. subglottic region). Small localised superficial tumours may be successfully treated with radiotherapy or surgery (including laser excision) alone. Advanced tumours require consideration of radical surgery and radiotherapy. Chemotherapy may modestly improve recurrence-free survival rates at the cost of increased toxicity. Salvage surgery and/or radiotherapy may have some success in the event of recurrence following single modality treatment but usually has a poor outcome if the initial treatment has been combined surgery and radiotherapy. Chemotherapy may deliver a remission of variable duration in some patients. Functional imaging (fMRI, positron emission tomography) has not yet become routinely established; but may ultimately provide some assistance particularly in the challenging imaging situation following intervention.

Session Objectives:

1. To discuss the epidemiology.
2. To learn about the available diagnostic imaging modalities.
3. To become familiar with the available treatment options.

A-461 14:05

A. Staging of laryngeal cancer: pearls and pitfalls

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

Larynx can be analysed by imaging techniques that have some specific strengths but also some limits. MSCT is very fast; it acquires a volume from which the proper view of the structures of interest can be extrapolated. MSCT provides detailed information on mineralised cartilages and fat spaces inside the larynx. The main variant in the examination technique is the time-delay after contrast agent administration (i.e. arterial vs. advanced venous phase). Subtle changes in soft tissues are difficult to detect on MSCT. MR, whose ability in separating tissue and detecting even mild oedematous changes or fibrosis, overcomes this limitation. More variants in the exploration of soft tissue-composition are possible with MR. Besides T2, T1

weighting (and contrast enhancement administration), fat sat and DWI sequences can be used to increase the confidence in differentiating the normal laryngeal soft tissues from neoplasms. MR time-resolution is, surely, its main limit. Ultrasound, though limited by the ossified cartilages walls, may integrate cross-sectional imaging and clear doubts about tumour extra-laryngeal spread or provide a guide to FNAC. When reporting, the radiologist should be aware of the checklist of the key points to address, and should also know how to navigate inside the volume of interest. Clinical findings, anatomic landmarks and tissue-decomposition are critical elements in image interpretation.

Learning Objectives:

1. To become familiar with the typical findings of T1-T4 laryngeal cancer.
2. To learn about the patterns of local nodal involvement.
3. To understand possible imaging pitfalls in staging.

A-462 14:28

B. Evaluation after surgery and non-surgical treatment: expected findings

S. Bisdas; Tübingen/DE (sotirios.bisdas@med.uni-tuebingen.de)

When compared to primary tumour assessment, the effectiveness of cross-sectional imaging is rather limited in the follow-up of laryngeal cancer treated by chemoradiation or surgery. Endoscopic examination is relatively easy and yields a satisfactory accuracy in detecting recurrent disease. Essential requirements for the proper interpretation of the post-treated larynx include knowledge of the initial tumour appearance, the applied surgical technique and/or the (neo)adjuvant chemoradiation therapy. The altered anatomy, the absence of symmetric landmarks and the additional changes in the normal tissue are expected findings, which should not be misinterpreted as residual or recurrent tumour. At the glottic level, the post-therapeutic changes are limited, but the paraglottic spaces may show increased density. Symmetric thickness of the walls of the laryngeal ventricles, the aryepiglottic folds and increased attenuation of the subcutaneous fat with thickening of the neck muscles are most pronounced during the first months after completion of the radiotherapy. On the other hand, variable asymmetric scar tissue with shortening of the larynx and alteration of the contrast-enhancement pattern are seen after conservative surgery. On contrary, total laryngectomy results in a smooth appearance of the neopharynx with symmetric thickness (partly collapsed) and variable enhancement. Possible flap reconstructions present as fat planes running along the neopharynx. Finally, transoral laser excision results in low soft tissue loss with a limited range of changes. Among them, the frequently observed plaque-like lesions without contrast enhancement may be usually attributed to scar tissue.

Learning Objectives:

1. To appreciate the expected imaging findings after surgery of laryngeal cancer.
2. To become familiar with imaging findings after non surgical treatment.
3. To know about the possible imaging pitfalls.

A-463 14:51

C. Cancer recurrence: how to address clinical dilemmas

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

As treatment choices for laryngeal cancer emphasize functional laryngeal preservation if possible, not only accurate staging by imaging for optimal treatment planning is of utmost importance, but also strategies for early identification of recurrences are necessary. Possible treatment options for laryngeal cancer are open or endoscopic surgery, radiotherapy, including intensity modulated radiation therapy (IMRT) or image-guided radiotherapy (IGRT) and eventually added induction or concomitant chemotherapy. Treatment changes will influence the detection of recurrent disease. Curative treatment of recurrent laryngeal cancer will require either conservation laryngeal surgery or total laryngectomy. In this lecture, the diagnostic as well as the therapeutic challenges of local recurrence of laryngeal cancer and/or regional nodal metastases will be discussed. The value and pitfalls of different imaging techniques will be addressed and possible treatment options will be reviewed.

Learning Objectives:

1. To understand the limitations of clinical examination.
2. To appreciate the value of different imaging techniques in the detection of recurrence.
3. To become familiar with the imaging findings of recurrent laryngeal cancer.

Panel discussion:

Diagnostic algorithms for diagnosis and follow-up of laryngeal cancer

15:14

14:00 - 15:30

Room P

Radiographers

RC 1414

Towards advancing and developing the role of radiographers

A-464 14:00

Chairmen's introduction

S. Mathers¹, D. Tscholakoff²; ¹Aberdeen/UK, ²Vienna/AT (s.mathers@rgu.ac.uk)

The tasks and duties performed by radiographers in a modern imaging department are constantly evolving. The main drivers have been i) the relentless development of technology in both the diagnostic and therapy fields and ii) the change in radiographer education leading to a graduate profession. The latter has led to radiographers in some countries such as Netherlands and United Kingdom to develop their roles to carry out tasks which were previously performed by radiologists for example performing ultrasound and musculo-skeletal reporting. One outcome of this process is all imaging staff, including radiographers and radiologists, work together as a team to provide a first class and timely service for patients. Increasingly this change of practice is attracting interest from imaging professionals across Europe. During this session, the history of radiographer role development will be reported and current work practices explained. The need for ongoing research and audit to support this change will be debated and the necessity for robust education and governance to underpin this process will be described. In conclusion, benefits of radiographer's performing these roles will be described from a European perspective, and the contribution of radiographers to a modern health care service will be outlined. This will be supported by the European Federation of Radiographer Societies (EFRS) document which has been developed to explain role development areas which are possible and the education required to carry out these roles. This session will conclude with a panel discussion with opportunities for delegates to ask questions of our expert presenters.

Session Objectives:

1. To appreciate the potential importance of advancing and developing the role of radiographers for the profession and for healthcare.
2. To become familiar with the level of activity across international societies in fostering this.
3. To understand the importance of such role developments meeting real clinical needs.

A-465 14:05

A. The current status: a clinical perspective

C. McLaren; London/UK (clare.mclaren@gosh.nhs.uk)

Career progression in radiography has historically been through management with experienced radiographers leaving behind their clinical role. This loss of senior radiographer skills leaves a gap that can often be difficult to fill. We started to address this issue in the interventional radiology (IR) service at Great Ormond Street Hospital in 2001. Our aim was to change the career structure for radiographers in IR, make the job more appealing, improve staff retention, and to develop skills that radiographers have, but don't always get the chance to use. The role of clinical specialist radiographer in IR has developed alongside that of nurses. The areas of role extension were chosen to suit a radiographer's skills and knowledge of fluoroscopy and imaging parameters. Initially, these included airway and oesophageal intervention and angiography. For this role to work well, you need a dedicated radiographer. New skills are required, for example, gaining patient consent for procedures and presenting imaging findings at multi-disciplinary team meetings. All aspects of IR are included in this role, including pre- and post-operative ward visits and reporting. This role was fully supported by the IR consultants and most senior consultants in the hospital, but did meet with initial opposition from some staff. We have implemented dedicated operating lists for procedures undertaken by the clinical specialist radiographer and thereby streamlined the patient pathway.

Learning Objectives:

1. To become familiar with the current status from the perspective of a radiographer in an advanced practice in a paediatric interventional role.
2. To understand the key factors that facilitate this advanced role, as well as the challenges faced during implementation.
3. To become familiar with the impact that this advanced role has had on patient care, interprofessional relationships and service delivery, in one institution.

A-466 14:28

B. The importance of evidence-based practice for the future of advanced practice in radiography

A. England; Liverpool/UK (aengland@liverpool.ac.uk)

Advanced radiographic practice has dominated discussions within the radiographic profession for over a decade. Within the UK, advanced practitioner roles are now well established and continue to develop. With the number of advanced practitioners steadily growing, there are increasing demands on training and education. With advancements in practice questions have arisen regarding the need for evidence to prove competency, effectiveness and from which to base recommendations for future practice. In the first half of the millenium, there were a series of reports providing comparative data on the accuracy of radiographers undertaking advanced practice, e.g. barium enema investigations or plain radiographic reporting. Such studies generally provided a comparison against the current standard, a report or examination by a radiologist. Such comparisons can carry limitations as they were rarely multicentre in design and the true status of the patient was often unknown. Training schemes were also highly heterogenous, they may have been in-house, via short courses or as part of validated post-graduate degree programme. It was often difficult to apply published research findings locally and gain unequivocal support from our radiology and clinical colleagues. Questions have also arisen as to what role research evidence of past radiographic performance plays in driving future developments. This may be by expanding into new areas or the more widespread role out of existing practices nationally or internationally. This paper aims to discuss these issues and the likely contribution of evidence-based practice in carving out the future of radiographic advanced practice.

Learning Objectives:

1. To become familiar with examples of evidence-based practice in the area of advanced practice and role development in radiography.
2. To understand the importance of such an evidence-based approach when considering the introduction of advanced roles in a clinical setting.
3. To gain an insight into the education and training requirements for advanced practice and role development.

Author Disclosure:

A. England: Employee; University of Liverpool. Research/Grant Support; National Institute for Health Research.

A-467 14:51

C. The view from the European level

G. Paulo; Coimbra/PT (graciano@estescoimbra.pt)

Technological evolution and new scientific developments have driven health care sector towards an unprecedented increase of its organizational complexity. One of the major contributors for that increase was, without doubt, the influence of medical imaging technology development. This change of paradigm is obviously a key driver for a (r)evolution in the daily practice of radiographers, because the radiographer is the ultimate interface between 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. To develop a profession, it is mandatory to develop the field of knowledge related to it. Evidence-based radiography practice is one of the best ways to achieve this desideratum, because it integrates the best research evidence with clinical knowledge and expertise, addressing the patient in a holistic way. It is necessary to build bridges between radiographer education institutions and clinical environments, combining efforts and promoting collaboration between radiographers from the academic and the clinical field. Radiographer role development and advanced practice is mandatory to develop more cost-efficient and cost-effective health systems. This is one of the most important pillars in the EU, once these systems are considered to be a central component of the Union's high levels of social protection and contribute to social cohesion and social. Radiographer advanced practice will definitely contribute to increase medical imaging department's workflow, decrease patient waiting time, allowing earlier diagnosis, decrease length of hospital stay and therefore decreasing health expenditure, contributing to economical growth.

Learning Objectives:

1. To understand the influence of evidence-based practice on the future of the radiography profession in Europe.
2. To become familiar with the advantage of advanced practice and role development in radiography in health systems.
3. To understand the benefits of advanced practice and role development in radiography for the patients.

Panel discussion:

How to use the EFRS guidance document on role development

15:14

14:00 - 15:30

Room Q

Paediatric

RC 1412

Paediatric emergencies

Moderator:

V. Donoghue; Dublin/IE

A-468 14:00

A. The acute non-traumatic neurological patient: CT or MRI?

E. Vázquez; Barcelona/ES (evazquez@vhebron.net)

Neurological deficits in children are an urgent condition that depends significantly on imaging for a prompt accurate diagnosis because significant overlap is present in clinical history, presentation and neurological examination. There are five major clinical categories of non-traumatic neuroemergencies: focal neurological deficit, headache, increasing confusion, visual progressive deficit and progressive myelopathy. Different imaging modalities, such as ultrasound (neonates and infants), computed tomography (CT) or magnetic resonance imaging (MRI) are utilised dependent on age of the patient and neurologic symptoms. The purpose of the present lecture is to discuss the causes and imaging appearance of acute neurological conditions in childhood, broadly categorised into stroke and stroke-mimics (infection, inflammatory demyelination, metabolic disorder, cerebral neoplasms or drug poisoning). A review of the main indications to perform a neuroimaging procedure in these children will be undertaken as well as a differential diagnosis based on representative cases selected from the daily routine in a paediatric tertiary hospital. Practical algorithms with the preferential use of either CT or MRI will be developed for each section. CT continues to be the first imaging modality in these patients with acute clinical presentations in many centers because it does not require sedation, even there is an accompanying radiation. MR imaging is nowadays better for imaging these children owing to the saved radiation, the more complete provided information and the useful advanced techniques that can be used, such as diffusion imaging (DI), spectroscopy, arterial spin labelling (ASL) or susceptibility-weighted imaging (SWI).

Learning Objectives:

1. To learn about the currently limited role of CT in the non-traumatic acute setting.
2. To become familiar with radioprotection strategies and protocols adapted to children.
3. To consolidate the role of MRI as the modality of choice for acute non-traumatic neurologically ill children, with an emphasis on newer techniques.
4. To become familiar with imaging findings and the main differential diagnosis of acute neurological conditions in children.

A-469 14:30

B. Imaging of acute chest pain and/or distress in children

C.E. de Lange; Oslo/NO (clange@ous-hf.no)

Acute chest pain in children is a common complaint in the emergency department, but patients rarely present with significant distress or life-threatening symptoms requiring immediate care or resuscitation. The most frequently reported cause is benign musculoskeletal pain followed by respiratory and gastrointestinal causes, while cardiac causes are less frequent. A thorough clinical history and careful physical examination will determine in most cases, the patients in need of further investigation to establish a diagnosis. In this regard, radiology plays an important role, especially in the emergency setting in patients with more serious associated symptoms like acute breathing difficulties, swallowing problems, fever or sepsis. When choosing the appropriate technique for investigation, the consequences of radiation exposure in children must be considered. Plain radiography and fluoroscopy still remains the most important and frequently used tool to gain information on various acute chest/pulmonary problems. Ultrasonography is the first choice for diagnosis/ treatment of pleural effusions. Multidetector computed tomography and magnetic resonance imaging are mainly used for investigating pulmonary / mediastinal masses and congenital abnormalities of the great vessels and the lungs. This lecture will discuss the choice of imaging technique and urgency of radiological management depending on the symptoms and age of the patient. The imaging characteristics of the different causes of acute chest pain and/or distress in children will be reviewed, represented by the more common conditions involving the chest wall, respiratory tract, oesophagus and the heart, as well as less frequent causes such as tumours, manifestations of congenital malformations and non-accidental trauma.

Learning Objectives:

1. To understand the role of radiographs, US, CT and MRI.
2. To become familiar with the most common conditions that cause acute chest pain and/or distress in children.
3. To appreciate the different differential diagnoses, depending on the age of the patient.
4. To understand the consequences of delaying in their diagnosis and treatment.

A-470 15:00

C. The role of the interventional radiologist in paediatric trauma

J.B. Karani; London/UK (johnbkarani@hotmail.com)

Outcome data from trauma series have demonstrated improved patient survival by the prompt diagnosis of the range of injuries and the recognition of life-threatening sequelae, principally that of active arterial haemorrhage. Widely used trauma scoring systems are applicable in the paediatric population although often the mechanisms and combination of injuries may differ from those encountered in adults. A CT diagnosis of active haemorrhage demands early operative or non-operative intervention with embolisation or use of alternative endovascular techniques including delivery of vascular stents. This principle is applicable to blunt or penetrating liver, splenic, renal or pelvic trauma. It is also applicable in some cases to severe mediastinal vascular and limb trauma. Important caveats are firstly the use of CT in an overall trauma service and avoidance of any inappropriate irradiation. Second, in paediatric interventional practice due regard needs to be given to delivery of implantable devices that may have adverse sequelae in later life. Nevertheless the demand for immediacy in intervention may outweigh any such consideration. This presentation will summarise the importance of CT technique and intervention in both the early and the delayed sequelae of trauma with an emphasis on abdominal and thoracic trauma.

Learning Objectives:

1. To understand the role of CT, CTA and conventional angiography in the diagnosis of traumatic vascular complications.
2. To understand the importance of vascular and non-vascular intervention following trauma in children.

14:00 - 15:30

Room Z

Special Focus Session

SF 14c

Advances in forensic radiology

A-471 14:00

Chairman's introduction

G. Guglielmi; Foggia/IT (g.guglielmi@unifg.it)

Post-mortem Computed Tomography has been recognised as a powerful technique to assist forensic pathologists in their post-mortem investigation. In particular, CT has proven to be useful in the recognition of bone structure, the detection of embolisms and the diagnostic of gross abnormalities of soft tissues. On the other hand, CT scan without injection of contrast agent cannot provide information about abnormalities of the vascular bed of the viscera and lesions of the vascular system. In order to investigate post-mortem vascular system, a standardised CT-angiography is necessary. It consists in the acquisition of one native scan and three angiographic phases during the perfusion of the body established with a mixture of paraffin oil and a specific oily contrast agent injected through the cannulation of the femoral artery and vein by means of a device reproducing perfusion conditions in analogy to living patients. Based on post-mortem MDCT studies, a new approach has been developed called virtual anthropology. In some cases of unidentified bodies, positive identification of the deceased can be obtained by adopting comparative or reconstructive criteria. These approaches permit assessment and determination of some important anthropological parameters: racial phenotype, age at death, sex and stature. More recently, MRI has been used to augment forensic investigation with an outlook into post-mortem studies applied on musculoskeletal, cardiovascular and angiographic fields and in forensic imaging of the living, such as cases of child abuse, survived strangulation and age estimation.

Session Objectives:

1. To become familiar with the role of imaging in forensic pathology.
2. To learn how the use of a contrast medium may help the native scan to recognise vascular lesions.
3. To learn about the possibilities of MDCT in anthropological identification.

A-472 14:05

Imaging in forensic medicine

M. Thali; Zurich/CH (michael.thali@irm.uzh.ch)

Over 15 years ago, the Virtopsy Project with its systematic integration of various technologies and modalities, such as photogrammetric 3D surface scanning, computer tomography and magnetic resonance scanning as well as in the area of clinical and post-mortem forensic medicine as well as post-mortem biopsy and angiography was perceived by professional circles as being revolutionary. After a decade, these technologies have been integrated as an evolutionary process development in daily forensic practice. The almost completed documentation procedure in the post-mortem area has also influenced future image-based documentation and analysis processes in clinical forensic medicine.

Learning Objectives:

1. To learn why imaging methods are becoming essential modalities in forensic medicine.
2. To become familiar with the modalities that can be used in forensic imaging.
3. To learn what the future developments in forensic radiology and imaging will be.

A-473 14:23

Advances in post-mortem CT angiography

S. Grabherr; Lausanne/CH (Silke.Grabherr@chuv.ch)

Performing a postmortem, MDCT-scan has become routine in some forensic institutes, especially in Switzerland. In order to investigate the vascular system, different techniques of post-mortem CT-angiography have been tested. Multi-phase post-mortem CT-angiography (MPMCTA) is a recently developed standardised technique which allows investigating the vascular system of human bodies similarly than in clinical CT-angiography. It consists in the performance of one native CT-scan and three angiographic phases (arterial, venous and dynamic phase). Data acquisition is performed after and during the perfusion of the body with a mixture of paraffin oil and the oily contrast agent Angiofil via a special perfusion device called Virtangio. Different studies have already proofed that the use of this method increases the sensitivity of the radiological exam significantly, especially concerning the detection of lesions of the vascular system and soft tissue. Depending on the findings, the sensitivity of the post-mortem CT-angiography is even higher than the one of conventional autopsy. Therefore, the performance of pre-autopsy MPMCTA has already become a new gold standard, especially in cases in which the source of a haemorrhage should be detected or a modified vascular anatomy is the result of a surgical intervention. However, there are still some diagnoses that have to be confirmed by conventional autopsy. In order to investigate the limits and advantages of post-mortem CT-angiography, an international working group has been created in 2012. The aim of this group is also to create recommendations for the indication of the exam and for the interpretation of the images.

Learning Objectives:

1. To consolidate knowledge of the advantages and limits of post-mortem CT angiography.
2. To understand the method of multi-phase post-mortem CT angiography and the indication for its performance.
3. To become familiar with the objectives and latest achievements of the Technical Working Group of Post-mortem Angiography Methods (TWGPAM).

Author Disclosure:

S. Grabherr: Research/Grant Support.

A-474 14:41

Virtual anthropology and forensic identification using MDCT

F. Dedouit; Toulouse/FR (fabded2@hotmail.com)

The applications of Multi Slice Computed Tomography (MSCT) in anthropology, paleoanthropology, bioarchaeology and paleopathology are grouped under the term paleoradiology. In recent years, a new approach has been developed called virtual anthropology, based on post-mortem MSCT studies. In some cases of unidentified bodies, both investigations can be carried out simultaneously through a single MSCT acquisition. The first analysis identifies causes of death, possible pre-existing disease processes and non-lethal abnormalities, while the second detects criteria potentially useful for positive identification of the deceased, based on comparative and reconstructive identification criteria. The comparative reconstruction is based on detection of surgical material, variants of normal radiological appearances, and pre-existing abnormalities whether congenital or acquired (permitting a complete paleopathological study), and ante-mortem MSCT images can be compared with post-mortem images. Reconstructive identification is based on two main approach-

es: the use of criteria and characteristics specific to MSCT, or the transposition of techniques used on dry bones in physical anthropology. It permits assessment and determination of some important anthropological parameters: racial phenotype, age at death, sex, stature. MSCT has many advantages over dry bone analysis: one of its major assets in forensic anthropology is the elimination of lengthy bone preparation, which may sometimes cause anatomical damage, especially when bone is already fragile (high useful when bones are very burned or charred). MSCT presents numerous inherent advantages over plain x-rays, in particular the ability to provide three-dimensional information. Post-processing allows segmentation of an individual bone, which can be highly useful for its analysis.

Learning Objectives:

1. To learn about the different paleo-pathological diagnoses and anthropological identification of bone lesions with MSCT.
2. To learn about the possibilities of MSCT for comparative identification.
3. To understand reconstructive identification and the main techniques useful for age-at-death assessment and sex determination.

A-475 14:59

Forensic MR imaging

T.D. Ruder; Zurich/CH (thomas.ruder@irm.uzh.ch)

Over the last decade, forensic imaging underwent enormous expansion and in many institutes across the world, pre-autopsy post-mortem CT or MR is now standard practice. Currently, CT is more widely used than MR in forensic imaging due to examination time constraints, limited access to MR scanners, and the complexity of MR technology. Nevertheless, MR imaging can be of great utility in forensic investigations. This lecture provides a summary of forensic applications of MR imaging. This includes an introduction to normal post-mortem findings on MR, such as posterior fluid sedimentation and temperature-dependent alterations of image contrast; a discussion of post-mortem musculoskeletal MR imaging in trauma cases, an outline of the current state-of-the-art in post-mortem cardiac MR with special emphasis on myocardial infarction; an overview of post-mortem MR angiography; and finally a synopsis of current applications and research efforts in forensic MR in living subjects, such as child abuse, survived strangulation and age estimation.

Learning Objectives:

1. To learn about typical post-mortem alterations in MR imaging.
2. To become familiar with application of MR imaging in the post-mortem setting.
3. To understand the added value of post-mortem cardiac MR in cases of cardiac death.

Panel discussion:

Which imaging technique for which forensic scenario?

15:17

16:00 - 17:30

Room A

Interactive Teaching Session

E³ 1520

Thoracic emergencies

A-476 16:00

A. Vascular

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

Based on representative cases, we will review the main causes of thoracic non-traumatic vascular emergencies (acute aortic syndrome, pulmonary thromboembolism and haemoptysis); MDCT angiography has become the first-line imaging test for the diagnosis of these entities. As acute aortic disease is the most common fatal condition in patients with chest pain, prompt recognition and treatment is of paramount importance, we will review the spectrum of acute aortic pathology focusing on the distinctive findings of each entity (classic dissection, intramural haematoma, and penetrating aortic ulcer) and upgrading the clues for their diagnosis. Acute pulmonary embolism (PE) remains a common clinical challenge. MDCT pulmonary angiography has become the first line imaging study in the diagnosis of PE because of its speed, accuracy, low-interobserver variability, and ability to provide alternative diagnoses. We will review the role of MDCT in the evaluation of acute thrombotic PE: findings of acute PE (including how to evaluate the severity of an episode of PE at CT pulmonary angiography), some potential pitfalls as well as some of the controversies in imaging young and pregnant patients. Massive haemoptysis is a life-threatening condition that is associated with a high mortality rate. Haemoptysis usually involves bleeding from the bronchial arteries or, less frequently, from non-bronchial systemic arteries. Haemoptysis of pulmonary arterial origin is

rare, estimated at less of 10% of haemoptysis cases. MDCT angiography permits noninvasive, rapid, and accurate assessment of the cause and consequences of haemorrhage into the airways and helps guide subsequent management.

Learning Objectives:

1. To become familiar with the main causes of thoracic vascular emergencies.
2. To understand the role of MDCT angiography in thoracic emergencies.
3. To learn about the radiological signs in vascular thoracic emergencies and its impact on the management of these patients.

A-477 16:45

B. Pulmonary

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

Acute respiratory failure can have multiple underlying causes including infection, fluid overload, immunological diseases or exacerbation of pre-existing lung disease. Since the clinical symptoms are nonspecific, imaging plays an important role. The first imaging method is mostly the chest radiograph, easy to access and to obtain, but non-diagnostic in many cases. (HR)CT offers more possibilities to define the differential diagnosis. Option of this interactive workshop will be to get familiar with the spectrum of diseases that can cause acute respiratory failure and learn about key findings in radiography as well as CT to reduce the differential diagnosis. The interaction between preexisting lung disease, clinical information (e.g., chemotherapy, rheumatoid arthritis, COPD) and imaging findings will be discussed by clinical case studies. Emphasis will be put on the patient on "intensive care". Options but also limitations of imaging findings will be illustrated.

Learning Objectives:

1. To learn about the role of imaging in severe attacks of obstructive lung disease.
2. To become familiar with direct and indirect signs of pleural disease causing respiratory failure with special emphasis on the intensive care patient.
3. To learn about imaging features that are helpful for the differential diagnosis of pulmonary consolidations causing respiratory failure.
4. To understand the interaction of comorbidity, age and extent of pulmonary disease resulting in severe respiratory failure and the role of imaging in it.

16:00 - 17:30

Room B

GI Tract

RC 1501

CT colonography: when the 'new' becomes 'ordinary'

A-478 16:00

Chairman's introduction

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

CT Colonography (CTC) is a well-established modality for colonic imaging, already implemented in several diagnostic-imaging departments worldwide. In order to be competitive and to fulfill clinical requirements, radiologists should provide an high-quality service. State-of-the-art techniques should be used to maximize diagnostic performances, to improve patient comfort and to minimize potential risks. The 2012 ESGAR Consensus will be presented and discussed in order to provide the attendees with the newest information on CTC techniques, including bowel preparation, fluid/faecal tagging, colonic distention, scanning protocols and reading approaches. A second important issue is the organization of the service. Radiologists interested in CTC should be aware of how to start a service. This means to be informed about marketing strategies to general public and other physicians (i.e. gastroenterologists, primary care physicians, etc). as well as about the additional tools needed to successfully run and to improve a CTC service. Concepts of quality control in CTC will be introduced and known data about quality issues in CTC will be presented. The main objective at this time is the definition of possible metrics for assessing quality in CTC: some parameters will be derived from those experimented and currently used for conventional colonoscopy, but some others, completely different and specifically tailored for CTC should be created ex-novo. Finally, it is important to establish good relationships with gastroenterologists, since most of the goals are common. CTC and colonoscopy are, in fact, complementary techniques and the joint use of both the techniques will result in a clear benefit for our patients.

Author Disclosure:

A. Laghi: Speaker; Bracco, General Electric Healthcare, Im3d.

A-479 16:05

A. State-of-the-art techniques in 2013

T. Mang; Vienna/AT (thomas.mang@meduniwien.ac.at)

Computed tomographic colonography (CTC) is a reliable technique for the detection and classification of neoplastic and non-neoplastic lesions of the colon. It is based on a thin-section CT dataset of the cleansed and gas-distended colon, acquired in the prone and supine positions. Tagging of faecal residuals with orally administered contrast media is generally recommended. For screening CTC, low-dose CT scanning protocols without IV contrast should be used. For diagnostic CTC, the use of IV contrast media and standard dose protocols for one scanning position is recommended for the evaluation of extra-colonic organs, particularly in patients with known colorectal cancer. Although CTC is considered to have a high safety profile, there could be a very small risk for complications such as perforations, bleeding, or cardiac events associated with the procedure. The risk can be minimized by adhering to recommended technical standards. Two-dimensional and three-dimensional views are used, in combination, for image interpretation. Colonic findings are characterised by their morphology, by their attenuation characteristics and by their mobility. Knowledge of the CTC imaging features of common colonic lesions and artifacts is necessary to characterise findings and to avoid pitfalls. Computer-aided detection (CAD) algorithms automatically highlight polyp "candidates," based on morphologic criteria. Used as a second reader, CAD has been shown to reduce the number of perceptual errors by pointing out possible abnormalities that might otherwise have been missed. CAD should be applied by radiologists only after they have been sufficiently trained in unassisted evaluation of CTC and the use of CAD.

Learning Objectives:

1. To become familiar with an optimised technique and how it can be optimised for specific patient groups.
2. To briefly describe basic interpretation and the role of CAD.
3. To understand the most common interpretative pitfalls and potential complications, and how they can be avoided.

A-480 16:28

B. How to set up a service

P. Lefere; Roeselare/BE (radiologie@skynet.be)

Implementation of CT colonography (CTC) is a complicated and delicate process, requiring consideration of several aspects. First, there is a need of intensive training, covering both the technical approach of CTC and the different aspects of interpretation. CTC workshops (ESGAR) are being organised since many years throughout Europe. They play a crucial role in the basic learning process by dealing with the several technical aspects and challenges of interpretation. They also allow for a personal contact with the international CTC-faculty. More recently, advanced workshops for experienced CTC-radiologists are being organised allowing for refinement of existing knowledge. As part of the learning process, independent double reading is a valuable option in the start up to avoid false-negative and false-positive findings, to refine the lessons learned during the workshops and to deal with difficult cases. Efficient CTC-implementation also relies upon the smooth performance of an experienced and well-organised CTC-team, consisting of administrative workers, radiographers and radiologists. The goal is to offer a patient-friendly and efficient diagnostic work up to both the patient and the clinician in a cost-effective way. Rigorous adoption of indications and contra-indications of CTC is a very important part of this process. Different approaches are necessary according to the patient or suspected pathology. At the end, the barium enema should be considered obsolete and totally replaced by an efficient combination of CTC and other imaging options, such as ultrasound, regular abdominal CT, and MR imaging. This lecture will present the options for CTC implementation in flow charts.

Learning Objectives:

1. To appreciate the need for training prior to CTC and understand the role of training courses and double reporting.
2. To become familiar with ways of maximising service efficiency, including cost effectiveness, and how best to replace the barium enema.
3. To appreciate the differences in approach from setting up a service for older symptomatic patients to setting up colorectal cancer screening.
4. To learn a basic audit framework.

Author Disclosure:

P. Lefere: Board Member; Co-founder of Virtual Colonoscopy Teaching Centre. Other; Collaboration for education in CTC with Bracco, Vital Images (Toshiba) and iCAD.

A-481 16:51

C. Interaction with gastroenterologists: friends or enemies?

A. Graser¹, C. Hassan²; ¹Munich/DE, ²Rome/IT
(Anno.Graser@med.uni-muenchen.de)

CT colonography is ready to be used on a larger scale. The examination is well accepted by patients and provides accurate depiction of the large bowel. It has a high sensitivity in the detection of relevant polyps and may help to pre-select patients who need to undergo subsequent colonoscopy for resection of such findings. However, conflicts of interest may exist between radiology and gastroenterology as they now "compete" for the same patients. This presentation will discuss political issues involved in one modality being used by different subspecialties. It will also focus on ways to create fruitful cooperations, communicate findings, recommend further tests and follow-ups, and unite the forces of both disciplines in order to benefit our patients. Indications to CT colonography and colonoscopy will also be discussed. Participants in the session will learn about when and how to best use CTC, and when to refer patients to colonoscopy.

Learning Objectives:

1. To understand what the gastroenterologists wants to know when referring their patients for CTC in both symptomatic and screening patients.
2. To learn how to formulate local polyp reporting guidelines and how best to integrate the service with the needs of patients.
3. To propose the most effective method for integrating endoscopic and CTC services, minimising competition and maximising cooperation.

Author Disclosure:

A. Graser: Advisory Board; Pfizer Pharma. Consultant; Siemens AG Healthcare. Grant Recipient; Bayer Healthcare. Speaker; Siemens AG Healthcare, Bracco AG.

Panel discussion:

How to create an efficient CTC team?

17:14

16:00 - 17:30

Room C

Urogenital Imaging

CC 1521

Paediatrics

Moderator:

M. Claudon; Vandoeuvre-lès-Nancy/FR

A-482 16:00

A. Imaging strategies for children: urinary tract infection and vesico-ureteral reflux

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

UTI is a common query in paediatric urology. As treatment strategies based on new insights into pathophysiology have changed, the role of imaging had to be revised. The imaging algorithm, techniques and some examples of common findings in childhood UTI will be presented in the light of this new concept and imaging potential; particularly age-related aspects and different strategies ("bottom-up" vs. "top-down" approach) are discussed. Infants and children with UTI are commonly primarily assessed by ultrasound (US). A dedicated detailed US study in a well-hydrated patient including post-void assessment often answers all queries necessary for managing, particularly if Power Doppler and contrast-enhanced voiding urosonography for assessment of vesico-ureteric reflux (VUR) are applied. Urinary tract malformations, signs for upper tract involvement, complications and even (indirect signs for) VUR can be reliably assessed in most cases. Only for evaluation of scarring (and equivocal US findings) DMSA scintigraphy and increasingly MRI - also for assessment of sonographically insufficiently addressable complications - are used. Voiding cystourethrography (VCUG) remains the gold standard for VUR assessment, particularly if a functional modified technique is applied and ce-VUS is not available. However, as VCUG is invasive with considerable radiation burden, thorough justification and patient selection is mandatory. CT (and IVU) are used only exceptionally, most commonly for the work-up of UTI complicated by or associated with childhood urolithiasis, or for complications and differential diagnosis if MRI is not available.

Learning Objectives:

1. To learn about the information provided by ultrasonography, MRI and nuclear medicine examinations.
2. To become familiar with the technique and indications for micturating cystourethrography and contrast-enhanced voiding urosonography.

3. To become familiar with an imaging algorithm for diagnostic approaches, and different strategies.

A-483 16:20

B. Paediatric adrenal tumours

P.-H. Vivier; Rouen/FR (pierre-hugues.vivier@chu-rouen.fr)

Adrenal lesions may occur as a result of neoplasms, haemorrhage, infection, or cysts. Adrenal masses in children may present with an asymptomatic adrenal mass lesion, an endocrinopathy, a hypertensive or metabolic crisis or a paraneoplastic syndrome. Neuroblastoma is the most common extracranial solid neoplasm in children, accounting for 10% of all paediatric neoplasms, and 15% of all childhood mortality from neoplasms. The median age at diagnosis is about 16 months, and 95% of cases are diagnosed by 7 years of age. It may be seen also antenatally or in the newborn period. About half of the patients have metastatic disease at diagnosis. Ultrasound is usually the first imaging examination performed. Extension assessment requires ¹²³I-MIBG-scintigraphy, chest x-ray and abdominal CT or MRI. Fluorodeoxyglucose positron-emission tomography is useful in neuroblastomas which fail to or weakly accumulate mIBG. Proper terms allow correct staging according to the 2011 Consensus Report from the International Neuroblastoma Risk Group. Two stages of localised disease are differentiated on whether image-defined risk factors (IDRFs) are or are not present. IDRFs are features detected with imaging at the time of diagnosis. Less aggressive medullary tumours include ganglioneuroblastoma, ganglioneuroma and pheochromocytoma. Neoplasms that arise from the adrenal cortex are rare in children and include adrenocortical carcinoma and adenoma.

Learning Objectives:

1. To become familiar with the different adrenal tumours in paediatrics.
2. To learn how imaging can help in differentiating neuroblastoma from Wilm's tumour.
3. To understand the value of adequate examinations for the initial workup of adrenal tumours.

A-484 16:40

C. Prenatal detection of GU diseases

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

During this course, the participants will learn how to evaluate the fetal GU tract in utero; the criteria used in order to diagnose GU malformation will be detailed and illustrated. The in utero management of uropathies will be explained. Also, the importance of MR imaging as a complementary examination will be discussed. The role of imaging in counselling parents will be explained. Furthermore, the postnatal work-up will be addressed and the potential role of each imaging examination will be evaluated leading to a standardised approach. Finally, the rationale of this management will be discussed in the light of up to date scientific data.

Learning Objectives:

1. To learn how to assess the diagnostic criteria of foetal uropathies.
2. To learn how to apply a standardised post-natal approach.
3. To understand the rationale behind a standardised approach.

A-485 17:00

D. Interactive case discussion

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

16:00 - 17:30

Room D1

CLICK (Clinical Lessons for Imaging Core Knowledge): Never without Arteries

CC 1518

When every step counts: imaging and management of peripheral arterial occlusive disease (PAOD)

Moderator:

J.F.M. Meaney; Dublin/IE

A-486 16:00

A. Clinical considerations

M. Schillinger; Vienna/AT (m.schillinger@imed19.at)

Indications for interventional treatment of peripheral artery disease mainly depend on clinical considerations. Precise knowledge on patients' clinical background,

therefore, is crucial. The following issues have to be considered: a. clinical stage of peripheral artery disease. This mainly includes the differentiation between patients with intermittent claudication and critical limb ischaemia. Interventional revascularization is an option for patients with intermittent claudication, it is a must for patients with critical limb ischaemia. b. Knowledge on patients comorbidities are essential in estimating the potential risk of any interventional procedures, this includes cardio-pulmonary comorbidities, renal disease, thyroid disorders and disorders of coagulation. c. Patients concomitant medication has to be considered to decide whether peri- and post-procedure standard medication can be used. In conclusion, clinical considerations have to be carefully evaluated prior to all interventional vascular procedures in patients with peripheral artery disease.

Learning Objectives:

1. To become familiar with clinical diagnosis and classification of peripheral arterial occlusive disease.
2. To learn about the most important clinical differential diagnosis.
3. To learn about the importance of imaging for treatment decision-making and planning.

A-487 16:30

B. Imaging techniques and typical findings

T. Leiner; Utrecht/NL (t.leiner@umcutrecht.nl)

Both CTA and MRA are highly valuable non-invasive imaging techniques in the clinical management of patients with peripheral arterial occlusive disease. This part of the refresher course will focus on the role of CTA and MRA in the diagnostic and interventional pathway of patients with suspected peripheral arterial occlusive disease, i.e. indications for imaging. The presentation will discuss relevant technical developments in CT and MR technology that facilitate routine high-quality imaging studies. In addition, the most commonly used imaging protocols will be discussed as well as the relative merits and shortcomings of CTA and MRA in specific patient populations. Furthermore, typical findings and relevant literature and guidelines as well as clinical recommendations will be reviewed with regard to evidence of clinical utility of both techniques.

Learning Objectives:

1. To learn about state-of-the art MR angiographic imaging of the peripheral arteries (including modern non-enhanced techniques).
2. To learn about state-of-the art CT angiographic imaging of the peripheral arteries (including modern dose-saving techniques).
3. To become familiar with the appropriate selection of the right patient for the right imaging test.

Author Disclosure:

T. Leiner: Grant Recipient; The Netherlands Organisation for Health Research and Development. Research/Grant Support; My department receives research support from Philips Healthcare, Bracco, Bayer Healthcare. Speaker; Philips Healthcare, Bracco, Bayer Healthcare, GE Healthcare, Lantheus Medical.

A-488 17:00

C. Interactive case discussion: how to deal with the results? Typical cases, pitfalls, and what is next?

L.P. Lawler; Dublin/IE (llawler@mater.ie)

Suitably skilled diagnostic and interventional radiologists, with an interest in cardiovascular disease, are a major healthcare asset with a potential large contribution to make to the public health challenge of PAOD. Contemporary high-quality invasive and non-invasive 2D and 3D angiographic studies are user-friendly for display, distribution and interpretation. However, radiologists must seek to provide a 'value-added' that is above and beyond simple descriptors of the images produced. Open and endovascular algorithms for PAOD are relatively straightforward and uniform but the imaging studies should seek to align themselves with local practice actively guide the patient selection and therapeutic approach. Similarly, the radiologist needs to be versed in the post-surgical appearances and the report narrative should reflect the local vernacular of practice. When available through EPR and PACS comprehensive reports seek to reconcile ABIs, Doppler, CTA, MRA and DSA studies in a succinct conclusion that guides management and problem solving. Furthermore, we need to be insightful to the comparative advantages and limitations of each modality to avoid pitfalls in interpretation. In this presentation, I shall seek to illustrate and discuss a multimodality and multidisciplinary approach. There will be case discussion including all modalities, optimal imaging protocols and 3D processing. A range of therapeutic interventions and post-operative appearances will be addressed including features of complications. I hope to communicate an approach which acknowledges the central role of radiologists in the modern care pathway of PAOD.

Learning Objectives:

1. To become familiar with typical cases illustrating the role of different imaging modalities in the diagnosis and differential diagnosis of PAOD.
2. To consolidate knowledge of the selection of the appropriate imaging technique, image interpretation and image based treatment recommendation.
3. To understand the needs and principles in modern multidisciplinary management of PAOD.

16:00 - 17:30

Room D2

Oncologic Imaging: Follow-up of Systemic and Local Therapies

CC 1519

Follow-up of thermal ablation (part II)

Moderator:

P.L. Pereira; Heilbronn/DE

A-489 16:00

A. Follow-up imaging of thermal ablative therapies for lung tumours

A.R. Gillams; London/UK (alliesorting@gmail.com)

Routine imaging follow-up uses pre- and post-contrast enhanced CT with comparison to previous imaging. Factors assessed include size, shape, density, cavitation and enhancement. The normal ablation zone initially increases in density and may increase a little in size but after 3 months consistently reduces in size. An increase in the size of the ablation zone, a change in the shape of the ablation zone indicating an increase in one area, or the development of nodular enhancement, > 10 HU, indicates local tumour progression. Early diagnosis provides the best opportunity for re-treatment and long-term tumour control. A baseline CT study is required within the first 4-6 weeks post ablation. Thereafter, routine interval scanning is at 2-4 month intervals depending on the aggressiveness of the cancer, e.g. primary lung, melanoma and most sarcoma metastases require two monthly assessment. Colorectal metastases are assessed three monthly, more indolent tumours may be scanned 4 monthly. Delayed complications include pneumothorax, effusion and infection. CT features of infection are enlargement of the ablation zone which may fill with fluid containing pockets of gas, the development of smooth rim enhancement and oedema in the surrounding parenchyma. Infected cavitating ablation zones, like other chronic infective cavitating lesions, may recruit a systemic collateral circulation and this can result in large volume haemoptysis. Some authors recommend PET-CT but this modality is poor at detecting small volume disease and carries a heavy financial and radiation burden. It does have an advantage in assessing the significance of borderline hilar and mediastinal lymphadenopathy.

Learning Objectives:

1. To consolidate knowledge of imaging aspect of successful ablation.
2. To become familiar with the main pitfalls of post-ablation imaging.
3. To learn about the imaging aspects of most common complications.

Author Disclosure:

A. R. Gillams: Speaker; CoVidien.

A-490 16:30

B. Follow-up imaging of percutaneous local treatment of bone tumours

F. Deschamps; G. Farouil, T. de Baere; Villejuif/FR (Frederic.Deschamps@igr.fr)

Thermal ablation techniques (radiofrequency and cryotherapy) are increasingly used to treat bone metastases. No post-procedure imaging is required for palliative intent because the success can be clinically assessed. However, post-procedure imaging is crucial if a local tumour control is expected or if a local complication is suspected. CT is routinely used. It allows depicting any fracture on the treatment site but the ablation zone as well as any residual tumour is usually poorly seen. Size increase and/or contrast enhancement within the ablation zone at CT is considered as incomplete treatment but is often lately discovered. On the other hand, MRI accurately determines the extent of the ablation zone and is probably the best imaging technique to depict any residual tumour as well as any damage to the surrounding tissue. Indeed, it has been demonstrated that the correlation between the diameter of coagulation necrosis and lesion size at MRI is strong. Nevertheless, there are some limitations with MRI: the post-procedure imaging findings are often unknown and there is a poor reproducibility in MRI protocols between the different hospitals and radiologists. In order to avoid a huge heterogeneity for the follow-up, standardised protocol must be used not only for post-procedure imaging but also for the pre-op MRI. Moreover, fluorine-18-fluorodeoxyglucose positron emission tomography (FDG-PET) is another tool for early diagnosis of incomplete treatment that consists in a peripheral increased focus uptake activity.

It is a reproducible imaging technique that also allows depicting other metastases location or disease progression.

Learning Objectives:

1. To learn about the post-ablation aspects, according to the ablation technique used.
2. To consolidate knowledge of the imaging aspects of successful ablation on various types of follow-up imaging, including CT and MRI.

A-491 17:00

C. Follow-up imaging of thermal ablative therapies for kidney tumours

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

The imaging follow-up of renal tumour ablation is critical as this represents definitive treatment of primary, curable carcinoma. Functional imaging such as FDG-PET plays no role due to the poor FDG-avidity of a large proportion of clear cell carcinomas. Diligent post-contrast CT or MR assessment remains the mainstay of follow-up remembering that papillary/chromophobe carcinomas are notoriously hypovascular. Careful subtraction MR imaging or dual energy CT are useful techniques for highlighting the usually crescentic marginal or peripheral nodular disease that indicates a subtotal treatment. Late arterial phase imaging with brisk contrast injection technique (at ≥ 5 m/s) is the best method to detect any such residual disease. Given improved image guidance and treatment dosimetry with techniques such as cryoablation subtotal treatment rates should now be well below 5% in experienced centres, if not negligible. Studies have suggested that there is a small but persistent late local recurrence rate of ~5% with current RFA technique. Such recurrences usually declare themselves as enhancing marginal nodules at the edge of the otherwise involuting ablation zone. These recurrences have been reported at anything from 1 to 4 years post treatment. Comparatively cryoablation series report trivial rates of late local recurrence, effectively in equipoise with surgical resection. Where the tumour mass is non-enhancing, gradually involuting, demonstrates a peri-tumoural 'halo' artefact in the adjacent fat and a subjacent, adequate wedge of cortical infarction recurrences are barely ever detected. These features are now establishing themselves as makers of complete and effective renal tumour ablation.

Learning Objectives:

1. To learn about the post-ablation aspects, according to ablation technique used.
2. To become familiar with the imaging aspect of successful ablation.
3. To appreciate the imaging aspect of most common complications.

Author Disclosure:

D. J. Breen: Consultant; Microsulis Medical Ltd. , Galil Medical Ltd.

16:00 - 17:30

Room E1

Emergency Radiology

RC 1517

ER: comprehensive imaging of non-traumatic abdominal emergencies

A-492 16:00

Chairman's introduction: logistics and management of critical patients with abdominal complaints

S. Wirth, M.F. Reiser; Munich/DE (swirth@med.uni-muenchen.de)

Emergency Radiology is a very rapidly growing field of modern radiology and of major importance in patient care. In particular, the number of CT examinations has still been continuously rising during the last decade because CT is fast, easily available, provides high-resolution cross sectional images and is thus playing a key role for patients with emergent abdominal complaints. However, every modality plays its own important role even when indications may change with today's possibilities. An excellent co-operation with referring physicians remains indispensable. Thus, radiologists need to have a concise understanding of specific pathologies and have to get used to being involved more deeply into choosing the appropriate imaging way. On one hand, the procedures have to be standardised to a maximum but the trend towards personalised medicine may be helpful to overcome some of the remaining limitations.

Session Objectives:

1. To learn about requirements for abdominal imaging for an emergency radiology department.

2. To learn about current developments with a clinical focus on who should undergo what and when, what kind of CT exam to use in order to triage emergency patients to the appropriate therapy options.

A-493 16:15

A. Imaging of the most frequent emergencies of the upper abdomen

C.J. Zech; Basle/CH (CZech@uhbs.ch)

The causes of frequent non-traumatic emergencies in the upper abdomen include oncological and inflammatory diseases or diseases related to cholestasis. Although US often is the first line modality to examine patients with acute abdominal diseases, the findings for treatment decisions are in many cases assessed by dedicated MDCT protocols. A monophasic venous enhanced-CT usually provides a robust and broad overview and enables the evaluation of many diseases. Nevertheless, in some clinical instances, the addition of arterial phase images is warranted. This is mainly the case when acute bleeding or occlusion/pathologies related to the arterial vessels like mesenteric occlusion is suspected. Additional plain CT images can be helpful in when patients had previous surgery or in cases biliary stone disease is suspected. MRI usually plays only a minor role in imaging of abdominal emergencies, with the clear exception of MRCP to evaluate the biliary system to decide about the indication of a therapeutic ERCP. Since MRCP protocols can be set up and acquired quickly and usually allow the very adequate evaluation of the biliary and pancreatic ductal system, it should be offered also for emergency patients. Interventional radiology can offer usually effective treatment options for patients with emergencies of the upper abdomen.

Learning Objectives:

1. To become familiar with dedicated MDCT protocols.
2. To learn about other types of imaging such as US and MR.
3. To learn about typical and atypical imaging findings.

A-494 16:35

B. Imaging of the most frequent emergencies of the gastrointestinal tract

M. Zins, I. Boulay-Coletta; Paris/FR (mzins@hpsj.fr)

Acute abdominal pain due to gastrointestinal (GI) tract pathology is one of the most frequent causes of patient presentation to the emergency room. Rapid and accurate diagnosis is crucial for applying appropriate treatment. US and CT have emerged as the most accurate non-invasive imaging tools for emergent evaluation of acute abdominal pain. This lecture will detail the typical and atypical imaging features and the respective indications of US and CT in the most frequent emergencies of the GI tract including appendicitis, diverticulitis, small and large bowel obstruction, bowel ischaemia and infection.

Learning Objectives:

1. To become familiar with dedicated MDCT protocols.
2. To learn about other types of imaging such as US and MR.
3. To learn about typical and atypical imaging findings.

A-495 16:55

C. Imaging of the most frequent emergencies of the genitourinary tract

L.E. Derchi; Genoa/IT (derchi@unige.it)

This presentation will deal with three of the most common and important acute problems of the GU system: testicular and ovarian torsion and the renal colic. US is the technique of choice in patients with acute scrotum and is able to identify torsion in up to 86% - 94% of cases. Tips and tricks to improve diagnostic accuracy and recognize possible false negatives will be presented. Difficulties can be encountered also in identifying ovarian torsion, and the role of US, CT and MRI in this field will be addressed, stressing the need for accurate correlation of clinical and radiological findings to reach the correct diagnosis. MDCT is the gold standard examination in patients with suspected renal colics, being able to recognize presence, location and size of the obstructing stone (s) in virtually all cases, or to identify other pathologic conditions which are responsible for the patient's symptoms. However, stone disease is frequent, recurrent and often affects patients of relatively young age; then, radiation exposure concerns have to be taken into account. Protocols using US as the first approach can solve up to 75% of cases, reserving MDCT only for those which are undetermined after US. The US examination techniques to be used in these situations will be addressed.

Learning Objectives:

1. To become familiar with dedicated MDCT protocols.
2. To learn about other types of imaging such as US and MR.
3. To learn about typical and atypical imaging findings.

Panel discussion:

How to speed up your diagnoses?

17:15

16:00 - 17:30

Room E2

State of the Art Symposium

SA 15

Imaging impingement syndromes

A-496 16:00

Chairman's introduction

C.W.A. Pfirrmann; Zurich/CH

The Latin word "impingere" means to thrust, to strike or to dash against something. Impingement in the musculoskeletal system has received considerable attention as an important mechanism for causing damage to joints and tendons. Impingement refers to a dynamic, abnormal contact between two anatomic structures. Because of the dynamic component, the diagnosis of an impingement based on imaging alone may not be possible. Some predisposing factors like a cam deformity at the proximal femur, leading to femoroacetabular impingement are well known. However, in other conditions, such as subacromial impingement at the shoulder joint, imaging findings may be much less evident.

Session Objectives:

1. To learn about the role of imaging for the diagnosis of impingement syndromes.
2. To understand what the clinician needs to know from the radiologist.
3. To learn the diagnostic value of different imaging modalities to answer the clinical questions.

Author Disclosure:

C. W. A. Pfirrmann: Advisory Board; Advisory Board Orthopaedic Diagnostics, Siemens.

A-497 16:05

Shoulder

P. Robinson; Leeds/UK (Philip.Robinson@leedsth.nhs.uk)

The anatomy, biomechanics and function of the shoulder girdle means that this area is extremely vulnerable to developing impingement syndromes both from athletic use and normal degenerative processes. The shoulder girdle anatomy will be reviewed in the context of the proposed theories concerning causes or associated causes of internal and external impingement syndromes. Imaging assessment will focus on ultrasound and MRI demonstration of the normal anatomy and relevant variations in normal. In external impingement syndromes, the relationship of the rotator cuff, overlying bursae and coracohumeral arch is the centre for both primary (morphological abnormality of the arch or rotator cuff) and secondary (micro or macro glenohumeral instability) causes. Imaging abnormalities of the arch, rotator cuff and bursae will be presented for both ultrasound and MRI and their relevance to clinical findings and subsequent management of impingement will be discussed. In internal impingement, a brief overview of the theories for posterolateral and anterosuperior impingement will be presented. Anterosuperior impingement is not as well recognised as other impingement syndromes but the mechanism and imaging findings will be presented. Despite the differing theories for posterolateral impingement, there are a common group of imaging features that occur. These imaging findings will be illustrated but because the areas affected include the glenoid labrum, capsule and undersurface of the rotator cuff the imaging focus will be on MRI (including arthrography) rather than ultrasound which cannot accurately assess this region.

Learning Objectives:

1. To understand impingement mechanisms of the shoulder.
2. To become familiar with external and internal shoulder impingement.
3. To learn about the typical imaging findings.
4. To appreciate the strength and weaknesses of different imaging modalities.

A-498 16:28

Ankle

M. Maas; Amsterdam/NL (m.maas@amc.nl)

Ankle impingement (AI) is an important cause of chronic ankle pain. AI is a painful mechanical limitation of full-ankle movement, secondary to osseous and/or soft-tissue pathology. Radiologists are frequently encountered with requests for MRI of the ankle, an investigation that needs to answer important preoperative questions. The presence of multiple ligaments, tendons and joint extensions make interpretation of MRI challenging. Anatomy of this small joint is considered difficult, yet

crucial knowledge to interpret these MRI's adequately. Using anatomical landmarks, AI is divided as 1) anterior impingement, with a subdivision in anteromedial and anterolateral impingement and 2) posterior impingement, also divided in posterior and posteromedial impingement. The specific clinical and radiological features are shown. Although plain film is mainstay in daily practice AI is not easily detected. Guidelines on improving use of plain film are provided. Also value of easy to perform additional plain films with low costs are explained. Since MR is thought essential in workup of chronic ankle pain, guidelines for standardised interpretation and reporting are provided. Together with demonstrating the typical imaging features, the reading radiologist is comfortable to be able to provide the surgeon with the necessary answers. In our daily practice, MRI holds several orthopaedic limitations, which are discussed. MDCT of both ankles, in neutral and maximal plantar flexion are thought of important additional value. Typical MDCT features of various AI subtypes are displayed. When radiologists are able to closely interact with the clinical colleagues, optimal care in chronic ankle pain can be provided.

Learning Objectives:

1. To understand impingement mechanisms of the ankle.
2. To become familiar with anterior and posterior ankle impingement.
3. To learn about the typical imaging findings.
4. To appreciate the strength and weaknesses of different imaging modalities.

A-499 16:51

Hip

K. Wörtler; Munich/DE (woertler@roe.med.tum.de)

Femoroacetabular impingement (FAI) results from abnormal contact between the femoral neck and the acetabular rim. The two basic mechanisms of FAI are cam and pincer impingement. Cam impingement is by far more common, is caused by osseous abnormalities of the femoral head-neck junction and leads to damage of the anterosuperior labrum and articular cartilage. Pincer impingement is characterised by acetabular overcoverage or abnormal retroversion of the acetabulum and provokes a typical pattern of injuries of the anterosuperior labrum and the posteroinferior joint surface. Both conditions are thought to initiate premature osteoarthritis and thus have gained increasing attention over the last decade. Plain radiography and MR imaging represent important tools for the diagnosis and preoperative planning of patients with FAI with a view to depiction and quantification of predisposing osseous abnormalities and definition of the extent of joint damage. It is however important to keep in mind, that the diagnosis always has to be based on clinical findings and cannot be established solely on the basis of imaging findings. This course will focus on imaging features, which support the diagnosis of cam and pincer type FAI, the strength and weaknesses of different imaging modalities, and the potential impact of radiological findings on clinical decisions.

Learning Objectives:

1. To understand impingement mechanisms of the hip.
2. To become familiar with cam and pincer type femoroacetabular impingement (FAI).
3. To learn about the typical imaging findings.
4. To appreciate the strength and weaknesses of different imaging modalities.

Panel discussion:

Form or function: is impingement a clinical or imaging diagnosis? 17:14

16:00 - 17:30

Room F1

Special Focus Session

SF 15a

Traumatic brain injury

A-500 16:00

Chairman's introduction

A. Rovira-Cañellas; Barcelona/ES (alex.rovira@idi-cat.org)

Traumatic brain injury (TBI) is a leading cause of death and disability worldwide. Every year, about 1.5 million people die and several million receive emergency treatment for this cause. In clinical practice, the severity of TBI is generally classified as severe, moderate, or mild according to the level of consciousness measured with the Glasgow Coma Scale (GCS). Nonetheless, the increasing use of early sedation, intubation, and ventilation in more severely injured patients has decreased the value of the GCS for classification purposes. Alternatively, and particularly in these more severe patients, TBI can be classified according to morphological criteria based on CT or MRI studies. Although MRI may be more sensitive for detecting small white matter lesions in later phases following TBI, CT remains the examination technique

of choice in the acute phase. However, both CT and conventional MRI fall short in accurate prediction of outcome, because of their inability to depict the full extension of brain injury and because they offer qualitative rather than quantitative information. In the last few years, advanced MR techniques such as diffusion tensor imaging (DTI) and proton MR spectroscopy (MRS) have been used to provide quantitative assessment of the extent of brain damage and have been proposed as markers of axonal injury and to predict long-term outcome. Outcome prediction is important because it has an impact on the choice of specific treatment methods, on deciding whether or not to withdraw treatment, and on counseling patients and relatives.

Session Objectives:

1. To understand the role of neuroradiology in the initial assessment.
2. To appreciate the role of conventional and non-conventional imaging techniques in the diagnosis and monitoring of primary and secondary traumatic lesions of the brain.
3. To learn about the prognostic value of neuroimaging.
4. To become familiar with the various types of cerebrovascular traumas and their treatment options.

Author Disclosure:

A. Rovira-Cañellas: Advisory Board; NeuroTec, Bayer AG. Board Member; Neuroradiology, Am J Neuroradiol. Consultant; Novartis. Research/Grant Support; Bayer AG. Speaker; Bayer AG, Novartis, Sanofi-Aventis.

A-501 16:05

Acute brain trauma: CT vs MRI

M. Muto; Naples/IT (mutomar2@gmail.com)

Traumatic brain injury is a common condition related to multiple mechanism of action of the traumatic vector axis that can cause mild clinical abnormality up to dramatic and urgent situation that needs to be treated surgically in emergency. Multiple classification has been published to correlate clinical findings, with risk factors trying to define with category of patients needs to be image. Loss of consciousness is an important clinical criteria to decide about CT evaluation or not. Focal contusion, lacero-contusion, epidural-subdural haematoma, post-traumatic subarachnoid hemorrhage, subtentorial and infratentorial haematoma, skull fractures are all conditions easily visible with CT and the semeiotic of this finding is well established also with MR. Clinical evaluation of those patients is also sometimes problematic related to the fact that we are dealing with unstable polytrauma patients. The real diagnostic problem are patients with coma state and minimal CT abnormality in which a diffuse axonal injury must be suspected and confirm by MR examination showing typical abnormal signal intensity at the level of the cortical-subcortical junction or at the level of the brainstem. The evolution and the follow-up of those patients can be performed either by CT or MR in relation to type of injury. MR perfusion can also give more information about the recovery of normal vascular supply in trauma patients.

Learning Objectives:

1. To understand the role of neuroradiology in the management of brain trauma patients.
2. To learn about the correlation between neuroradiological features and clinical findings.
3. To understand the importance of imaging follow-up.

A-502 16:23

New imaging techniques in the detection and quantification of brain damage

S. Sunaert; Leuven/BE (Stefan.Sunaert@uz.kuleuven.ac.be)

This talk will cover the use of new magnetic resonance imaging techniques in the detection and quantification of brain damage. Susceptibility weighted imaging has become standard in the detection of microbleeds and diffuse axonal injury. More subtle changes in brain function and connectivity can be studied by the combination of fMRI, resting state fMRI and diffusion tensor imaging. These can be used at the stage of diagnosis, but also have a role in the prediction of outcome and follow-up of brain plastic changes after injury.

Learning Objectives:

1. To consolidate knowledge of new advanced imaging techniques.
2. To learn about quantifying brain damage using these techniques.
3. To understand the challenges of performing MR examinations in these patients.

A-503 16:41

Advanced imaging of brain trauma: outcome prediction

D. Galanaud; Paris/FR (galanaud@gmail.com)

Determining the prognosis of a patient with severe traumatic brain injury (TBI) at the acute phase remains challenging. MRI is now considered the method of choice to address this issue. Sequences such as diffusion tensor imaging, MR

spectroscopy and functional MRI have been shown to hold great promises in this indication, since they enable quantification of neuronal suffering, injury of the white matter or physical and functional disconnection of critical brain areas. Lesions of the mesencephalon, thalamus, corpus callosum and diffuse destruction of the white matter secondary to increased intracranial pressure often lead to an unfavorable evolution. A method for reliable prognostication of outcome in severe TBI could be developed by integrating clinical and neuroimaging information. This aim will require a large multicenter study using a harmonized imaging protocol and common clinical data elements.

Learning Objectives:

1. To understand the value of diffusion tensor imaging and MR spectroscopy in severe cases.
2. To understand the role of these techniques in early- and late-phase diagnosis and treatment follow-up.
3. To learn about the lesion patterns associated with favourable and unfavourable outcomes.

Author Disclosure:

D. Galanaud: Consultant; Olea Medical, La Ciotat, France.

A-504 16:59

Cerebrovascular trauma: diagnosis and therapy

T. Krings; Toronto, ON/CA (timo.krings@uhn.ca)

Vascular injury of the head and neck region is a rare and often life-threatening complication of head or neck trauma and is due to two major pathomechanisms: penetrating or blunt trauma. Both the arterial and the venous site of the CNS vasculature can be involved, the latter one being often overlooked. Concerning arterial lesions, depending on how many layers of the arterial vessel are affected and on the spatial relationship to adjacent structures, dissections, false aneurysms or arteriovenous fistulae may develop. On the venous side, dural tears, compressive effects on pial veins and a deranged clotting system may lead to delayed venous thrombosis. In this lecture clinical and imaging findings, as well as diagnostic and treatment strategies in these lesions are described.

Learning Objectives:

1. To learn about the classification of the different types of cerebrovascular trauma.
2. To become familiar with vascular emergencies requiring urgent treatment.
3. To become familiar with treatment strategies in cerebrovascular trauma.

Panel discussion:

Role of neuroimaging in traumatic brain injury in 2013

17:17

16:00 - 17:30

Room F2

Special Focus Session

SF 15b

Digital breast tomosynthesis

A-505 16:00

Chairman's introduction

G. Gennaro; Padua/IT (gisella.gennaro@ioveneto.it)

In the past two decades, important progresses have been obtained by manufacturers in development of digital breast tomosynthesis (DBT), a 3D breast imaging technique which aims to overcome inherent limitations of mammography associated with normal breast tissue superimposition. Several retrospective studies have demonstrated DBT potentials in reducing both false negatives and false positives compared to standard mammography. Nowadays, commercial DBT systems are facing on the market, with different technical solutions in terms of both physical parameters which control DBT acquisition, and reconstruction algorithms. Moreover, several clinical questions are still open about the actual applications of tomosynthesis in clinical practice. Different scenarios have been considered, either proposing DBT to replace mammography, or to be used as an adjunct to mammography, together with other diagnostic tools, like mammography extra-views or ultrasound. One concern about the real use of DBT regards its impact on the clinical workflow, caused by the strong increase in the amount of DBT images to be reviewed compared to the current standard of care in breast imaging; one possible solution comes from computer-aided detection (CAD), which could support lesion detection, as well as speed up radiologists' reviewing time. This session aims to cover the tomosynthesis subject, including all the aspects mentioned above.

Session Objectives:

1. To understand the physical parameters and reconstruction methods which determine digital breast tomosynthesis (DBT) image quality.

2. To learn about DBT clinical performance and potential clinical applications.
3. To understand if CAD could be successfully applied compensate for the time required to review DBT images.

A-506 16:05

Optimisation of image acquisition and reconstruction in DBT

M.J. Yaffe, J.G. Mainprize; Toronto, ON/CA (Martin.Yaffe@sri.utoronto.ca)

Digital breast tomosynthesis (DBT) is an extension of digital mammography (DM) and is typically built on a DM platform. To accomplish tomosynthesis image acquisition, the x-ray tube moves over a range of angles about a pivot point located above the digital detector to obtain a series of low-dose digital projection radiographs. The detector may be stationary or (in the isocentric design) also rotate about the pivot point. The x-ray tube may temporarily halt as each projection is acquired or may move continuously during acquisition. From the set of projection images, an algorithm reconstructs a quasi three-dimensional representation of the x-ray attenuation properties of the breast tissues. As in CT, the reconstruction algorithm may be based on an iterative approach or employ Fourier methods or filtered back projection. Constraints may be applied to speed or simplify the reconstruction. The reconstructed images are often viewed as a "movie-loop" where adjacent x-y planes (parallel to the x-ray detector) are displayed sequentially. Because a complete range of angular data is not obtained, the dataset is highly undersampled, giving rise to artefacts. Typically in DBT, the spatial resolution in the x-y plane is quite high while it is coarser in the z (x-ray tube to detector) direction. The quality of the reconstructed image and the dose to the breast are dependent on the angular range and number of projections, the dose used per projection and the performance of the x-ray detector and electronics. In this presentation an approach to optimization will be discussed.

Learning Objectives:

1. To understand DBT principles.
2. To learn about DBT acquisition and optimisation.
3. To understand DBT reconstruction algorithms.
4. To become familiar with radiation dose from DBT.

Author Disclosure:

M. J. Yaffe: Equipment Support Recipient; GE Healthcare. **J. G. Mainprize:** Equipment Support Recipient; GE Healthcare.

A-507 16:28

Current role of DBT in diagnostic imaging

S. Zackrisson, K. Lång, A. Tingberg, P. Timberg, D. Förmvik, M. Dustler, I. Andersson; Malmö/SE (sophia.zackrisson@med.lu.se)

The sensitivity of mammography for the detection of breast cancer is less than optimal. One of the main reasons is that a 3D structure (the breast) is projected on to a 2D plane (radiographic image) meaning that the normal breast tissue can conceal a tumour especially if the breast tissue is "dense". Digital breast tomosynthesis, DBT, is a three-dimensional radiographic technique which may reduce the impact of overlapping tissues in breast cancer detection. The aims of this presentation are: 1. to describe the potential impact of DBT on sensitivity and specificity of breast cancer detection. 2. To illustrate limitations of DBT and its impact on image interpretation time and effort. 3. To discuss if DBT is applicable to screening. A review of the current literature and studies on diagnostic and screening DBT will be presented. DBT is a promising tool in breast imaging. However, further evidence from the ongoing trials is needed to establish its place in breast cancer diagnosis and screening.

Learning Objectives:

1. To understand the potential impact of DBT on sensitivity and specificity of breast cancer detection.
2. To appreciate limitations of DBT and its impact on image interpretation time and effort.
3. To understand if DBT is applicable to screening.

Author Disclosure:

S. Zackrisson: Research/Grant Support; Swedish Cancer Foundation, Swedish Research Council.

A-508 16:51

Clinical aspects of computer aided detection and diagnosis in DBT

H.-P. Chan; Ann Arbor, MI/US (chanhp@umich.edu)

Digital breast tomosynthesis (DBT) can potentially increase the sensitivity and reduce recall rate in breast cancer screening. However, the chance of oversight may not be negligible because of the very large search space (~50-80 slices per

view) and the increased workload and possibly fatigue to the radiologists. CAD has been shown to reduce radiologists' false negatives in screening mammography. It can be expected that CAD may be useful for DBT interpretation. DBT in clinical use is still at an early stage. Although the impact of CAD on DBT interpretation has not been reported, some important issues associated with CAD use can be expected based on the experiences in screening mammography. In this talk, the potential usefulness of CAD in DBT and the issues as observed from the reported prospective studies of CAD use in the clinic will be discussed, including the potential impact of off-label use (i.e., CAD systems approved as second reader used as concurrent or first reader), user training, and quality assurance of CAD performance. Because of the increased reading time for DBT, there will be an even stronger tendency that radiologists may want to use CAD as a concurrent or even first reader to improve workflow. To have a CAD system for such intended use, much more stringent requirements for the standalone performance of the CAD system and properly designed studies to evaluate its impact as a concurrent or first reader should be required before the CAD system can be approved for clinical use with DBT.

Learning Objectives:

1. To learn about the challenges of DBT interpretation in clinical practice.
2. To understand the potential impact of computer-aided detection on DBT.
3. To learn about CAD as a second reader to improve DBT sensitivity.
4. To appreciate CAD as a concurrent reader to improve DBT workflow.

Panel discussion:

Digital breast tomosynthesis: replacing or just supporting standard mammography?

17:14

16:00 - 17:30

Room G/H

Neuro

RC 1511

Epilepsy: a lack of knowledge can be dangerous

Moderator:

M.A. Papathanasiou; Athens/GR

A-509 16:00

A. Anatomy of the limbic system

T.A. Yousry; London/UK (t.yousry@ucl.ac.uk)

The anatomy of the limbic lobe and system can be seen as being composed of 2 main structures: the limbic and the intralimbic gyri. 1. The limbic gyrus is composed of the subcallosal gyrus anteriorly, followed in an arc by the cingulate gyrus, isthmus and finally the parahippocampal gyrus. The latter is composed of 2 parts: i) a posterior narrow segment, the superior surface of which is called subiculum, and ii) a more voluminous anterior segment, also known as the piriform lobe. The latter consist of the anterior part of the uncus and the entorhinal area. 2. The intralimbic gyrus arches within the limbic gyrus. It is divided into 3 parts: i) anterior (prehippocampal rudiment); ii) superior (indisium griseum); and iii) inferior (hippocampus). The latter consist of 2 lamina rolled inside each other: the cornu ammonis and the dentate gyrus, with the cornu ammonis consisting of 4 neuronal fields (CA1-4). We will review the MRI characteristics of these structures and their relationships with each other, using 1.5 T, 3 T and 9.4 T high field imaging. At the end of this lecture, you will know the major subdivisions of the limbic lobe/system and will be able to identify them on MRI.

Learning Objectives:

1. To learn the components of the limbic system.
2. To understand the structure of the hippocampus proper.
3. To become familiar with the imaging characteristics at 1.5 T, 3 T, and 9.4T.

Author Disclosure:

T. A. Yousry: Advisory Board; Biogen Idec. Author; T Yousry. Board Member; European Eadiology. Research/Grant Support; MS Society of Great Britain and Northern Ireland, MRC, Wellcome Trust, Stroke Association, British Heart Foundation, UCL/UCLH Biomedical Research Centre, Biogen Idec, GlaxoSmithKline, Novartis. Speaker; ESOR, King Abdullah Medical City.

A-510 16:30

B. Temporal lobe epilepsy

I.N. Pronin; Moscow/RU (pronin@nsi.ru)

Neuroimaging is essential in the work-up of patients with temporal lobe epilepsy (TLE) because in majority of the cases, the structural lesions causally related to the epilepsy are small and the success of the surgery is directly dependent on the

accuracy of these lesions' identification. For this reason, there has been ongoing interest in utilising new advanced imaging techniques to improve the ability to identify, diagnose, characterise and delineate the epilepsy cause. Structural high-resolution MRI commonly reveals the structural basis of partial seizures. In a case with TLE, there are different disorders such as hippocampal sclerosis, long-term epilepsy-associated tumours, focal cortical dysplasias, vascular malformations, encephalitis, gyral scarring and so on. Functional imaging, however, can demonstrate the pathophysiological processes that occur in epilepsy. MRS allows the "in vivo" assessment of brain metabolism on the basis of investigation of various cerebral metabolites involved in a variety of neuronal processes that occur in TLE. DWI and DTI are sensitive tools to identify microstructural changes and integrity in the white brain matter. fMRI offers the possibility to assess the physiologic processes of neuronal activity to be measured in terms of local brain volume, flow, and oxygen saturation. The traditional radiotracer methods such as SPECT and PET have been used in attempt of noninvasive assessment of cerebral blood flow and energy metabolism caused by neuronal activity. MEG increases the MRI sensitivity in detection of subtle or invisible epileptogenic foci on structural MRI.

Learning Objectives:

1. To become familiar with MR-characteristics of neoplastic and non-neoplastic causes of temporal lobe epilepsy.
2. To learn about optimised imaging protocol.
3. To appreciate the potential impact of modern MR-imaging techniques to improve visualisation of structural brain changes.

A-511 17:00

C. fMRI in epilepsy

N. Bargallo; Barcelona/ES (bargallo@clinic.ub.es)

Functional MRI (fMRI) is a non-invasive tool that is capable to detect the subtle homodynamic changes produced in regional brain activation. The main fMRI clinical application until now is localisation and evaluation of brain eloquent areas in surgical planning of brain pathology. fMRI application in epilepsy patients are language lateralization, memory function assessment and localisation of ictal and interictal BOLD changes. There are several factors that can influence the results of a fMRI experiment such as the scan noise for the rest condition, the simplicity of the task performance, the monitoring of the experiment during the exam, how to achieve a real baseline condition and the most important, to use the most specific paradigm that would activate the selected brain areas. In practical approach, one must be aware that sometime fMRI studies are applied in paediatric or impaired cognitive epilepsy population when deciding the language or memory paradigm, and is recommended to use multiple and feasibility tasks to assure the results. fMRI for language lateralization is currently used in the clinical practice and provides comparable results to the intracarotid amobarbital test (IAT). In fMRI studies for memory function assessment, results show changes in epileptic patients, but further studies are required to validate this technique to an individual level. A new application is ictal or interictal fMRI with EEG recorded that provide more detailed information about simultaneously electrographic and homodynamic changes in the seizure process, with encouraging results for epileptogenic area localisation and propagation patterns.

Learning Objectives:

1. To become familiar with the application and limitations of fMRI.
2. To appreciate technical aspects and interpretation of fMRI for language localisation and memory testing.
3. To consolidate of advanced fMRI applications.

16:00 - 17:30

Room /K

Cardiac

RC 1503

Cardiac CT and MRI in difficult patients: what to do?

A-512 16:00

Chairman's introduction

M. Hamilton; Bristol/UK (Mark.Hamilton@UHBristol.nhs.uk)

What is a difficult patient? It is perhaps easier to state that an easy patient is a 70 kg middle-aged healthy adult. Why? Slim, can breath hold, calm, has a slow steady sinus rhythm with no sinus arrhythmia. Almost everyone else can be a problem. Anxiety, obesity, breathlessness, arrhythmia, small size, high heart rates can all cause problems and may require the examination to be modified accordingly. This session will assist you to get the best out of your patients and scanner.

A-513 16:05

A. Coronary CTA in patients with severe arrhythmias and high heart rate

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

Beside all advances in scanner technology, heart rate remains a critical issue for coronary CTA and motion artifacts due to cardiac function represent still the most frequent reason for limited diagnostic image quality in cardiac CTA. Thus, heart rate control by medical treatment is standard of care for cardiac CTA. The target heart rate is defined depending on the scanner system used and ranged below between 60 and 70 bpm. However, there are patients and conditions, where a heart rate control is not possible or not successful, whereas a relevant proportion of CTA's are performed in patients with heart rates higher than the target frequency including children, emergency patients, patients suffering from severe COPD and/or heart transplant recipients. Scanning at higher heart rates has severe implications for scan protocol selection and on dose saving strategies. During this presentation, possibilities for heart rate control beyond beta blockers should be discussed and examination strategies for patients with high heart rates will be presented. Different to high heart rates and even more critical with regard to image quality is arrhythmia. Due to the complexity of cardiac synchronization, a CT suite is not the place for cardiac resynchronization, whereas the indication to CTA has to be reevaluated depending on referring diagnosis and severity of arrhythmia. Since there are patients undergoing CTA because of arrhythmia including patients prior to ablation treatment, strategies for examination and image reconstruction in case of arrhythmic patients have to be established and will be presented during this presentation.

Learning Objectives:

1. To understand the criteria for optimal patient selection and preparation to achieve best results.
2. To learn about acquisition techniques in patients with arrhythmias and tachycardia.
3. To become familiar with the post-processing techniques available for optimising images quality following the scan.

Author Disclosure:

C. Loewe: Board Member; steering committee member B/S (Apixaban studies). Investigator; investigator in different multicenter trials sponsored by BMS, Guerbet, GE Healthcare, Bayer. Speaker; speaker for Siemens, Bracco, GE Healthcare, Bayer, Guerbet, Covidien.

A-514 16:28

B. Severe coronary calcinosis and stents: tips and tricks in image acquisition and interpretation

F. Pugliese¹, A. Rossi²; ¹London/UK, ²Trieste/IT (francesca.pugliese@libero.it)

Cardiac computed tomography (CT) has become a widely available diagnostic tool used in a range of heart conditions. The commonest application of this technique is the evaluation for coronary artery patency (coronary CT angiography) in patients with chest pain. When coronary arteries are heavily calcified, or post-coronary angioplasty with stent implantation, diagnostic problems can occur. In these circumstances, the evaluation of the coronary arteries on CT is hampered by the occurrence of high-density artefacts caused by calcifications and stent struts. These artefacts may preclude the appropriate assessment of the coronary lumen. The presence of motion artefacts in the dataset, or image noise in very large patients may exacerbate the problem. In this scenario, accurate patient selection and preparation remain key to ensure that the diagnostic yield of the cardiac CT study is good. Optimisation of scan parameters (kV, mAs), contrast injection protocol and use of appropriate post-processing techniques (e.g. dedicated convolution filters) play an important role in daily clinical practice. Recent technical developments include dual-energy scan techniques and gemstone spectral detector systems that acquire simultaneously high and low kilovoltage datasets. This is done to achieve tissue differentiation. In principle, by using monochromatic image reconstruction the effect of high-density artefacts may be decreased. Using a similar principle high-density structures can be subtracted from the image. The introduction of iterative reconstruction algorithms may play a role because these algorithms are theoretically more accurate in the modeling of physical noise and tissue geometries.

Learning Objectives:

1. To understand the challenge of calcification and stents when performing coronary CTA.
2. To become familiar with technical features that maximise image quality in this patient group.
3. To be aware of the accuracy of coronary CTA in stented or calcified vessels with the optimum imaging techniques.

A-515 16:51

C. Cardiac MRI: possible problems and how to avoid them

E. Merzhina; Moscow/RU (elena_merzhina@mail.ru)

Lack of movement artifacts is one of major prerequisites for getting good image quality in cardiac MR. Data acquisition should be synchronized with patient's ECG or pulse. Special attention should be paid to good quality of ECG recordings and recognition of artifacts related to influence of permanent and alternating magnetic fields during examination. It is more difficult to perform cardiac MRI in patients with atrial fibrillation or frequent extrasystoli than in ones with sinus rhythm. In patients with arrhythmia prospective ECG synchronization should be used instead of retrospective one or special antiarrhythmic protocols may be designed. Breathing artifacts usually are not a problem for cardiac MRI because most sequences are acquired during a single breath-hold. Using SSFP and parallel imaging allows to obtain a complete set of cine MR images through the whole heart in 1-8 short breath-hold periods. Possible way to perform successful examinations in difficult patients, especially the ones with heart failure, is a technique of real-time cardiac MR. To meet the challenges and the benefits of cardiac MRI one must balance the constraints of signal-to-noise ratio, contrast-to-noise ratio, spatial and temporal resolution, scan time and image quality. Radiologist performing cardiac MRI should be aware of specific flow artifacts which are more prominent in case of 3 T systems. They should not be misinterpreted as intracardiac masses or abnormal flow jets. Late-enhancement studies with Gd are very dependent on correct selection of TI time. Modern MR scanners allow getting good cardiac images even in very difficult cases.

Learning Objectives:

1. To learn the importance of patient selection and preparation in achieving high quality scans.
2. To understand the practical techniques available for performing a successful scan in difficult patients such as those with arrhythmia or poor breath-holding ability.
3. To learn how imaging parameters can be changed for optimal results.

Panel discussion:

When to scan and when not to? How can we make the best of what we have?

17:14

16:00 - 17:30

Room L/M

Physics in Radiology

RC 1513

Novel developments in CT and their impact on dose

Moderators:

M. Prokop; Nijmegen/NL
V. Tsapaki; Athens/GR

A-516 16:00

A. Patient dose assessment in CT

P.C. Shrimpton; Didcot/UK (paul.shrimpton@hpa.org.uk)

CT remains a particular focus for efforts in radiological protection owing to its steadily increasing clinical application and the relatively high patient doses. Dosimetry is an essential element within good CT practice in order to allow the assessment of typical radiation risks in support of the justification of procedures, and the routine monitoring and comparison of typical doses in pursuit of the optimisation of patient protection. The practical basis for dosimetry in contemporary CT remains the (updated) CT dose index (CTDI₁₀₀), measured in either free air or the standard CT dosimetry phantoms. These latter measurements underpin the dose indicators commonly displayed by the CT scanner: volume-weighted CT dose index (CTDI_{vol}) and dose-length product (DLP). Whereas these quantities are not patient doses, they nevertheless provide useful characterisation of each CT exposure in order to allow comparison of practice and facilitate improvements in patient protection. Typical levels of CTDI_{vol} and DLP at each CT centre, periodically determined as the mean values observed for representative samples for each patient group and type of examination (and associated clinical indication), should be adopted as local diagnostic reference levels (DRLs). These should be subject to periodic review and compared with both corresponding national DRLs and also practice at other CT centres in pursuit of optimised patient protection. When required, estimates of typical organ and effective doses to reference patients from standard CT examinations can be made on the basis of appropriate dose coefficients normalised to the dose indicators (CTDI_{air}, CTDI_{vol} or DLP).

Learning Objectives:

1. To become familiar with technical dose parameters in CT.
2. To understand how to assess patient dose.
3. To be informed about the role of diagnostic reference levels in CT.

A-517 16:30

B. New frontiers in CT: functional and spectral imaging

N. Pelc; Stanford, CA/US (pelc@stanford.edu)

Recent advances have generated renewed interest in dual energy CT and CT-perfusion imaging. This presentation will discuss the basic principles, and the strengths and limitations of the techniques and implementations of multi-energy methods for material characterisation, and of CT methods for imaging tissue perfusion. Conventional CT measures the linear attenuation coefficient at one energy and cannot uniquely identify tissue. Multi-energy imaging measures attenuation at different energies to more fully characterise materials. An important limitation is that in the diagnostic energy range, the attenuation is dominated by only two interactions (Compton and photoelectric). While there can be residual ambiguity, spectral CT still provides important information. Measurements at two spectra can be achieved using multiple kVp and/or filtration or with detectors with energy discrimination. These various approaches to obtain energy dependent measurements have different dose efficiency and different sensitivity to subject motion. The simplest method to process the multi-energy data reconstructs CT images from each spectrum and performs the multi-energy analysis on the reconstructed images. A somewhat preferred method performs energy dependent processing on the raw projections prior to reconstruction. Hybrid methods are now available. To measure perfusion with CT, 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. Both dual energy and perfusion CT acquire multiple images, and so issues of radiation dose are relevant. Acquisition protocols can be optimised to mitigate these concerns.

Learning Objectives:

1. To learn about new developments in functional and spectral CT imaging.
2. To learn about impact on patient dose.

Author Disclosure:

N. Pelc: Advisory Board; Samplify, Inc. Board Member; RTR, Inc. Research/Grant Support; GE Healthcare. Shareholder; GE.

A-518 17:00

C. New image reconstruction techniques

J. Sijbers; Antwerp/BE (jan.sijbers@ua.ac.be)

The purpose of this presentation is to provide insight into novel reconstruction techniques in computed tomography and to discuss their impact on dose. Next to very fast, analytic reconstruction methods, iterative algebraic reconstruction methods are emerging, which are computationally much more demanding, but far more flexible and promising. These methods often exploit prior knowledge to either increase image quality or reduce dose. A short overview of standard and emerging techniques will be given. Compared to analytic reconstruction methods, iterative reconstruction algorithms have the potential to reduce patient dose. Moreover, these methods are suited for multiple acquisition geometries. Thanks to the availability of parallel processing hardware and efficient computational tools, iterative reconstruction methods are becoming increasingly popular. Future developments are promising for dose reduction as well as quality improvement of CT images.

Learning Objectives:

1. To understand the principles of iterative reconstruction techniques in CT.
2. To learn about novel algorithms.
3. To learn about the impact on patient dose.

16:00 - 17:30

Room N/O

Head and Neck

RC 1508

Performing and reporting head and neck examinations: how should I do it?

Moderator:

K. Šurlan Popovič; Ljubljana/SI

A-519 16:00

A. Sinonasal CT scans: technique and evaluation

H.B. Eggesbø; Oslo/NO (h.b.eggesbo@medisin.uio.no)

Computed tomography (CT) is the primary modality in paranasal sinus imaging. In "screening sinus CT" radiation dose can be as low as 20 mAs. However, optimal imaging of rhinosinusitis, fungal sinusitis, and tumour needs radiation dose > 50 mAs. Additional imaging techniques that are mandatory are: 1. axial volume uptake in order to keep dental filling artefacts to the axial plane. Coronal volume uptake cause dental filling artefacts into the maxillary sinuses and can obscure odontogenic cause to maxillary sinusitis. 2. Image reformation in several planes axial/coronal/sagittal/oblique is valuable to delineate pathology. 3. Bone algorithm is standard, but additional soft tissue algorithm can detect small calcifications in a fungus ball (mycetoma), high attenuation of pus-filled sinuses and inspissated mucus in allergic fungal sinusitis, and fatty tissue obliteration outside the sinuses in invasive fungal sinusitis. 4. Slice thickness should be no more than 3 mm, while 0.625 mm is optimal for evaluating bone erosion or odontogenic cause to sinusitis. Approach to a systematical interpretation: 1. Development of the 4-paired sinuses. 2. Pneumatisation variants that may interfere with mucociliary transport: concha bullosa, agger cells, infraorbital cells, and large ethmoid bulla. Sphenothmoidal cells and anterior clinoid process pneumatisation may contain the optic nerve. 3. Anatomical variants: nasal septum deviation, accessory maxillary sinus ostium (often misinterpreted as surgical procedure), low ethmoid roof/deep olfactory fossa that can cause cranial perforation during surgery. 4. Last and important, to discriminate sporadic findings from conditions that need follow-up as inflammatory patterns of chronic rhinosinusitis, fungal sinusitis and tumours.

Learning Objectives:

1. To learn how to perform a state-of-the-art CT examination of the sinuses.
2. To understand how to evaluate and what to report on CT examinations of the sinuses.

A-520 16:30

B. Temporal bone: CT and MRI

M.M. Lemmerling; Gent/BE

CT examination of the temporal bone: temporal bone CT scans should be performed in a reproducible way. Axial reconstructions are made in the plane of the lateral semicircular canal, and coronal reconstructions exactly perpendicular to this plane. Thin-sliced images are postprocessed using high-resolution algorithms. MR examination of the temporal bone: the challenge is to perform a complete examination. The standard version of such an exam starts with axial T2-weighted images of the brain and posterior fossa, and axial T1- and heavily T2-weighted images covering the temporal bone. After intravenous injection of gadolinium axial and coronal T1-weighted images are performed. Temporal bone report on CT and MRI. Structured reporting is the result of structured viewing. In the evaluation of the middle ear on CT examinations, it is best to follow the sound wave on the axial images (from tympanic membrane over malleus, incus and stapes to oval window) than inspect the fissula antefenestram region and the oval window. The inner ear is evaluated from cranially to caudally (semicircular canals, vestibule and vestibular aqueduct, cochlea and cochlear aqueduct). The facial canal, carotid canal and jugular fossa are finally evaluated. On the coronal images, one should at least inspect the intactness of tegmen tympani and the bony cover of the lateral semicircular canal. On MRI, after viewing the brain images, one best first tries to detect abnormal enhancing inner ear structures on the gadolinium-enhanced T1-weighted images, and then explains them using the heavily T2-weighted images.

Learning Objectives:

1. To learn how to perform a state-of-the-art CT and MRI examination of the temporal bone.
2. To learn how to create a complete temporal bone report.

A-521 17:00

C. CT and MRI of the neck: how to address key clinical questions

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

Accurate assessment of neck pathology requires a systematic approach which starts from the application of appropriate scanning strategies. MRI of the neck can be challenging, due to intrinsic difficulties posed by the anatomy of this region. Scans may be severely degraded by motion artefacts because neck immobility is simultaneously affected by breathing, swallowing, coughing. Magnetic field inhomogeneities, particularly marked at the junction between supra- and infrahyoid neck may result in very poor fat suppression and gross anatomic distortion on DWI. Spatial and, even more, contrast resolution are somehow weakened by the distance between the neck coil and its target. All these drawbacks can be efficiently controlled selecting alternative coils, sequences, acquisition parameters if the operator is sufficiently flexible to tailor the protocol to the patient. CT is overall less demanding, however, appropriate management of acquisition phases (particularly plain and arterial phase) may optimise the information provided by the technique. Knowledge of the anatomy of the neck is pivotal to image interpretation: the space-based classification offers a shortcut to diagnosis because once the space of origin of the lesion is established, the list of differentials invariably narrows. The discrimination between solid, cystic or fatty content (relatively easy on both MRI and CT) offers further clues to the diagnosis. Furthermore, the identification of the space of origin of the lesion allows to predict its pattern of growth and its relationships with vessels and nerves. All these information is what the clinician needs to know to plan further diagnostic steps and therapy.

Learning Objectives:

1. To understand key clinical questions.
2. To learn how to do a structured reading of the CT and MRI scans of the head and neck.
3. To become familiar with reporting in order to address the needs of the clinician.

16:00 - 17:30

Room P

Radiographers

RC 1514

Hybrid imaging technologies

Moderators:

C.D. Claussen; Tübingen/DE

C. Malamateniou; London/UK

A-522 16:00

A. Recent developments

S. Rep; Ljubljana/SI (sebastijan.rep@guest.arnes.si)

Positron emission tomography (PET) and single photon emission computed tomography (SPECT) systems are used to image accumulation and distribution of radiopharmaceuticals to provide physiological information for diagnostic and therapeutic purposes. However, these images often lack sufficient anatomical detail, a fact that has triggered the development of a new technology termed hybrid imaging. Hybrid imaging is a term to describe the combination of x-ray computed tomography (CT) systems and magnetic resonance imaging (MR) with nuclear medicine imaging devices (PET and SPECT systems) in order to provide the technology for acquiring images of anatomy and function in a registered format during a single imaging session with the patient positioned on a common imaging table. There are two primary advantages to this technology. First, the x-ray transmission images acquired with CT can be used to perform attenuation correction of the PET and SPECT emission data. In addition, the MR and CT anatomical images can be fused with the PET and SPECT functional images to provide precise anatomical localisation of radiopharmaceuticals. Technology and problems common to SPECT/CT and PET/CT are respiratory motion, quantification, radiation dose considerations, CT-based attenuation correction, contrast CT or metallic parts and motion between or during studies. Advances in SPECT and PET include the introduction of a new PET and SPECT scintillators and processing software. In general, the combination of PET or SPECT with CT or MRI may lead to new insights in research and novel clinical applications.

Learning Objectives:

1. To become familiar with the basic principles of hybrid imaging.
2. To learn about the newest techniques in hybrid imaging.
3. To understand the potential technical implications of the use of hybrid imaging.

A-523 16:30

B. Clinical applications

T. Lindner; Ternitz/AT (63629@fhwn.ac.at)

Hybrid imaging is not anymore a specialty for research purposes only. It is more and more coming into clinical routine and in the last few years, multimodality devices have started replacing single modality imaging devices in the clinical workflow. The first part of the presentation will be a short overview of the devices and technologies used for hybrid imaging in human medicine. Starting from a short introduction of SPECT-CT, the main part will be the PET-CT and a little introduction to the topic of MR-PET. The main topics covered here are the main indications in clinical routine, like oncology (primary tumours and metastasis), metabolic disorders, cardiac pathologies, etc. The second part presented are the major benefits and drawbacks of hybrid-imaging devices. The topics covered are the overall costs, the logistics, the availability of the devices, a short overview of the radiation dose to which the patient is exposed in the different devices and the diagnostic outcome. In this part also, a comparison to single modality devices is given, including two single acquisitions on two devices for retrospective hybrid imaging (Image Fusion). The last part presented are clinical case studies. Here, the major part is also a comparison of single modalities to hybrid imaging. In this part, the presented benefits and drawbacks will be shown on examples of real clinical patients in the daily workflow. In the end, a conclusion is given and also a future outlook of methods coming into clinical routine in the next few years.

Learning Objectives:

1. To become familiar with the major clinical applications of hybrid imaging.
2. To understand its benefits and drawbacks compared with a single modality.
3. To become familiar with some case studies.

A-524 17:00

C. Trends in radiography education

P. Hogg; Manchester/UK (P.Hogg@salford.ac.uk)

Educational challenges continue to be difficult to address and with an emphasis on hybrid imaging and radiographer/nuclear medicine technologist (NMR/T) roles, this presentation will explore some of these issues. Practice varies significantly between and within European countries. Legal and cultural challenges can be difficult to overcome and our ambition here should lie with enhancing the patient experience whilst maximizing physical and human resource. Legal restrictions in some countries do not allow NMTS to make x-ray exposures and clearly a change in law would be necessary to redress this. Roles need to - to reflect the nature of hybrid imaging. For instance, after SPECT acquisition, a decision may need to be taken to justify CT. Emphasizing the importance of patient experience, such decisions should be taken appropriately by suitably trained NMR/Ts / radiographers acting in an advanced capacity. Alongside, NMR/Ts making x-ray exposures, justifying CT imaging after SPECT would require people to think differently and accept change and how it may impact into their professional group. Extending from a focus on imaging, the hybrid department would need to centrally embrace the end user more than ever before. An example is illustrated for oncology, where the nuclear medicine and oncology teams would need to work more closely. This will require multi-professional working in which the NMR/T should play an important role in patient diagnosis and management. Returning to curriculum design, it is worth noting that the skills and knowledge required for effective team working will need instilling.

Learning Objectives:

1. To understand the impact on education.
2. To learn how these new requirements can be met by changes in the curriculum of educational institutions in Europe.
3. To understand what further changes in European laws, research infrastructure, and collaboration might be required to strengthen and protect the introduction of hybrid imaging in clinical practice.

16:00 - 17:30

Room Q

Paediatric

RC 1512

Paediatric MSK radiology: what is important?

Moderator:

M. Raissaki; Iraklion/GR

A-525 16:00

A. Scoliosis: what the radiologist needs to know

J.-F. Chateil; S. Missonnier; Bordeaux/FR

(jean-francois.chateil@chu-bordeaux.fr)

Disorders of the spinal posture are common in children and adolescents. Scoliosis may be primitive, structural, particularly during adolescence; during this period, careful follow-up is mandatory, because worsening is frequent. Scoliosis can also be secondary, and imaging is important to find a cause and adapt management. Among the aetiologies, radiologist must recognize spine malformations, dysplastic and neuromuscular scoliosis. In addition, scoliosis may also be secondary to a primitive lesion, tumour-related or not, whether the initial disease could be within the spinal canal, spinal or paravertebral. The initial clinical examination is essential, and must be completed first with AP and lateral full spine x-rays, if possible with a low dose device (flat panel, slot-scanning system), keeping in mind that follow-up with repetitive exposures may be necessary. Reproducible measures of different curvatures help to assess the overall static spine and the importance of scoliosis with Cobb angle. The assessment of axial rotation can be obtained through 3D simulations. Morphologic evaluation of the spine is mandatory: if a secondary scoliosis is suspected, the research to aetiology needs to perform CT or MRI, depending on the clinical signs. Similarly, these explorations are useful in the preoperative assessment when surgical treatment is necessary.

Learning Objectives:

1. To learn about the aetiology of scoliosis.
2. To become familiar with imaging findings, measurements and follow-up.
3. To understand how to report imaging findings.

A-526 16:30

B. Benign bone tumours and pseudotumours in children: the pitfalls

K.J. Johnson; Birmingham/UK (karl.johnson@bch.nhs.uk)

While assessing any bone lesion in a child, the first consideration is in determining whether it is pathological or a normal variant. For those pathological lesions, it is then very important to determine those that are aggressive/malignant and those that are benign. This presentation will highlight those features that classify a bone tumour as being benign. In addition, the spectrum of imaging abnormalities which may mimic tumour (so-called pseudo-tumours) will also be discussed. The importance of good quality radiographs as the initial modality of choice will be illustrated and reference to the need and value of other modalities as required in the diagnostic pathway will be covered. The presentation will emphasise the different radiological findings which would be expected depending on the age of the child. The importance of recognising post-traumatic changes and pathological fractures which occur as a consequence of an underlying bony lesion will be considered. The aim is to provide an illustrative review of an approach to a skeletal lesion, recognising normal variants, identifying typical benign lesions and understanding their relationship with trauma and infection.

Learning Objectives:

1. To recognise the most common benign bone tumours and pseudotumours.
2. To understand the differences between benign bone and pseudo tumours and malignancies in children.
3. To understand imaging modalities that could help in the differential diagnosis of benign bone tumours and pseudo tumours in children.

A-527 17:00

C. Congenital bone dysplasias

A.C. Offiah; Sheffield/UK (amaka.offiah@nhs.net)

By the end of the session, delegates will understand the radiological investigations that should be performed when a dysplasia is suspected. The latest classification system will be reviewed and the requirements of the radiology report will be highlighted. Delegates will be led through the process of interpreting the imaging,

by use of examples of the most common conditions from several of the broad groups of dysplasias.

Learning Objectives:

1. To understand the role of the radiologist in diagnosing congenital bone dysplasias.
2. To understand how to classify bone dysplasias.
3. To become familiar with reporting radiological studies related to bone dysplasias.

Author Disclosure:

A. C. Offiah: Other; Committee Member Skeletal Dysplasia Group for Teaching and Research.

Monday, March 11

08:30 - 10:00

Room A

Interactive Teaching Session

E³ 1620

Acute abdominal inflammatory disorders

A-528 08:30

A. Colitis and enterocolitis

D.J.M. Tolan; Leeds/UK (djmtolan@doctors.org.uk)

The imaging related to colitis and enterocolitis relies on detection of thickening and abnormal enhancement or blood flow to the large or small bowel. The main imaging modalities in day to day use are ultrasound, CT and MRI. However, these augment endoscopic assessment which is the primary diagnostic evaluation of choice for biopsy and histological confirmation. Imaging allows non-invasive global assessment of the bowel and a search for complications, particularly outside the lumen (such as perforation, abscess or fistula). The patient clinical status and disease distribution influence the likely differential diagnosis as much as the imaging signs. This includes the length of symptoms and immune status as much as the degree of wall thickening, pattern of enhancement and location of the abnormality. Particular imaging signs include pneumatosis, a variety of enhancement patterns and extra intestinal features such as ascites. Specific conditions that will be covered include inflammatory bowel disease (Crohn's disease vs ulcerative colitis), the immune competent patient (gastroenteritis and pseudomembranous colitis), immunocompromised patient (neutropenic enterocolitis and CMV colitis) as well as ischaemia.

Learning Objectives:

1. To know how to choose the appropriate imaging modality.
2. To become familiar with the patterns of distribution and appearance in imaging.
3. To learn how to differentiate ischaemia from inflammation.

A-529 09:15

B. Liver and bile ducts

C.D. Becker; Geneva/CH (Christoph.Becker@hcuge.ch)

Obstruction of the extra- or intra-hepatic bile ducts may occur in stone disease and a variety of other benign or malignant pathologic conditions and may be complicated by acute cholangitis and pyogenic liver abscess. We review the role of the different radiologic techniques that are used in the context of obstructive jaundice and its complications and discuss the advantages and shortcomings of each modality with regard to the clinical situation and treatment.

Learning Objectives:

1. To know the advantages of each imaging technique.
2. To become familiar with the findings in infrequent infections.
3. To learn how to study obstructive jaundice.

08:30 - 10:00

Room B

Special Focus Session

SF 16a

My most beautiful mistakes in paediatric radiology

A-530 08:30

Chairman's introduction

P. Tomà; Rome/IT (paolo.toma@opbg.net)

The only way that we can avoid making the same mistakes again is to learn from them. The prevalence of errors in medical diagnosis has received increasing attention. Learning from mistakes is important to maintain and improve the quality of care and patient safety. The invited experts will focus on a single area of paediatric radiology. An expert is a person who has made all the mistakes that can be made in a very narrow field. The interpretation of imaging in children is challenging and requires knowledge of the normal appearance of the maturing anatomic structures that change with age. Special attention needs to be given to radiation protection in paediatric radiology: the speakers will examine all aspects.

Session Objectives:

1. To become familiar with growth and development of newborns to teens.
2. To become familiar with the main pitfalls in paediatric radiology.

A-531 08:35

Abdomen

S.G.F. Robben; Maastricht/NL (s.robbe@mumc.nl)

The most efficient way to learn is to make many mistakes and to be corrected shortly thereafter. Preferably without serious damage to the patient. Eventually, the summation of these mistakes is called "experience". The retention rate of this way of learning exceeds the retention rate of lectures (like this) many times. Until now, this method has only been incorporated in medical curricula in virtual environments (for obvious reasons).

Learning Objectives:

1. To become familiar with the most important differential diagnoses.
2. To learn about imaging strategies for children.
3. To understand the role, importance of, and information obtained, from ultrasonography.

A-532 08:58

CNS

B. Bernardi; T. Verdolotti; Rome/IT (bruno.bernardi@opbg.net)

Three main categories of error are responsible for the majority of "missed" or misinterpreted observation on diagnostic radiology: system-related (latent or technical, error), radiologist-related (active error in recognition, interpretation and/or judgment due to lack of knowledge in specific fields or to many other factors), or a combination of both. In this lecture are presented active errors leading to missed diagnosis, the most feared event for pediatric neuroradiologists but also a great opportunity for learning. Learning from errors requires a critical appraisal of our radiological practice and the implementation of a change aimed at improving our performance, also through multidisciplinary meeting, particularly useful in paediatric neuroradiology. In the first months of life, MRI evaluation of the brain requires specific knowledge about its normal development and optimised sequences for age and strength of the MR system; an insufficient satisfaction of such conditions may result in failing to detect a lesion, in incorrect interpretation of a normal structure as a pathological finding or vice versa. In other cases, the abnormal finding is recognised but its interpretation is incorrect. This is sometimes due to an incorrect transmission of the clinical history or to the report of an earlier examination that can be misleading. The increasing complexity of MRI of the CNS with ever increasing expectations, the rarity of some neurological diseases and the spread of diseases previously unusual in our Country, through migration and tourism, may be other sources of diagnostic errors.

Learning Objectives:

1. To understand the significance of MR findings in a developing brain.
2. To learn how to avoid misinterpretations of easily detectable MR abnormalities.
3. To become familiar with the differential diagnosis of uncommon diseases.

A-533 09:21

Musculoskeletal

K. Rosendahl; Bergen/NO (karen.rosendahl@helse-bergen.no)

The role of skeletal imaging is to detect, and possibly quantify, any bone involvement to secure a correct diagnosis, to search for complications to treatment and to guide further management. Growing bone is challenging, as bone structure, shape and size changes continuously until skeletal maturity. The numerous normal variants of growth which may mimic pathology have been accurately described radiographically, but little is known on the appearances on magnetic resonance imaging (MRI). Thus, radiography remains an important method with a high specificity for a number of diseases through "pattern recognition". Its low sensitivity for cartilage, bone marrow and soft tissue involvement, however, has opened the way for additional techniques, such as ultrasound, MRI, computed tomography (CT) and nuclear imaging. Mistakes do occur along the whole chain of events involved in imaging; from choosing the most appropriate modality and image protocol, to image processing, analysis and communication of the results. During this lecture, we will focus on controversies regarding US screening programmes for developmental dysplasia of the hip, discuss some of the limitations of ultrasound in the assessment of soft tissue lesions, and of MRI in the assessment of juvenile idiopathic arthritis.

Learning Objectives:

1. To become familiar with the various controversies regarding US screening programmes for developmental dysplasia of the hip.
2. To understand the value of ultrasonography in the study of the musculoskeletal system.
3. To learn how and when to use MRI for investigations and differential diagnosis.

Panel discussion:

How have you changed or improved yourself after recognising your mistakes?

09:44

08:30 - 10:00

Room C

Urogenital Imaging

CC 1621

The usual, the unusual and the dangerous

Moderator:

S.K. Morcos; Sheffield/UK

A-534 08:30

A. Imaging of renal trauma

V. Logager; Copenhagen/DK (VILOE@heh.regionh.dk)

Approximately, 10% of all trauma admissions have kidney injuries. According to the American Association of Surgeons in Trauma (AAST), blunt traumas can be graded in a 5-point Renal Injury Scale. (Moore EE, Shackford SR, Pacher HL et.al. Organ Injury Scaling: Spleen, Liver and Kidney. J. Trauma 1989;29:1664-1666). On the basis of the patient's clinical findings an imaging algorithm is set. In general, patients that are normotensive with microscopic haematuria have less than 0.2% risk of serious kidney damage and imaging is unnecessary, whereas patients with either: A) gross haematuria or B) microscopic haematuria and blood pressure less than 90 mmHg or occasionally C) microscopic haematuria and positive result of diagnostic peritoneal lavage will require imaging. Contrast-enhanced CT is the way to go. Imaging should be in 3 phases (cortico medullary, delayed 3-5 min and late phase (more than 10 min). Image reading should be a multiplanar approach. Most of the findings do not require surgical intervention, the rest does. On the basis of case presentations, findings will be analysed, discussed and correlated to the patient's clinical status and treatment possibilities, including where and which signs to look for. Which modality could be used to solve the diagnostic problem when the clinical picture does not fit with the radiological picture. Always expect the unexpected.

Learning Objectives:

1. To learn how to recognise and describe the different types of traumatic renal injuries.
2. To learn how to correlate these image findings with clinical severity.
3. To understand treatment possibilities.

A-535 08:50

B. Postoperative anatomy and complications after GU interventions

H.C. Thoeny; Berne/CH (harriet.thoeny@insel.ch)

Radical prostatectomy, cystectomy with various forms of urinary diversion, and hysterectomy including pelvic lymph node dissection as well as (partial) nephrectomy are the most frequent surgical procedures performed in patients with urogenital malignancies. Familiarity with normal postoperative imaging features and potential complications are important to avoid misinterpretation to ensure appropriate post-operative management. Although complications are relatively rare in experienced centers, it is important to be aware of early (< 1 month) and late (> 1 month after surgery) post-operative complications for the respective intervention including anastomotic leaks, fluid collections (urinoma, lymphocele, abscess, haematoma), alterations in bowel motility, vascular complications, fistulas, sepsis, wound infection, urinary infection, ureteral strictures, calculi, etc. in order to initiate appropriate treatment. Furthermore, these patients have to undergo regular radiological follow-up to detect recurrence as early as possible. It is important to be aware of the typical location of recurrence and to know the appropriate imaging methods and techniques to make needed to make correct and timely diagnosis. In patients with bladder and renal cancer as well as gynaecological malignancies, CT is the method of choice to detect recurrence. In patients with prostate cancer suspicious for local recurrence, MR imaging is superior to CT, however CT is the method of choice when lymph node, organ or bone metastases are suspected.

Learning Objectives:

1. To become familiar with expected imaging findings after (partial) nephrectomy, ileal bladder substitute and radical prostatectomy.
2. To understand common complications after surgery.
3. To learn where and how to detect tumour recurrence.

A-536 09:10

C. GU complications in patients with spinal cord damage

S. Agarwal; Wrexham/UK (sanaga28@hotmail.com)

Spinal cord damage is a complex and devastating condition arising from trauma, tumours, ischaemia, infection and congenital causes. The management and follow-up of these patients pose several challenges unique to this particular group. Urinary tract complications are one of the commonest causes of morbidity and mortality in these patients, the incidence of which has significantly reduced in recent decades but remains as one of the important systems to follow-up and manage. Primary problem relates to bladder dysfunction (neurogenic bladder), which in turn causes upper urinary tract complications such as reflux, hydronephrosis, infection and stone formation, eventually leading to renal failure if left unmonitored and untreated. Pathophysiology of neurogenic bladder is complex and the clinical findings depend on the level and the extent of cord damage, however, some basic understanding is paramount for management of these patients. Ultrasound scan and plain radiographs have been the main modalities for regular follow-up of upper urinary tract in these patients. Imaging difficulties due to obesity, constipation, immobility, deformities and prosthesis are common occurrence. The development of radionuclide, CT and MR imaging with continuous progress in the scanning and dose radiation techniques have enabled us to commonly use them during management of the complications. Routine use of these techniques for follow-up and monitoring can be limited by availability, logistics and radiation involved.

Learning Objectives:

1. To understand the pathophysiology of urinary tract problems in patients with spinal cord damage.
2. To become familiar with the urinary tract complications associated with this group of patients.
3. To understand the role of different modalities and common problems during imaging.

A-537 09:30

D. Interactive case discussion

S.K. Morcos; Sheffield/UK (morcsk2@aol.com)

08:30 - 10:00

Room D1

CLICK (Clinical Lessons for Imaging Core Knowledge): Never without Arteries

CC 1618

The fast and the furious: vascular trauma resulting from traffic accidents

Moderator:

U. Linzenmaier; Munich/DE

A-538 08:30

A. Clinical considerations

H. Hoppe; Berne/CH (hanno.hoppe@gmail.com)

The majority of blunt thoracic aortic injuries (BTAI) results from deceleration trauma. Thereof, 70% are caused by motor vehicle crashes and 13% by motorcycle accidents. Accordingly, the incidence of BTAI is high in fatal traffic injuries and increases with age. It is rare in the paediatric population. The most common site of BTAI is the medial aspect of the lumen distal to the origin of left subclavian artery where injury is found in about 93% of hospital admissions and in about 80% of autopsy studies. This is due to a high pressure combined with rotational forces exerting stress at the aortic isthmus. The most common type of injury is false aneurysm (58%), followed by dissection (25%) and intimal tear (20%). Most patients with BTAI die at the scene. For patients reaching the hospital, timely imaging is essential for definitive management since risk for rupture of contained aortic injury is highest within the first 24 hours. Regarding treatment of BTAI, there is a paradigm shift from open repair to endovascular repair. In selected patients with minor grade aortic injuries, nonoperative management has been applied. Modern treatment options have resulted in improvement of survival.

Learning Objectives:

1. To learn about the frequency and importance of arterial involvement in deceleration trauma.
2. To know more about the differential diagnosis as well as the different localisations of arterial lesions.
3. To learn about prognosis, treatment and outcome after arterial involvement.

A-539 09:00

B. Imaging techniques and typical findings

H. Alkadhi; Zurich/CH

Arterial injury may occur after blunt or penetrating trauma. The clinical outcome of patients with traumatic vascular injury depends on a rapid diagnosis and repair of injury. But despite recent advances in the prehospital care, CT technology and therapy, trauma to the arteries (and particularly to the aorta) continues to be associated with a considerable morbidity and mortality. Imaging of the arteries in the emergency setting remains a challenging imaging practice, requiring broad knowledge of the attending radiologist.

Learning Objectives:

1. To learn about the importance of selecting the appropriate imaging technique to allow for the detection of arterial involvement in trauma patients.
2. To become familiar with the typical image appearance of arterial involvement in trauma patients.
3. To learn about the most important findings and diagnoses for treatment planning.

A-540 09:30

C. Interactive case discussion

R. Morgan; London/UK (robert.morgan@stgeorges.nhs.uk)

This session will discuss the main types of vascular trauma arising from motor vehicle accidents. The imaging strategies for the trauma patient will be presented. Main focus points of the session will include the diagnosis and management of aortic trauma by endografts, and the role of embolisation for the management of visceral orfan trauma.

Learning Objectives:

1. To become familiar with typical cases illustrating the role of appropriate imaging modalities in the assessment of patients after deceleration trauma.
2. To consolidate knowledge of the selection of the appropriate imaging technique, image interpretation and image based treatment recommendation.
3. To understand the most important information urgently needed for treatment decisions and planning.

Author Disclosure:

R. Morgan: Advisory Board; Angiodynamics. Consultant; Cook.

08:30 - 10:00

Room D2

Oncologic Imaging: Follow-up of Systemic and Local Therapies

CC 1619

Follow-up of local treatments of breast cancer

Moderator:

M.H. Fuchsjaeger; Graz/AT

A-541 08:30

A. MRI-guided HIFU therapies in the breast

M. Sklair-Levy; Tel Aviv/IL (mirisklair@gmail.com)

Magnetic resonance high-intensity focused ultrasound is an innovative, non-invasive tumour ablation technique. MRI and focused ultrasound are combined allowing real-time anatomic guidance and temperature mapping during treatment. MRI-guided FUS treatment is performed under local anesthesia with analgesic and sedative agents to reduce pain, unnecessary motion, and claustrophobia. Imaging: T2-V images to define the tumour. T1-weighted with-contrast to verify efficacy after MRg-FUS. MRI-guided FUS ablation of breast cancer to date, most protocols have been treat-and-resect protocols, FUS ablation followed by surgery. Results of studies is variable with histopathologic analysis demonstrating complete tumour necrosis in 20% to 100% of patients treated. There are only a few FUS ablation studies where treated tumour tissue was left in situ after ablation, without a following surgery. All patients tolerated the MRI-guided FUS procedure well, and only minor complication, a skin burn, was reported. Several issues need to be further investigated for successful cancer treatment with MR-guided focused Ultrasound, including patient selection criteria, definition of treatment margins and optimal transducer technology. In summary, FUS ablation has the potential to become an important modality for non-invasive image-guided treatment of localised breast cancer. Multiple phase I studies have proven MRI-guided and US-guided FUS ablation of breast cancer to be technically feasible and safe.

Learning Objectives:

1. To learn about HIFU in breast tumours.
2. To become familiar with the post-HIFU aspects of various types of imaging.

A-542 09:00

B. Pre- and post- imaging appearance of breast lesion excision system (BLES) lesions

S.D. Allen; Sutton/UK (steven.allen@rmh.nhs.uk)

The breast lesion excision system (BLES) has evolved as a breast radiological technology over the last decade and is now in widespread use in Europe and across the world. It was designed as a large biopsy device but more recently due to its unique capability to obtain a single large breast tissue specimen in only a few seconds by utilising a radiofrequency cutting and cauterising wave, it has increasingly been explored in the therapeutic setting. It is easy to use under ultrasound or mammographic guidance with procedures taking a similar length of time to that of a vacuum biopsy, and with patient preparation and anaesthetic essentially identical. The technical aspects of performing these procedures will be detailed as well as its use specifically to perform excisional biopsies. This is limited by patient and lesional factors, all of which will be discussed in more detail. Following a BLES, the post procedure appearances need to be considered in order that follow-up imaging can be interpreted accurately. Risks and complications of this procedure are outlined as well as a discussion made of the latest papers in this field that may suggest future applications and developments.

Learning Objectives:

1. To understand the mechanism of the BLES technique.
2. To become familiar with the post-BLES aspects of various types of imaging.

A-543 09:30

C. Common features and pitfalls in imaging the treated breast

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

During the past years, it has been shown that there is not a single disease entity called "breast cancer". There are different subtypes that entail diverse recurrence risks, this is the first issue to take into account, and patients will be stratified accordingly before any follow-up is planned. Imaging findings in a patient treated for breast cancer will depend on the type of treatment: breast conserving therapy (BCT), mastectomy (and all the reconstructive techniques) radioterapy and minimally invasive techniques. In order to differentiate between fat necrosis and other common post-treatment changes from relapse, it is important to know the timeline when all these changes take place and also schedule the follow-up imaging procedures accordingly. Another important issue to take into account are the limitations and indications of the different modalities (mammography, ultrasound and MRI). Although ultrasound and mammography have traditionally been used in the follow-up of these patients, MRI is being used more and more often due to its superior multiplanar capabilities and the functional information not supplied by the other techniques.

Learning Objectives:

1. To learn about the post-surgical and post-radiation therapies aspects of the breast and their timing.
2. To learn about how to diagnose a recurrence in the treated breast and its differential diagnoses.
3. To become familiar with the imaging findings of post-ablation (RFA) of breast.

Author Disclosure:

J. Camps Herrero: Advisory Board; Bayer.

08:30 - 10:00

Room E1

GI Tract

RC 1601a

Diagnosis and staging of esophageal cancer

A-544 08:30

Chairman's introduction

Z. Tarjan; Budapest/HU (ztarjan@gmail.com)

Oesophageal cancer is more frequent in western countries. Squamous cell carcinoma occurs in the upper and middle third, adenocarcinoma is typical in the distal third and EG junction. The diagnosis is based on endoscopy with biopsy.

However, barium studies are frequently used as a first line exam for patients with oesophageal complaints for assessing both morphology and motility. Only surgical resection including all associated nodes at a very early stage has been shown to improve survival rates. Dilatation and stent placement, endoscopic laser ablation and external-beam radiation therapy alone or together with chemotherapy are typically used as palliation to relieve dysphagia and decrease tumour burden. The main purpose of the staging is to select patients suitable for surgical resection or select early mucosal cancers suitable for endoscopic treatment. There is unique lymphatic anatomy of the oesophagus, as lymphatic vessels in the lamina propria make it possible to have lymph node metastases from superficial T1 tumours. The number of the positive nodes correlates with survival. There is often direct drainage of the submucosal lymphatic plexus into the thoracic duct facilitating systemic metastases. Tumours invading the pleura, peritoneum, pericardium and diaphragm are resectable, while aorta, carotid arteries, azygos vein, trachea, left main bronchus and vertebral body invasion and distant metastatic disease precludes curative surgical resection. Involved celiac lymph nodes are considered distant metastases for squamous cell carcinoma, but N1 disease for oesophageal adenocarcinoma. Size, viability, stage and resectability may change after therapy, therefore needs accurate assessment by radiology for further therapeutic decisions.

A-545 08:35

A. Diagnosis

M. Krokidis; Cambridge/UK (mkrokidis@hotmail.com)

Oesophageal cancer is the sixth leading cause of death from cancer worldwide. More than 90% of oesophageal cancers are either squamous-cell carcinomas or adenocarcinomas. Approximately, three quarters of all adenocarcinomas are found in the distal oesophagus, whereas squamous cell carcinomas are more evenly distributed between the middle and lower third. The cervical oesophagus is an uncommon site of disease. The pathogenesis of oesophageal cancer remains unclear. At the time of the diagnosis of oesophageal cancer, more than 50% of patients have either unresectable tumours or visible metastases on imaging. The most common symptom of presentation is dysphagia which is present in > 70% of the cases; odynophagia may also be present in a smaller percentage of patients. The patients are usually presented also with significant weight loss which appears to be also an important prognostic factor of the outcome of the disease. Diagnosis is based on the findings of a contrast swallow - which is usually the first exam to be performed; oesophageal cancer may present as polypoid, infiltrative, varicoid, or ulcerative lesions. Endoscopy usually confirms the findings of the swallow study, revealing the presence of a mass and offering the possibility of taking biopsy samples. Endoscopic ultrasound is the imaging method that is used for local staging and CT and PET-CT are used to determine the presence of metastatic disease. In case of presence of enlarged lymphnodes, fine needle aspiration or even open biopsy may be performed.

Learning Objectives:

1. To become familiar with the pros and cons of each of the main diagnostic imaging modalities available when assessing a patient with suspected esophageal cancer.
2. To learn the basic imaging findings of esophageal cancer through each modality with emphasis on local disease.
3. To understand the pitfall in diagnosis and staging of tumours located in the gastroesophageal junction.

A-546 08:58

B. Staging

V. Válek; Brno/CZ (vlv@med.muni.cz)

Imaging technology including EUS, PET, MDCT and MRI is suggested for the staging of esophageal cancer. "T" characteristics are assessed with EUS, overall accuracy is 72% - 90%, the accuracy decreases after neoadjuvant therapy. MDCT can define the local extent of tumour. Aortic invasion is suggested when tumour contacts over 90% of the circumference of the vessel (accuracy 59% - 82%). MRI provides little advantage over CT, CT and MR cannot distinguish between T1 and T2. EUS with fine-needle biopsy provides the best modality for assessing LN (sensitivity, 85%; specificity, 97. Accuracy for N staging showed no significant difference (66% for EUS, 68% for PET, and 63% for CT). Most common locations for metastatic "M" disease from oesophageal adenocarcinoma involve the liver, lung, and bone. For the evaluation of distant metastases, PET has a higher sensitivity than CT. An operable tumour has been defined as of radiological stage T1-3, N0 or 1, M0, with a primary length of \leq 5 cm. In "T" staging, EUS could play an important role in the choice of candidates for endoscopic and surgical treatment. However, it remains unclear how to best select patients for a non-operative approach. PET is

a good modality for predicting the efficacy of neoadjuvant chemotherapy/chemoradiotherapy for advanced oesophageal cancer. The two most important prognostic indicators for OC are depth of tumour penetration and the number of malignant lymph node metastases. The 5-year survival rate for patients with tumours remaining in the oesophageal wall and without nodal involvement is approximately 40%.

Learning Objectives:

1. To learn about optimised EUS, MDCT and PET-CT techniques for esophageal cancer staging.
2. To critically review those imaging findings impacting on patient management with regard to palliation, radiation therapy and surgery.
3. To understand the potential of imaging prognostic markers.

A-547 09:21

C. Treatment response

B. Mahon; Birmingham/UK

The last decade has seen a change in the therapy of patients with oesophageal cancer. For many years, the standard therapy for locally advanced lesions has been surgical resection. However, overall survival for patients with locally advanced tumours after resection remains poor, with a five-year survival rate between 10% and 20%. Most patients still present with an advanced tumour stage; therefore, multimodal therapy regimens have been introduced, some using neo-adjuvant chemotherapy or chemo-radiotherapy followed by radical resection, whereas others use adjuvant protocol. Imaging therefore can potentially play an important role in assessing for tumour response. Being able to measure this response to treatment can determine subsequent treatment. Conventional staging tools such as CT are often undertaken to predict responses to neo-adjuvant therapy, however how useful is this? The higher resolution technique of endoscopic ultrasound is often undertaken as a primary staging tool, however can it provide any useful information after neo-adjuvant treatment? Positron emission tomography have shown promising results in the early selection of responders and non-responders during the course of neo-adjuvant therapy, allowing physicians to alter the treatment plan accordingly, however remains a relatively expensive investigation. This is explored together with practical examples of each modality along with potential pitfalls.

Learning Objectives:

1. To learn the normal post-surgical and post-radiation therapy imaging findings and criteria and to differentiate between these and local recurrence.
2. To become familiar with anatomical and functional imaging criteria to assess treatment response.
3. To learn the rationale for follow-up of patients after definitive or neo-adjuvant chemoradiotherapy.

Panel discussion:

Cross-sectional techniques: developing an integrated imaging algorithm in oesophageal cancer

09:44

08:30 - 10:00

Room E2

Oncologic Imaging

RC 1616

Complications of cancer treatment and the detection of recurrences

A-548 08:30

Chairman's introduction

M. Laniado; Dresden/DE (michael.laniado@uniklinikum-dresden.de)

One of the complications after curative treatment of cancer patients that affect patients' prognosis is a local or distant recurrence. In the absence of a distant recurrence, the patient with a local recurrence still has a chance for cure if it is detected in an early curable state. Here is where imaging plays a crucial role. Treatment effects from surgery, chemo- or radiotherapy, however, provide a difficult ground for imaging evaluation. Late toxicity effects such as inflammation and fibrosis confound imaging appearances of a recurrence and expose the radiologists to a diagnostic dilemma. This session will address the different imaging findings of treatment sequelae in head and neck, liver, pancreas and rectal cancer patients and will give an understanding of how various imaging methods can differentiate between treatment-related effects and active tumour regrowth.

Author Disclosure:

M. Laniado: Consultant; Janssen Pharmaceutica N. V.

A-549 08:35

A. Head and neck cancer

L. Oleaga Zufiria; Barcelona/ES (lauraoleaga@gmail.com)

Identification of recurrent tumour in the post-therapy setting is often challenging. It is essential to have a baseline study for monitoring changes and evaluating possible recurrences. After surgery, there is distortion of the anatomy, the fat planes are lost, functional lymphadenectomy may be associated with muscle resection, resection of the jugular vein or grafting, therefore, it is essential to know this data to properly analyze the images. The immediate postoperative baseline study after surgery should be performed between 4 and 6 weeks after surgery. When radiotherapy is performed, there is loss of fat planes, significant edema in the mucosa and in subcutaneous tissue. The recommended baseline study should be obtained at 3 months after a completion of radiation therapy. The imaging methods used for the staging and follow-up of head and neck tumours varies between centres. CT is the most commonly used imaging technique, however, at some institutions MRI or PET are used to detect tumour recurrence after therapy, either surgery or chemo/radiation. Distinction between post-treatment changes and recurrent or residual tumour might be difficult to assess on imaging. A soft tissue mass present in the baseline study that decreases in size, should be considered treatment-related changes. If the mass increases in size, it is suggestive of persistent or recurrent tumour. A new onset mass in the follow-up study should be considered as recurrence. Late complications due to chemo/radiation include soft-tissue necrosis, osteochondronecrosis, carotid atherosclerosis, myelopathy, nerve paralysis secondary to fibrosis and sarcomas.

Learning Objectives:

1. To learn about the possible range of late toxicity effects after surgery and chemoradiotherapy of the neck.
2. To become familiar with the imaging findings after surgery and chemoradiotherapy.
3. To understand which imaging method to use to differentiate between treatment sequelae and remaining tumour.

A-550 08:58

B. Liver and pancreatic cancer

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

In the recent past, there have been significant improvements in the treatment of cancer, including liver and pancreatic tumours. Surgery provides excellent results in liver and pancreatic cancer, although early and late complications must always be taken into account. Percutaneous treatments have several advantages over surgery, above all the minimal invasiveness; nevertheless, there might be complications, although less common as compared to surgery. In the assessment of early complications, namely abscess formation and bleeding, US and especially contrast enhanced CT provide the best results. All patients undergoing surgery or percutaneous treatments should undergo strict follow-up with imaging modalities. In both liver and pancreatic cancer, recurrency must be considered, especially if the tumour at the time of treatment is at an advanced stage; for this purpose, the radiologist should exactly know the type of procedure the patient was submitted in order to avoid misinterpretation determined by surgical material or granulomatous components. In all cases, it is crucial, for the assessment of recurrences, comparative studies that allow to detect even minimal modification. In this respect, functional studies play an important role: PET-CT already has a well defined role, while diffusion weighted and perfusion MR is gaining importance. In all cases, the combination of different imaging modalities and correct clinical information help in the diagnosis, allowing early detection of complications and recurrences.

Learning Objectives:

1. To become familiar with the imaging of complications following pancreatic surgery and liver chemotherapy and/or radiotherapy.
2. To understand how these changes can conceal or mimic active disease.
3. To learn how to distinguish post-treatment changes from residual or recurrent disease.

A-551 09:21

C. Rectal cancer

L.C.O. Blomqvist; Stockholm/SE (lennart.k.blomqvist@ki.se)

Treatment of rectal cancer is multi-modality based and continuously improved. Despite reduction of recurrence rates, local recurrence of still occurs in about 5-10 % of patients. Complications of rectal cancer treatment, such as anastomotic leakage occur in about 10 % of patients. Neoadjuvant treatment with chemo- and/or radiotherapy also induces changes in the pelvic tissues that challenge the diagnosis of locally recurrent disease. To make correct diagnosis, knowledge about the normal

post-treatment anatomy as well as the typical patterns of distribution both of post-treatment and recurrent disease is essential. In the initial stage, an important role of imaging is to target areas for biopsy confirmation of locally recurrent disease. CT, MRI as well as PET/CT hybrid imaging with 18 F-fluorodeoxyglucose as a tracer all individually have their important role in the work-up. If anterior resection has been performed, endorectal ultrasonography is an additional option for evaluation of the anastomosis in these patients. For treatment planning of recurrent rectal cancer, diagnostic imaging is presented by the radiologist in a multidisciplinary conference to make sure that the information brought by the images is used to select the best possible treatment for the patient. In this presentation, the role of different imaging techniques for diagnosis of locally recurrent rectal cancer and challenges based on differentiation of recurrent disease from post treatment changes will be discussed.

Learning Objectives:

1. To understand the role of CT, PET and MRI in the surveillance of patients after rectal cancer surgery.
2. To become familiar with the imaging changes of the irradiated and resected tumour bed.
3. To understand the diagnostic algorithm for early detection of a local recurrence in the treated tumour bed.

Panel discussion:

How to differentiate between treatment sequelae and active disease 09:44

08:30 - 10:00

Room F1

Abdominal Viscera/GI Tract

RC 1601b

Abdominal MRI: standard and advanced protocols in clinical settings

Moderator:

M.A. Patak; Zurich/CH

A-552 08:30

A. Fistula in ano

A. Gupta; London/UK (arungupta1@nhs.net)

MRI is a fundamental part of perianal fistula evaluation in any patient in whom surgical or biological therapy is being considered. This lecture will explain what role MRI plays in the management and how MRI should be performed optimally. Hardware requirements, the choice of sequences to use, interpretation of the MRI scan and the significance of the findings will be discussed. The future directions of MRI scanning will also be reviewed.

Learning Objectives:

1. To learn optimised MRI state-of-the-art protocols to image patients with fistula in ano.
2. To understand of the role of imaging in fistula classification and staging, impact on therapeutic decision-making, assessment of activity and in treatment monitoring.
3. To describe how to provide an optimal MRI fistula report.

A-553 09:00

B. Pelvic floor disease

M. Bazot, L. Jarboui, I. Thomassin-Naggara, F. Haab, E. Darai; Paris/FR (marc.bazot@tnn.aphp.fr)

Pelvic floor disease (PFD), including pelvic organ prolapse (POP), urinary incontinence, defaecatory dysfunction, and pelvic floor relaxation is a common condition. Physical examination is the first step to determine the presence of PFD but has limitations. MR imaging performed in decubitus position after rectal opacification by sonographic gel is an excellent imaging modality for evaluation of PFD. Static MRI using sagittal, axial, and coronal T2-weighted MRI sequences provides detailed informations of pelvic organs and pelvic floor anatomy. Dynamic MRI using rapid T2/T1 MRI sequences in midsagittal plane are performed at rest, squeezing, straining, and defecation, and must be repeated two or three times. Images are reviewed with cine for evaluation of anterior (cystocele), middle (uterine, vaginal, or apex prolapse), posterior (rectocele), and peritoneal prolapses (peritoneocele, enterocele, sigmoidocele). Competition between these different compartments is common. The use of reference lines (pubococcygeal, H and M lines) is helpful for image evaluation. MRI has excellent clinical correlation and can be associated with other modalities (ultrasonography, electrophysiologic examinations) depending

on clinical setting. MRI is essential when choosing conservative versus surgical treatment (multicompartment POP, pelvic floor relaxation, incidental pathologic conditions).

Learning Objectives:

1. To learn the clinical indications and the optimised dynamic MR imaging protocol for investigating pelvic floor disease in patients.
2. To understand common and uncommon findings related to the posterior, middle and anterior compartments and how they impact on subsequent patient management.
3. To understand how to introduce MRI into a pelvic floor therapy and how to best integrate with conventional techniques.

A-554 09:30

C. Suspected biliary tumour

C. Matos; Brussels/BE (cmatos@ulb.ac.be)

Magnetic Resonance (MR) imaging has been accepted as a major non-invasive diagnostic modality for investigating the bile ducts. MR imaging with MR cholangiopancreatography (MRCP) may be used as a replacement for diagnostic endoscopic retrograde cholangiopancreatography (ERCP) and has gained acceptance by gastroenterologists, surgeons and general practitioners because of its high success rate and because of the ability to project a virtual cholangiogram image display. Comprehensive MR imaging of biliary tumours should a) show the size and location of a primary lesion and assess the longitudinal and radial extent of bile duct involvement, b) enable the characterisation of biliary stenosis, c) show involvement of the hepatic artery and lobar branches and of portal vein and lobar branches for the purpose of surgical planning, d) depict the presence and extent of liver invasion and lobar atrophy and hypertrophy and e) enable the detection of regional lymph nodes and metastases. To achieve this, MR imaging should be performed at high field strength, using multichannel, phased-array coils, parallel imaging technology and ideally before any biliary drainage procedure. This lecture will emphasize the importance of a comprehensive protocol that includes T2-weighted imaging and MRCP, gadolinium-enhanced T1-weighted imaging, and diffusion-weighted imaging. Imaging characteristics that may indicate a specific diagnosis of biliary tumour will be described.

Learning Objectives:

1. To learn the basic MRI technique for patients with suspected biliary tumour.
2. To understand advanced imaging protocols for both structural and functional imaging of the bile ducts, and when these are indicated.
3. To understand the MR imaging findings which best differentiate benign from malignant disease, and how to produce an optimised report.

08:30 - 10:00

Room G/H

Neuro

RC 1611

Spine: update on postoperative imaging and minimally invasive procedures

A-555 08:30

Chairman's introduction

J. Van Goethem; Antwerp/BE (johan.vangoethem@ua.ac.be)

Spinal surgery has evolved significantly over the past decades. From simple discectomies and laminectomies over herniectomy and posterior fusions we now have a plethora of open, classic surgical procedures, fusion procedures, artificial discs and posterior elements devices. More importantly minimally invasive procedures, started with vertebroplasties but nowadays also including more complex procedures and even transcatheter fusion surgery is available. Scientific studies that support the use of some of these procedures are still scarce and sometimes only anecdotal information is available. Imaging in these patients is sometimes complex and depends not only on the patients' complaints but also on the type of procedure and time lapse since the intervention.

Author Disclosure:

J. Van Goethem: Consultant; Zimmer Spine.

A-556 08:35

A. Postoperative spine

L. van den Hauwe; J.W. Van Goethem, C. Venstermans, F. De Belder, P.M. Parizel; Antwerp/BE (lucvdhauwe@mac.com)

The increase in the number of surgical spinal procedures is reflected by the increase in post-operative imaging studies (conventional x-rays, CT, and MRI). Imaging assessment of the spine after surgery is complex and depends on several factors, including the age and anatomy of the patient, indication for and type of surgery performed, biomaterials used, time elapsed since the surgical procedure, and - most importantly - the duration and the nature of the post-surgical syndrome. Adequate understanding of the various surgical techniques (both instrumented and non-instrumented), coupled with an appropriate awareness of the possible complications - acute and late - is vital when interpreting post-operative studies. Normal post-operative findings as well as imaging findings in acute complications (haematoma, spondylodiscitis) and the failed back surgery syndrome (recurrent disc herniation vs epidural fibrosis) will be discussed.

Learning Objectives:

1. To become familiar with the appropriate imaging technique in the postoperative spine.
2. To learn how to differentiate between normal and abnormal postoperative findings.
3. To recognise the most common postoperative complications.

A-557 08:58

B. Indications for vertebroplasty

A. Gangi, J. Garnon, G. Tsoumakidou, I. Enescu; Strasbourg/FR (gangi@rad6.u-strasbg.fr)

Percutaneous vertebroplasty is a therapeutic, image-guided procedure that involves injection of radio-opaque cement (methyl methacrylate) into a painful, collapsed vertebral body to consolidate it, in an effort to relieve pain and provide stability. Cementoplasty can be considered for five specific indications: 1. osteoporotic fractures: vertebroplasty has become the standard of care for osteoporotic fractures; 2. painful bone tumours: osteolytic destruction of the vertebral body by metastases are a source of debilitating pain and disability; 3. aggressive vertebral hemangiomas: in patients with haemangiomas localised to the bone only, vertebroplasty for direct vascular embolisation with stabilization can be performed. However, haemangiomas, with epidural and/or paravertebral involvement, sclerotherapy (ethibloc or alcohol) is performed first, followed two weeks later by vertebroplasty; 4. painful vertebral fractures associated with osteonecrosis (Kummel's disease); 5. traumatic vertebral fractures in young patients associated to an augmentation technique (Stentoplasty). In combination with bone surgery and others: conditions in which anterior stabilization of the vertebral body is required prior to or after posterior surgical stabilization or epidural decompression. The absolute contraindications to the performance of vertebroplasty are uncorrectable coagulopathy, presence of vertebral osteomyelitis, discitis or infection of the overlying skin, systemic infection, and presence of free posterior wall fragment with or without retropulsion associated with spinal canal stenosis and/or neurological symptoms, asymptomatic vertebral compression fractures and prophylaxis for osteoporosis. Following spinal trauma, vertebral burst fractures with discoligamentous disruption require surgical stabilization and are not indicated for vertebroplasty alone.

Learning Objectives:

1. To consolidate knowledge of the actual indications for vertebral augmentation.
2. To understand the contraindications and limitations.
3. To become familiar with the algorithm of patient selection.
4. To understand the best timing for vertebral augmentation.

A-558 09:21

C. Percutaneous treatment of spinal diseases

M. Muto; Naples/IT (mutomar2@gmail.com)

Spine pain is a very common problem in western country. It is very important to find a correct clinical and diagnostic approach to understand the source of the pain. X-ray, CT and MR can give a wide spectrum of finding helping clinicians to choose the best mini-invasive treatment. Beside vertebral body fractures, herniated disk, spinal canal stenosis and degenerative facet joint disease are the major cause of spine pain. Multiple percutaneous disk treatment are available and the choice of the device is made in relation of the type of herniated disk and clinical finding. The presence of cono-cauda syndrome, hyperalgetic sciatica and progressive foot drop represent an urgent indication to surgery. Percutaneous disk treatment can be apply also to cervical disk disease. Radiofrequency facet joint ablation, perig-

angliar and interarticular steroid injection can also be performed helping patients with spine pain to reduce drugs dependence. The position of interspinous spacer can be apply in patients with low back pain, degenerative disk disease and spinal canal stenosis associated also to spino-plasty giving a redistribution of axial load on the lumbar spine elements.

Learning Objectives:

1. To understand the clinical indications for percutaneous treatment of spinal diseases.
2. To know what diagnostic modality to suggest.
3. To become familiar with the different percutaneous techniques available.

Panel discussion:

Minimally invasive spinal procedures: the radiologist's future role? 09:44

08:30 - 10:00

Room I/K

Chest

RC 1604

Pulmonary embolism: guidelines and best practice throughout Europe

A-559 08:30

Chairman's introduction

M. Rémy-Jardin; Lille/FR (martine.remy@chru-lille.fr)

Owing to substantial advances in CT technology during the past decade, the routine analysis of pulmonary arteries down to the subsegmental level is now possible and CT is considered the reference standard for the imaging diagnosis of pulmonary embolism. This imaging modality has also seen its impact extended to the prognostic approach of acute pulmonary embolism and is widely available throughout Europe. Despite high rates of awareness and adoption of management guidelines in the radiological community, radiologists have variable degrees of conformance with these recommendations, reflecting the variable degrees of conformance also seen among clinicians and the variable categories of patients in whom this diagnosis is suspected or incidentally recognised. Full implementation of guidelines has the potential to reduce the number of CT examinations, and thus to decrease not only radiation exposure and health care costs. The purpose of this refresher course is to emphasize the benefits and limitations of guidelines as actually implemented in routine clinical practice throughout Europe.

A-560 08:35

A. Pioped 1-2-3: what have we learned so far?

C. Engelke; Göttingen/DE (c.engelke@med.uni-goettingen.de)

The goal of this refresher course is to summarize the published data from the three large National Heart, Lung and Blood Institute-sponsored prospective multicenter studies on the diagnosis of acute pulmonary venous thromboembolism (VTE) - the „Prospective Investigations of Pulmonary Embolism Diagnosis“ (PIOPED I to III): 1. the „Prospective Investigation of Pulmonary Embolism Diagnosis“ (PIOPED I) study on the diagnostic accuracy of scintigraphy, 2. the „Pulmonary Embolism Diagnosis (PIOPED) II trial on the diagnostic accuracy of multi-detector row pulmonary CT angiography (PCTA) and 3. the „Prospective Investigation of Pulmonary Embolism Diagnosis III“ trial on the diagnostic accuracy of gadolinium-enhanced magnetic resonance angiography (Gd-MRA) as diagnostic tools in patients with suspected acute VTE. While the results of the PIOPED I study supported the first-line use of V/Q lung scanning in the diagnostic evaluation of patients with suspected VTE before CTA could be developed to become a widely available reliable diagnostic tool the results of each study with its conceptual details are now set into current perspective and the evolution of PCTA to become the imaging reference standard in the diagnosis of acute VTE is outlined. Furthermore, the current status of Gd-MRA of pulmonary arteries and peripheral veins is outlined. The course will discuss the recommendations of all PIOPED studies and open the discussion for current clinical applications of all three modalities in this patient group.

Learning Objectives:

1. To appreciate the results of Pioped 1-2-3 in the light of technological refinements in 2013.
2. To become familiar with the pros and cons of CT versus MR.
3. To understand the residual potential indications of scintigraphy.

A-561 08:58

B. PE in oncologic patients

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

Oncologic patients have a 4 to 6 times increased risk of venous thromboembolism (VTE) compared to the general population. The risk is further increased in patient undergoing new antitumoural treatments. VTE decreases the overall survival by three times in this population, making it important to be detected by the radiologists. Most of those VTE episodes are clinically suspected by the clinician and are incidentally found on follow-up oncologic thoracic CT. Unfortunately, radiologists fail to report 30 to 75% of pulmonary embolism (PE) in clinical routine. New CT software or technical refinements should help the radiologists to detect PE on oncologic thoracic CT. Radiologists have also to look for other types of pulmonary embolism in cancer patients, including tumoural and exogenous material (i.e. cement, catheter, radioactive seeds) embolism.

Learning Objectives:

1. To learn about the increased risk of venous thromboembolism.
2. To understand the means of recognising peripheral PE, including CAD and new software tools.
3. To learn how to deal with clinically unsuspected PE, both for reporting and treatment.

A-562 09:21

C. PE during pregnancy and puerperium

M.-P. Revel; Paris/FR (marie-pierre.revel@htd.aphp.fr)

The risk of venous thromboembolism (VTE) is especially increased during the third trimester antepartum and the first 6 weeks post-partum. VTE remains the first cause of maternal death in developed countries. There is no validated clinical probability scoring system for VTE in pregnancy and puerperium and a negative D-dimer test is insufficient to rule out VTE. Thus, all patients require further diagnostic tests, accounting for the low prevalence of VTE in most reported series. Fetal radiation dose is considered negligible with both ventilation perfusion (V/Q) scan and computed tomography pulmonary angiography (CTPA). The latter provides high maternal breast radiation dose, but allows alternative diagnosis, such as post-partum pneumomediastinum, a cause of chest pain after vaginal delivery. CT may also help detecting mild pulmonary oedema, in dyspneic patients developing peripartum cardiomyopathy. Compression ultrasound of the legs and magnetic resonance imaging are alternative tests avoiding radiation exposure, but require further investigation when negative. Compression ultrasound is the first-line test in women with symptomatic leg. In the remaining patients, V/Q scan is recommended if chest x-ray is normal, in patients free of pulmonary disease and is diagnostic in 80% of cases. CT angiography is performed if chest x-ray is abnormal or V/Q scan is not diagnostic. CT parameters require adjustment to avoid excessive breast radiation exposure during CTPA. To optimise pulmonary arteries opacification, CTPA should not be performed at deep inspiration, to avoid increasing inferior vena caval flow and the return of non-opacified blood to the right atrium.

Learning Objectives:

1. To learn more about the increased risk of venous thromboembolism.
2. To appreciate the pros and cons of US, CT, MR and scintigraphy.
3. To learn about specific diagnostic algorithms.

Panel discussion:

Pulmonary embolism work-up in 2013

09:44

08:30 - 10:00

Room L/M

Special Focus Session

SF 16c

Making homogeneous the reading in HCC

A-563 08:30

Chairman's introduction

C. Bartolozzi; Pisa/IT (carlo.bartolozzi@med.unipi.it)

Management and prognosis of HCC patients is strongly dependent on early diagnosis, definition of tumour extension and on an efficient communication with referring clinicians. Thus, radiologists need to be aware of the implications of their own interpretation and reporting of imaging findings. International guidelines

have been developed to provide confident non-invasive diagnosis of HCC in the setting of liver cirrhosis, according to typical imaging findings. However, atypical enhancement patterns may be frequently encountered in HCC nodules, and their understanding, interpretation and reporting may be challenging, requiring the need for adjunctive information, such as diffusion characteristics and hepatobiliary function of the nodules. On the other hand, strict and continuous follow-up is essential in HCC patients, and treatment outcome represents a strong prognostic indicator. However, understanding of tumour response to treatment requires knowledge of the different findings after percutaneous, transarterial and/or systemic therapies. The development of specific cataloguing systems for focal liver lesions, the improvement and standardization of imaging criteria to assess tumour response to therapy and the creation of specific software and platforms for oncologic follow-up may facilitate the radiologist's daily workflow, yet improving homogeneity and consistency in image interpretation. The session will provide an up-to-date overview of typical and atypical findings in liver imaging and diagnostic criteria to assess tumour response and will focus on the importance of standardization for efficient reporting and communication with referring clinicians.

Session Objectives:

1. To become familiar with common and uncommon findings in HCC and with updated guidelines in HCC diagnosis and follow-up.
2. To understand how interpretation and reporting in HCC influence patient management.
3. To learn about recent developments in computer-aided reporting.

A-564 08:35

HCC diagnosis: how to report 'typical' findings

C. Ayuso; Barcelona/ES (cayuso@clinic.ub.es)

Diagnosis of early stage HCC is a key point with prognostic and patient survival implications, thus it is crucial to have standardised reports for clinical and research purposes, being aware that specificity is the goal in the diagnosis of HCC. Any categorization as "possible" or "probable" HCC will require pathologic confirmation to avoid wrong treatment indications. Any new hepatic nodule ≥ 1 cm detected by screening US, whether hypo or hyperechoic, in a population at risk of HCC is suspicious to be an HCC and deserves a cross-sectional dynamic study. CEUS can recognize the "wash-in wash-out" HCC profile, but it may overlap with the vascular profile of intrahepatic cholangiocarcinoma. Thus, AASLD recommends to examine these lesions under dynamic MR or MDCT to get a confident HCC diagnosis. Most of HCCs > 2 cm show arterial enhancement followed by wash-out in the portal/delayed phase that makes possible to detect the lesion as hypointense/hypodense compared to the surrounding liver. The term "wash-out" would be desirable to be stated only when extracellular contrast medium is used for MR to avoid confusion in the application of non-invasive criteria when hepatobiliary contrast agents are used and lesions are hypointense on the delayed venous and/or hepatobiliary phases. Fatty metamorphosis and pseudocapsule have low sensitive without any additional diagnostic improvement over dynamic studies. DWI has shown high sensitivity but any strong data on specificity is yet available. Differentiation of very early distinctly and indistinctly nodular HCC types is by now not feasible by means of imaging techniques.

Learning Objectives:

1. To learn about AASLD/EASL imaging criteria for non-invasive diagnosis of hepatocellular carcinoma.
2. To understand the need for standardised interpretation and reporting in HCC surveillance.
3. To learn the current terminology in HCC reporting.

A-565 08:53

How to interpret and report 'atypical' findings

C.J. Zech; Basle/CH (CZech@uhbs.ch)

In imaging, the depiction of arterial hypervascularisation and venous wash-out is the hallmarks of non-invasive HCC diagnosis. However, the findings in patients with liver cirrhosis or longstanding chronic hepatitis B or C often include unclear or atypical findings. The aim of imaging is to sensitively and specifically make the diagnosis of typical HCC nodules on the one hand, and provide the differential diagnosis of unclear and atypical cases on the other hand. Very often untypical nodular findings represent early forms of carcinogenesis - from uncomplicated regenerative nodules to early HCCs. The edge between benign and malignant is hard to determine - however, it seems that high-grade dysplastic nodules are usually regarded as pre-malignant lesions. On the other hand, it is known that also small overt HCC (< 2 cm) often also does not show typical vascular features. MRI

can offer additional features like hyperintensity in high b-value DWI images and T2w images or missing hepatobiliary uptake to help for the differential diagnosis. Other entities which can pose difficulties are small pseudolesions, which are usually depicted as hypervascular areas or small hemangioma. In cirrhotic liver, the most common cause for pseudolesions are small ap-shunts. Beside the late vascular images and hepato-biliary phase images, morphology and shape of this entity is often characteristic. Hepatic haemangioma is a rarely seen lesion in cirrhotic livers. A certain proportion of large HCCs also present with atypical vascular features. In these cases, image-guided biopsy is needed to establish the diagnosis.

Learning Objectives:

1. To learn about common tricks and traps in interpreting atypical findings in HCC surveillance.
2. To learn about the key elements for homogeneous reading and reporting in 'atypical' HCC.
3. To understand the key role that specific findings reported by radiologists have in determining patient management.

Author Disclosure:

C. J. Zech: Advisory Board; Bayer. Speaker; Bayer, Bracco, Siemens.

A-566 09:11

How to evaluate tumour response to therapies

J. Ricke; Magdeburg/DE (Jens.Ricke@med.ovgu.de)

Assessing tumour response in HCC is extremely challenging. First, previous studies such as the SHARP trial have demonstrated that systemic treatment with targeted molecules such as Sorafenib (the only approved drug as of today) cannot be evaluated based on established morphologic size criteria such as RECIST or WHO alone. In SHARP and other studies, response criteria based on tumour size did not correlate with overall survival. Thus, response criteria adding tumour perfusion as a variable such as EASL or, not supported by appropriate evidence today, mRECIST need to be considered. In addition, all criteria at hand today have been developed for systemic approaches, in theory targeting all lesions simultaneously. In HCC, locoregional treatments are well accepted specifically in the intermediate tumour stages. These techniques are staged approaches that may often be repeated over time. Thus, tumour growth at a given time point may not necessarily correlate with prognosis since the lesion in question may not even have been targeted yet by the therapy. In this lecture, response criteria established for HCC will be reviewed and their appropriateness for clinical use or as study endpoints will be discussed.

Learning Objectives:

1. To understand imaging findings after HCC locoregional and systemic treatments.
2. To learn about the current guidelines for defining HCC response to treatment.
3. To learn about the key elements of homogeneous reading and reporting after HCC treatment.

A-567 09:29

Information technology: the practical impact on the management of HCC patients

I. Bargellini; Pisa/IT (irenebargellini@hotmail.com)

The need for more quantifiable and standardised data is advocated in oncologic imaging, for clinical practice and research purposes. The Liver Imaging Reporting and Data System (LI-RADS®), adopted by the ACR in March 2011, represents a step forward in the standardization of liver findings, in the attempt 1) to reduce variability in lesion interpretation and omissions of relevant information, 2) to improve communication with clinicians, patient management and outcome monitoring, and 3) to enable performance auditing and quality assurance. With the adoption of standardised categories, liver CAD (computer-aided diagnosis) may become an intriguing reality. CAD enables automated cataloguing of lesions, each lesion being displayed with size, kinetics, ADC, and segmental localisation, thus facilitating comparison of serial exams. Cataloguing also provides a solid basis for potential research database. In later years, new software have been developed providing simple, automated workflows for routine oncology reading. These user-friendly platforms facilitate comparisons among different imaging modalities over time and provide auto-measurements for reproducible tumour response evaluation according to different criteria (RECIST, WHO, tumour volume, SUV quantification). They enable to collect and share results in a structured manner, automatically storing measurements captured during reading and providing an overview of the findings for easy exporting or dictation. Management of HCC patients requires a continuous integration between imaging findings and clinical data. Development of specifically designed interactive database is required to gather all the clinical, radiological and

surgical data for each single patient, thus facilitating communication among clinicians, decision making and outcome analysis.

Learning Objectives:

1. To understand the need for new systems to improve standardization of reading and reporting.
2. To learn about new tools and software for managing oncologic patients.
3. To understand the added value of computer technology in the management of HCC patients.

Panel discussion:

Case-based discussion: a practical demonstration of how interpretation and reporting affect patient management

09:47

08:30 - 10:00

Room N/O

Special Focus Session

SF 16b

Head and neck cancer battle: the power of imaging studies

A-568 08:30

Chairman's introduction

V. Vandecaveye; Leuven/BE (vincent.vandecaveye@uz.kuleuven.ac.be)

Organ sparing surgery and radiation treatment such as intensity modulated radiotherapy (IMRT) - often combined with chemotherapy - have enhanced the need for advanced imaging in the head and neck in the pre- and post-treatment head and neck; including CT, (functional) MRI, PET/CT and PET/MRI. The radiologist plays an indispensable role as a consultant to the clinician for appropriate staging of the deep tumour extension in the pretreatment setting and characterisation and staging of indeterminate (sub)mucosal and nodal lesions in the post-treatment setting. The vast progression in anatomical, functional and hybrid diagnostic modalities raises many questions and potential problems for daily clinical practice: which imaging technique is most suitable, also taking into account cost-benefit? How should the report be structured in order to reach the demands of the clinician? Moreover, increasing knowledge is required from the radiologist regarding treatment, patterns of tumour spread and treatment failure and the appearance of tumour recurrence versus expected - and often treatment induced - tissue changes that may mimic tumoural recurrence. As such, key points to provide accurate and cost-efficient oncologic imaging in the pre- and post-treatment head and neck include knowledge of the several treatment types and their indications and most frequent causes and patterns of treatment failure, knowledge of imaging features that differentiate malignant from benign lesions, knowledge of proper implementation of imaging techniques according to the indication and the ability to deliver a comprehensible and structured report enabling both diagnosis and treatment planning.

Session Objectives:

1. To learn how to choose the optimal imaging modality for head and neck cancer staging and detection of tumour recurrence.
2. To understand which elements are key to writing a structured radiological report in diagnosis and staging.
3. To become familiar with the imaging features of tumour relapse versus complications in the post-treatment neck.
4. To understand the clinical role of imaging in post-treatment patient management.

A-569 08:35

Building blocks for locoregional staging of head and neck tumours

F.A. Pameijer; Utrecht/NL (f.a.pameijer@umcutrecht.nl)

In the head and neck, squamous cell carcinoma is by far the most prevalent histology. As in any cancer, correct pretherapeutic TNM-staging is an important factor in treatment planning of head and neck neoplasms. This is a multidisciplinary effort. While the otolaryngologist uses endoscopy to evaluate the mucosal surface, it is the radiologist's role to describe the deep extent of lesions. CT or MRI has become essential for pre-therapeutic staging of these tumours. In this era of cost concern, it seems to be a good principle to do one cross-sectional study that accurately answers the clinical questions. The relative value of CT and MRI in this aspect will be discussed. The role of PET CT (MR) in primary staging is evolving. To be an effective consultant, the radiologist's report should contain information needed by the treating physician (surgeon and/or radiation oncologist). Therefore, it is helpful if the radiologist is aware of tumour spread patterns in the various subsites

of the head and neck. In addition, the radiologist should be aware of 'key' findings with direct impact on treatment choice. This approach will be demonstrated using clinical examples from daily practice, focusing on oropharynx/oral cavity and larynx/hypopharynx. Since so many specialists are involved in care of these patients, structured radiological reporting is strongly recommended. Based on the imaging finding, it is (usually) possible to conclude the report with a 'radiological' TN (M)-stage which serves as proposal towards the head and neck tumour board.

Learning Objectives:

1. To learn how to make a choice between CT and MRI.
2. To understand which imaging findings should be assessed to obtain a radiological TN-stage.
3. To become familiar with structured radiological reporting of head and neck tumours.

A-570 09:00

Detection of tumour recurrence in head and neck cancer: challenges and pitfalls

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

The purpose of this lecture is to provide a simplified, systematic approach on how to detect tumour recurrence on MRI, PET/CT and PET/MRI examinations of patients treated for head and neck squamous cell carcinoma. First, the radiologist will be familiarized with the relevant imaging findings of post-therapeutic expected tissue alterations with a special focus on their temporal relationship. Then a brief discussion of common complications affecting the soft tissues, vasculature and bony structures will follow. A systematic review will include key radiologic features of osteoradionecrosis, soft-tissue necrosis, neck fibrosis and scar tissue mimicking tumour recurrence. Typical radiologic findings of tumour recurrence will be discussed with an emphasis on the early detection of lesions, their appearance on different imaging modalities and the added value of multimodality fusion or hybrid imaging techniques. The potential pitfalls of post-therapeutic image interpretation and how to avoid them will be equally addressed. Major emphasis will be put on what the clinician needs to know and on how to report the findings in a comprehensive way.

Learning Objectives:

1. To appreciate the spectrum of expected tissue alterations after therapy and their temporal relationship.
2. To understand the imaging aspects of common complications after therapy.
3. To become familiar with key imaging features of tumour recurrence.
4. To learn the potential pitfalls in post-therapeutic image interpretation and how to avoid them.

A-571 09:20

Locoregional treatment failure in head and neck cancer: causes and clinical implications

R. Maroldi; P. Nicolai; Brescia/IT (maroldi@med.unibs.it)

It is estimated that 50-60% of patients with locally advanced squamous cell carcinoma (SCC) of the head and neck receiving a multimodal treatment will develop locoregional and/or distant relapse within 2 years. Therefore, surveillance and treatment planning in this cluster of patients is a demanding activity for a head and neck multidisciplinary team. Although there are some subtle differences in the pattern of recurrence in relation to the primary site and the type of treatment (surgical vs. non-surgical), relapse of the disease more frequently involves the primary site than the neck, although both sites can be affected at the same time. The reasons for treatment failure at the primary site in surgically treated patients can be the presence of inadequate surgical margins, perineural spread, or vascular embolisation. Regional failures can occur in a previously dissected neck or in an untreated field. There is general consensus in the literature that surgery is the treatment offering the best rescue chance in recurrent SCC of the head and neck. This possibility is higher in laryngeal cancer than in the oral cavity, oropharyngeal, and hypopharyngeal localisations. In early lesions of the larynx, conservative surgical techniques can be considered an oncologically sound alternative to total laryngectomy. Salvage surgery is instead feasible in 20%-40% of patients with recurrent SCC of the oral cavity, oropharynx, and hypopharynx. Irrespective of the primary treatment, patients require a compulsory follow-up which should combine clinical examination, including endoscopy with narrow-band imaging, and imaging techniques, with the intent to early diagnose recurrences.

Learning Objectives:

1. To understand the most frequent causes of local and regional post-treatment relapses.
2. To become familiar with the indications and options for salvage surgery and non-surgical procedures.

3. To understand the role of imaging in decision-making concerning local and regional recurrences.

Panel discussion:

Advanced imaging in clinical practice: how does it help the patient? 09:50

08:30 - 10:00

Room P

Cardiac

RC 1603

How I report

Moderator:

R. Vliegenthart; Groningen/NL

A-572 08:30

A. Chest x-ray in cardiac disease

M.B. Rubens; London/UK (m.rubens@rbht.nhs.uk)

The chest x-ray is a fundamental investigation in the management and follow-up of all patients with known or suspected heart disease. As in all areas of clinical practise, an organised approach to the patient is paramount and the following sequential approach is proposed: 1. Extra-cardiac analysis. This requires assessment of the quality of the radiograph, assessment of situs, scrutiny of the bones and soft tissues for features of previous interventions, syndromes and systemic diseases, inspection of the upper abdomen and assessment of the aortic and azygous arches. 2. Physiological analysis. This concerns analysis of the pulmonary vasculature. The possible vascular patterns are normal, increased (these are pulmonary venous hypertension, pulmonary arterial hypertension, plethora and systemic supply to the lungs), decreased and uneven. Each of these patterns has a precise physiological meaning. 3. Anatomic analysis. This concerns the cardiovascular silhouette. The CXR may suggest specific chamber enlargement; this should be interpreted in the context of the pulmonary vascular pattern. The shape and size of the aortic arch and central pulmonary arteries and any abnormal calcification may also be diagnostically useful. Finally, the cardio-thoracic ratio may provide important prognostic information, as may sequential changes in heart size.

Learning Objectives:

1. To be aware of the indications for performing a chest x-ray in patients with cardiac disease.
2. To become familiar with the most important and relevant findings for the diagnosis of cardiac disease.
3. To learn about a structured approach to reading chest x-ray in cardiac patients.

A-573 09:00

B. Coronary CTA

F. Wolf; Vienna/AT (florian.wolf@meduniwien.ac.at)

Cardiac CT is a relatively young discipline in the era of computed tomography especially due to the fast and still on going technical developments. Using standardised protocols performed by well-trained technicians and reported by well-trained and experienced radiologists, cardiac CT quickly can become a routine examination. Beside the coronaries cardiac function with wall motion, myocardial perfusion, valvular disease and pericardial pathologies can be imaged with cardiac CT. Depending on the indication, the optimal imaging protocol has to be chosen. A cardiac CT exam is planned with or without coronary calcium scoring. Retrospective ECG gating or prospective ECG triggering is selected to image the heart during the whole cardiac cycle or only in a predefined phase of the cardiac cycle. The contrast media protocol depends on the body weight of the patient as well as the imaging protocol and indication. Reading and reporting of cardiac CT exams should be done in a standardised way - this ensures not to miss any important pathology and facilitates the fast orientation of the clinicians within the report. Moreover, important non-cardiac findings should also be included in the report. This presentation will show in a step-by-step approach how to perform a perfect cardiac CT exam tailored to the individual patient and how to read and report the important cardiac and non-cardiac findings in a standardised way. The presentation will be finished with some clinical cases and the respective reports.

Learning Objectives:

1. To appreciate the scope of information needed by a referring physician from a coronary CTA examination.
2. To become familiar with protocols of cardiac CT and image processing.
3. To learn a structured approach to reading cardiac CT examinations.

A-574 09:30

C. Cardiac MRI in ischaemic heart disease

J. Bremerich; Basle/CH (jbremerich@uhbs.ch)

Cardiac MRI is a powerful tool for assessment and management of ischaemic heart disease. It provides a lot of relevant data and thus requires structured and standardised reporting. In ischaemic heart disease, cardiac MRI provides data on 1. cardiac structure such as thrombus, aneurysm or pericardial effusion, 2. cardiac function such as left and right ventricular ejection fraction, 3. flow in valvular dysfunction and 4. enables tissue characterisation to define presence and extent of infarction as well as to identify differential diagnoses, e.g. myocarditis or Takotsubo cardiomyopathy. Standardised reporting should be categorised into cardiac structure, function, tissue characterisation (usually referred to as late gadolinium enhancement) and extracardiac findings. Tables with normal values for female and male patients are helpful. In many institutions, the report is signed by both, a radiologist and a cardiologist which underlines the shared responsibility and enhances acceptance from referring physicians. Cardiac MR is a powerful tool for assessment of ischaemic heart disease. Structured reporting including tables with normal values is helpful to present the enormous quantity of data in a clear fashion. Signatures from both, radiologist and cardiologist are helpful to demonstrate shared responsibility and complementary expertise.

Learning Objectives:

1. To know when to do cardiac MRI in ischaemic heart disease.
2. To become familiar with protocols of cardiac MRI and image processing.
3. To learn about a structured reporting approach to cardiac MRI.

08:30 - 10:00

Room Q

Computer Applications

RC 1605

Improving workflow efficiency and quality

A-575 08:30

Chairman's introduction

D. Caramella; Pisa/IT

The question that this refresher course is aimed to answer is the following: will novel IT tools really improve quality and efficiency in daily radiological practice? In fact, since the early installations of PACS, IT tools have been primarily considered as productivity tools rather than enabling technologies for fostering quality in medical care. The three distinguished lecturers in this course will address the following topics: improving quality and efficiency of computerised order entry through decision support, improving quality and efficiency of reporting by structure and templates, improving quality and efficiency of dose management through exchange between modalities and registries. They will cover all aspects of the radiological workflow: from the selection of the diagnostic procedure, to the optimization of the acquisition parameters, to the efficient reporting of diagnostic and non-diagnostic data (such as radiation dose). They will demonstrate how newly adapted IT tools may provide assistance throughout the radiological workflow, with potentially enormous gains in terms of safety for the patient and quality assurance.

Session Objectives:

1. To highlight the need for IT tools to ensure quality control.
2. To understand how to collect data concerning radiation dose.
3. To learn about the integration of contrast media injectors into PACS.

A-576 08:35

A. Improving quality and efficiency of computerised order entry through decision support

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

Communication of orders is a logical and relevant extension to integrated information systems in healthcare. The electronic communication of orders and the entry (OE) into RIS improves the workflows. But quality improvements require additional efforts to link order-entry-solutions with health knowledge for ordering the appropriate imaging procedure. These Clinical Decision Support (CDS) tools should be based on generally accepted and implemented criteria, e.g. evidence-based medicine. It is known that the acceptance of such systems, if successful and efficient implementation are given, is very good. IT concepts for CDS are well known, standards for classifications are available, but semantic interoperability is still an developing area. Actually, clinical information systems provide different levels of integration of OE and CDS. Further developments could be an implementation

of interoperability profiles and the representation of CDS knowledge in web-based services of non-commercial organisations.

Learning Objectives:

1. To understand the relationship of decision support tools and evidence-based medicine.
2. To learn how decision support tools can be implemented for requesting radiological studies.
3. To appreciate potential effects of decision support tools on workflow efficiency.

Author Disclosure:

P. Mildenberger: Founder; GeSITmbH. Speaker; Bracco.

A-577 08:58

B. Improving quality and efficiency of reporting by structure and templates

N. Dugar; Doncaster/UK (Neelam.Dugar@gmail.com)

What does radiology report quality and structure/template mean from a patient's and a clinical perspective will be discussed. How radiologists can use technology and informatics to optimise and to improve report quality and reporting efficiency. We are aware that electronic transfer of reports to the requester is hugely important for timely management of patients. Vendor neutral standards for transfer of radiology reports in a multivendor environment will be discussed. Role of documents standards like CDA, pdf and also current messaging standards like HL7v2, to support transfer of reports between multi-vendor systems will be touched upon. Report templates both from electronic document standard perspective and clinical perspective will be discussed.

Learning Objectives:

1. To learn about clinical requirements for structured reports.
2. To become familiar with the IT requirements for report templates.
3. To appreciate the potential to generate data for evidence-based radiology.

A-578 09:21

C. Improving quality and efficiency of dose management through exchange between modalities and registries

E. Vaño; Madrid/ES (elivano@terra.es)

The European directive on Medical Exposures requires the assessment and evaluation of patient doses, especially in procedures involving high doses to the patient. In the current draft of the new directive of Basic Safety Standards, some requirements on patient dosimetry in diagnostic and interventional radiology have been reinforced: x-ray systems should provide dosimetric information with the capability to be transferred to the examination report (for all CT and interventional systems). Diagnostic reference levels (DRLs) shall be reviewed regularly. These requirements will push the industry and the users to develop better strategies to evaluate patient doses, to transfer these values to the patient reports (contributing to the patient dose tracking system) but also to do available software to process these dosimetric data and to do some automatic analysis. This analysis should include: a) periodic calibration factors for patient dose quantities, b) automatic detection of high dose values (especially relevant for interventional procedures), c) statistical analysis to update DRLs and to do comparisons with the existing ones, and d) suggest corrective actions to fulfill the quality assurance programs and the clinical audit requirements. DICOM radiation dose structured reports are representing a significant advantage but more efforts will be necessary for the automatic process of the relevant data contained in the report, to verify that the radiological risk is acceptable and to suggest, if appropriate, corrective actions to improve the clinical practice. Without these last steps, patient dosimetry efforts and European regulations for radiation safety could only have a moderate impact.

Learning Objectives:

1. To learn about current European regulation requirements and standards on patient dosimetry.
2. To become familiar with the dose reporting evolution and dose structured reporting.
3. To appreciate the potential for dose analysis and reporting as well as future registries.

Panel discussion:

Will novel IT tools really improve quality and efficiency in daily radiological practice?

09:44

08:30 - 10:00

Room Z

Joint Session of the ESR and EFSUMB

Advances in diagnostic ultrasound: better results through cooperation

Moderators:

L.E. Derchi; Genoa/IT

F. Piscaglia; Bologna/IT

A-579 08:30

Introducing the EFSUMB: the world's largest ultrasound society

N. Gritzmann; Vienna/AT (norbert.gritzmann@gmail.com)

The acronym EFSUMB is explained. The membership is presented. The committees and the educational portal are discussed. The individual benefit being an EFSUMB member is presented. The potential fields of collaboration of the societies are addressed. The European Course Book and the Euroson schools are presented. The guidelines regarding CEUS are addressed.

Learning Objectives:

1. To learn about the work and responsibility of the different committees.
2. To understand the membership basis and objectives of the EFSUMB.
3. To learn about the benefits for ultrasound societies and individual members.
4. To learn about the educational tools of the EFSUMB.

A-580 08:48

ESR/EFUMB collaboration: a newly established platform for joint development of ultrasound in radiology and clinical specialties

L.E. Derchi; Genoa/IT (derchi@unige.it)

The European Society of Radiology has established a working group on ultrasound with the aim of promoting advances in ultrasonography within the radiological community. Liaising with other societies in this field is one of the goals of the working group: the first move in this direction has been to meet with the European Federation of Societies in Ultrasound in Medicine and Biology in order to know each others, to identify common problems and to work together. It has been decided to meet on an annual basis and to hold joint sessions at meetings of the two societies. The title of this session: "Advances in diagnostic ultrasound: better results through cooperation" demonstrates that sharing experiences gained from different points of view is felt by both parties as the best way to enhance knowledge and to ameliorate our practices in order to offer the best service to our patients.

Learning Objectives:

1. To learn about the goals of the ESR Working Group on Ultrasound.
2. To understand the cooperative agreement between the ESR and EFSUMB.
3. To learn about the initial results of the cooperation between the two societies.

A-581 09:06

Image fusion and intervention

T. Lorentzen; Herlev/DK (tlo@dadlnet.dk)

Image fusion can be carried out between all image modalities provided they are geometrically consistent. Fusion ultrasound (FUS) is the application of image fusion, where dynamic ultrasound (US) images are presented simultaneously with corresponding images obtained from a previously acquired CT, CT/PET or MRI volume. The first step on a FUS procedure is to load a dataset (CT, CT/PET or MRI) into the US-system by means of a USB-memory stick, a CD-ROM, a hard drive, or via the network cable and a DICOM query/retrieve connection to PACS. A magnetic field is created around the patient by a magnetic transmitter and position sensors mounted on the US-transducer enable definition of the actual three-dimensional transducer position. Definition of three points defines a plane, by which alignment (registration) can be established between an US-image and the corresponding slice from the uploaded dataset of the previously acquired CT-exam. The US-exam is carried out as usual and images are shown in real-time (master) side-by-side and simultaneously with the corresponding dynamic virtual CT-image (slave). Small liver metastases for US-guided biopsy or US-guided ablation might in some cases be difficult to find with conventional US, and in this situation FUS can often provide a helpful guide to the correct lesion area. Finally, in some cases, a biopsy might be avoided either due to agreement between a suspicious tumour finding on CT and subsequent fusion with contrast enhanced US that confirms the tumour or because the subsequent fusion provides a benign explanation to the CT finding.

Learning Objectives:

1. To understand the technical aspects of image fusion with ultrasound (US) and other imaging modalities (most frequently CT or MRI).
2. To learn how to align two sets of data, obtained through different axial imaging techniques, with one another and perform live US scanning, where the fused image follows the live US.
3. To understand how a lesion, even when invisible, can be targeted for US-guided, using CT and MRI image fusion.

A-582 09:24

The EFSUMB non-liver CEUS guidelines

F. Piscaglia, S. Marinelli, E. Terzi; Bologna/IT (fabio.piscaglia@unibo.it)

Given the many new organs studied by CEUS, EFSUMB decided to publish in 2012 the update of its clinical recommendations on CEUS separately for hepatic and non-hepatic applications. These are based on comprehensive literature surveys and/or on expert committee reports and/or on the views of a panel of experts authors, providing a recommendation level (RL) for each indication based on the Levels of Evidence provided by the Centre for Evidence-Based Medicine, Oxford (UK). Worth to remind that most of daily routine non-hepatic applications continue to be off-label and patients should be informed and must consent to the investigation. In general, microbubble contrast agents are very safe with an extremely low incidence of side effects. Herein, the most important non-hepatic applications of CEUS from guidelines are listed. One very important issue is the use of CEUS in paediatrics. In this setting, CEUS has several advantages, a) lack of any radiation exposure, b) excellent safety, c) easy repeatability to monitor potentially evolving situations, d) user friendly approach, allowing parents to stand aside and in contact with their examinee children and e) no need for sedation or general anesthesia to obtain a relaxed lying patient. The main applications are the characterisation of pancreatic masses, distinguishing between solid and cystic, the assessment of local complications of Chron disease, the identification of renal parenchymal ischaemia or infarction, the assessment of blunt minor abdominal trauma to ascertain the absence of parenchyma injuries, the identification of endoleaks in treated abdominal aortic aneurysms and several others.

Learning Objectives:

1. To learn about new guidelines and clinical recommendations on the use of contrast enhanced ultrasound in non-liver applications, which were released by the EFSUMB in 2012.
2. To learn about the process of producing the document.
3. To learn, based on the evidence, which organs are suitable for CEUS in daily practice, and which are only suitable for research using CEUS.

Author Disclosure:

F. Piscaglia: Advisory Board; Bayer. Board Member; Bayer. Consultant; Bracco. Speaker; Bayer, Siemens.

A-583 09:42

The EFSUMB/WFUMB liver-CEUS guidelines

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

The present document describes the third iteration of recommendations for the use hepatic of contrast-enhanced ultrasound (CEUS) and contrast-specific imaging techniques which were introduced ten years ago in Europe and Canada. Time has moved on, and the need for worldwide guidelines on the use of contrast-enhanced ultrasound (CEUS) in the liver has become apparent. WFUMB (World Federation for Ultrasound in Medicine and Biology) and EFSUMB (European Federation of Societies for Ultrasound in Medicine and Biology) initiated further discussions in 2010, in conjunction with the AFSUMB (Asian Federation of Societies for Ultrasound in Medicine and Biology), AIUM (American Institute of Ultrasound in Medicine), ASUM (Australasian Society for Ultrasound in Medicine), FLAUS (Federation of Latin American Societies for Ultrasound) and ICUS (International Contrast Ultrasound Society) to bring the 2008 liver guidelines up-to-date, recognizing the fact that contrast agents are now licensed in many parts of the world, including Australasia, Brazil, Canada, China, Europe, India, Japan and Korea. The content of these international liver guidelines includes general considerations on CEUS, characterisation of focal liver lesions (FLL) in non-cirrhotic and cirrhotic liver, portal vein thrombosis, FLL biopsy guided by CEUS, detection of FLL by both transabdominal and intraoperative approaches, monitoring of abative treatment, liver transplantation, contrast quantification and monitoring of systemic treatment of malignancies.

Learning Objectives:

1. To learn about the current practice of contrast enhanced ultrasound (CEUS) worldwide.
2. To learn how the CEUS international guidelines were established.
3. To learn about the main indications for CEUS in cases of liver disease.

10:30 - 12:00

Room A

Interactive Teaching Session

E³ 1720b

Musculoskeletal emergencies

A-584 10:30

A. Axial skeleton

E. Llopis; Valencia/ES (ellopis@hospital-ribera.com)

The purpose of this interactive course on axial skeleton is to overview spine emergency lesions in order to improve prognosis on acutely compromised cord. First, how to select the best protocol depending on clinical scenarios. Second, to analyse key signs for each anatomic location: intradural-intramedullary, intradural-extramedullary and extramedullary lesions and third to become familiar with MRI specific findings for spinal infection, tumour cord compression, trauma and postsurgical complications.

Learning Objectives:

1. To understand the principal indications for emergency spinal imaging.
2. To be able to analyse the pros and cons of each imaging modality in spinal trauma: how, why, when?
3. To become familiar with key MRI findings in spinal infection, tumour cord compression and other non-traumatic spine disorders.
4. To become familiar with the main emergency complications following spinal surgery.

A-585 11:15

B. Peripheral skeleton

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

In this interactive session focussing on peripheral musculoskeletal lesions presenting to the Accident and Emergency Department, we will review the strengths and weaknesses of the imaging modalities applied to chosen bone, joint and soft tissue lesions. The imaging-based approach will strengthen the understanding of the different pathological entities which vary from trauma to infection in both the paediatric and adult age groups.

Learning Objectives:

1. To learn when and how to use the different imaging modalities in acute skeletal lesions.
2. To learn about the US and MRI findings in infection.
3. To understand the value of MDCT in acute MSK lesions.

10:30 - 12:00

Room B

Interactive Teaching Session

E³ 1720a

Pitfalls in pelvic imaging

A-586 10:30

A. Pitfalls in MRI of the pelvis

E. Sala; New York, NY/US (salae@mskcc.org)

There are several MRI pitfalls that should be recognised when imaging the female and male pelvis. MRI appearances of uterus and ovaries are dependent on the phase of menstrual cycle/use of exogenous hormone therapy. Normal post-surgical and post-radiation appearances of the pelvis can sometime mimic tumour recurrence. It is important to become familiar with these appearances in order to avoid potential pitfalls. One very common pitfall is differentiation of transient myometrial contraction from adenomyosis. Interrogation of all imaging planes over the duration of the entire MRI examination can be useful to distinguish between the two, although myometrial contractions can last up to 45 min. Choice of correct imaging plane is crucial for precise classification of uterine anomalies (coronal oblique) and accurate evaluation of parametrial invasion (axial oblique) in patients with cervical cancer. Both dynamic contrast-enhanced MRI and diffusion weighted MRI improve the accuracy of MRI in evaluation of the malignant pelvic conditions. However, certain pitfalls related to each technique should be recognised in order to avoid misinterpretation. It is crucial to be familiar with the anatomy of the uterovesical (UV) ligament as it is often the site of pelvic lymphoma (such as bladder or cervix lymphoma). However, some benign conditions such as endometriosis can involve

the UV-fold and invade both bladder and uterine wall. Certain MRI features can be helpful in making the correct diagnosis.

Learning Objectives:

1. To become familiar with normal variations in MRI appearances of female pelvis resulting from physiologic conditions (e.g. different phases of menstrual cycle) and treatments (including exogenous hormone therapy, surgery and radiation) potentially mimicking disease.
2. To discuss the role of correct MR imaging plane in avoiding potential misclassification of uterine anomalies and parametrial invasion in patients with cervical cancer.
3. To recognise certain pitfalls related to dynamic contrast-enhanced MRI and diffusion weighted MRI.

A-587 11:15

B. Pitfalls in pelvic ultrasound

K. Kinkel; Chêne-Bougeries/CH (karen.kinkel-trugli@wanadoo.fr)

Pitfalls of sonographic findings in the pelvis can be related to technical issues, interpretation errors or due to the patient's specific condition or pathology. Common problems consist of insufficient bladder filling, misinterpretation of posterior enhancement or shadowing according to the anatomical structure and pathology of a size that goes beyond the field of view of the probe. Organ specific problems will be illustrated in interactive questions particularly for the uterus and the ovaries.

Learning Objectives:

1. To become familiar with anatomical variants, potentially mimicking disease.
2. To learn about common pitfalls in pelvic ultrasound.

12:30 - 13:30

Room N/O

The Beauty of Basic Knowledge: Head and Neck

MC 24E

Temporal bone: so beautiful, yet so complicated

A-588 12:30

Temporal bone: so beautiful, yet so complicated

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

The complex temporal bone anatomy will be reviewed, as specifically visualized on the two most important imaging techniques for temporal bone imaging, CT and MRI. The use of adapted imaging techniques for various clinical conditions, indications and questions will be discussed and illustrated. The issue of CBCT versus MDCT in temporal bone imaging will be discussed and different MRI protocols adapted to various clinical conditions, indications and questions will be highlighted. The most important pathological issues in the external ear, middle ear and inner ear will be demonstrated including congenital, tumoural, infectious and inflammatory pathologies. In the middle ear, special attention will be paid to chronic middle ear infection, cholesteatoma and otodystrophies. In the inner ear, special attention will be paid to the broad scala of pathology of the vestibulocochlear nerve.

Learning Objectives:

1. To become familiar with temporal bone anatomy.
2. To learn how to choose and tailor imaging techniques according to clinical presentation.
3. To appreciate the most common pathologies affecting the three main compartments of the temporal bone.

12:30 - 13:30

Room P

The Beauty of Basic Knowledge: Musculoskeletal Imaging

MC 25E

Metabolic/endocrine disease

A-589 12:30

Metabolic/endocrine disease

J. Freyschmidt; Bremen/DE (freyschmidt@radiologie-freyschmidt.de)

Systemic metabolic bone diseases in the narrower sense include osteoporosis, osteomalacia, hyperparathyroidism and renal osteodystrophy. But also Paget's disease is traditionally counted among the metabolic diseases, although it has inflammatory roots. In this course osteoporosis will not be discussed. Osteomalacia

is an increasing disease in the elder population, primary hyperparathyroidism is the most common systemic metabolic bone disease following osteoporosis with an incidence of 21-25 cases/100.000 population/year, and Paget's disease has a prevalence of 10% in the population older than 80 years. Therefore it is challenging for the radiologist to be familiar with these diseases. To understand the radiologic changes of metabolic bone diseases it is necessary to have knowledge about their pathophysiology and pathologic anatomy. In most cases of osteomalacia, hyperparathyroidism, renal osteodystrophy and Paget's disease the diagnosis can be made with conventional radiography and scintigraphic bone scan. The use of advanced radiologic techniques (CT, MRI, PET) is limited, because there are hitherto only few experiences and a lack of specific patterns, in contrast to x-rays with an overwhelming fundus of more or less specific findings.

Learning Objectives:

1. To understand the basic pathophysiology of metabolic and endocrine bone diseases.
2. To become familiar with the most typical imaging findings of metabolic and endocrine diseases.
3. To appreciate specific imaging patterns and to discuss the value of different imaging techniques.

16:00 - 17:30

Room C

GI Tract

RC 1901

Cross-sectional imaging of colitis

A-590 16:00

Chairman's introduction

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

Cross-sectional imaging is playing an increasing role in the diagnosis, staging and follow-up of colitis. Often the radiologist diagnoses colitis on cross-sectional imaging, and the clinician requires the most likely diagnosis. Alternatively, imaging is used to assess the severity of a known colitis and monitor treatment response. This session will describe state of the art protocols for assessing the inflamed colon using CT, MRI and USS. The common aetiologies of colitis will then be discussed and tips and tricks as to how to limit the differential diagnosis presented. Finally, the role of cross-sectional imaging in the management of inflammatory bowel disease (IBD) will be described with emphasis on disease activity. An integrated approach to imaging patients with colonic IBD will be presented.

A-591 16:05

A. What protocol to use?

S. Schmidt; Lausanne/CH (sabine.schmidt@chuv.ch)

The role of cross-sectional imaging in the diagnosis of colitis is increasing following recent technologic advances. Prior colonic cleansing is usually not required, unlike in CTC. However, careful attention to examination technique is essential, since collapsed colon may suggest colonic wall thickening, thus mimicking colitis. When using CT or MRI, adequate luminal distension is required, while this optional in US where direct compression of the bowel aids diagnosis. Recommended imaging protocols will be discussed. CT remains the work horse for imaging suspected colitis, especially in emergency settings. It is widely available and facilitates rapid data acquisition with excellent spatial resolution aiding image interpretation. Intravenous contrast-medium administration can reveal the typical target sign of colitis, which can easily be differentiated from other wall patterns, such as diffuse enhancement, seen in cancer. MRI does not expose patients to radiation and provides excellent tissue contrast facilitating the detailed analysis of the inflamed colonic wall. Both conventional and diffusion-weighted sequences provide functional non-invasive assessment of the severity of colitis and monitoring of treatment responses, essential in Crohn patients. Colonic US is safe, well tolerated and, in general, freely available, although it requires specific operator expertise. It simultaneously provides morphological and functional information. Absent peristalsis and wall thickening in acute colitis usually reduce intraluminal air, thus facilitating colonic assessment compared to healthy subjects. Akin to CT and MRI, the three colonic wall layers are differentiated and pericolonic findings can be assessed. However, US can be limited by patient's body habit and the radiologist's practical experience.

Learning Objectives:

1. To become familiar with the role of colonic distension prior to imaging of suspected or known colitis.
2. To understand typical CT, MRI and US protocols.
3. To highlight the pros and cons of CT, MRI and US.

A-592 16:28

B. Differentiating between the causes of colitis

B. Gallix; Montpellier/FR (b-gallix@chu-montpellier.fr)

The final diagnosis of the type of colitis is based on clinical and laboratory data and colonoscopic and biopsy findings. However, information provided by endoscopy is limited to the mucosal surface. Cross-sectional imaging techniques, such as ultrasound, computed tomography, and magnetic resonance, are widely used to assess patients with non-specific abdominal pain and are gaining acceptance for the assessment of patients with suspected acute or chronic colitis. Cross-sectional studies are useful alternative tools not only in the assessment of bowel wall abnormalities, but also for the assessment of extraluminal alterations. Differentiating between the causes of colitis is based on the location of involvement, extent and appearance of colonic wall thickening, extraluminal changes, and type of complications encountered. When chronic inflammatory colitis suspected, imaging help to distinguish ulcerative colitis from Crohn colitis. Infectious types of colitis share the features of wall thickening, pericolonic stranding, and various degrees of ascites according to the severity of the disease. Pseudomembranous colitis demonstrates marked wall thickening and, occasionally, skip areas but is associated with broad-spectrum antibiotic treatment or chemotherapy. Neutropenic colitis is characterised by right-sided colonic and ileal involvement, whereas ischaemic colitis is characterised by vascular distribution pattern and history. Diverticulitis is a focal asymmetric process with fascial thickening and inflamed diverticula. The diagnosis of ischaemic colitis is suspected when the distribution of the colon wall involvement follow the vascular. The ischaemic changes are commonly segmental especially on left colon in elderly patients.

Learning Objectives:

1. To learn the most common cause of colitis through cross sectional imaging in both immune competent and immune compromised patients.
2. To become familiar with differentiating infectious, inflammatory, ischaemic and autoimmune conditions based on cross sectional imaging criteria.
3. To understand the limitations of cross sectional imaging in differentiating between its causes.

A-593 16:51

C. The role of cross-sectional imaging in colonic inflammatory bowel disease

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 maximized efficacy and safety. Overall, findings from cross-sectional imaging accurately reflect disease activity and provide reliable information for decision-making and patient care optimization.

Learning Objectives:

1. To learn the optimised examination protocols for ulcerative colitis and colonic Crohn's disease in the acute, subacute and chronic disease setting.
2. To describe criteria for the assessment of disease activity through CT, MRI and ultrasound.
3. To outline an integrated approach to the use of cross sectional imaging in colonic inflammatory bowel disease.

Author Disclosure:

J. Rimola: Advisory Board; Genentech. Research/Grant Support; Abbott.

Panel discussion:

The role of cross-sectional imaging in the diagnosis and follow-up of colitis

17:14

16:00 - 17:30

Room D2

Contrast Media

RC 1906

How I optimise contrast media administration

Moderator:

W. Semmler; Heidelberg/DE

A-594 16:00

A. CT

P. Leander; Malmö/SE (peter.leander@med.lu.se)

There are different reasons for optimising contrast media (CM) use in computed tomography (CT). The first and maybe most obvious is to obtain a highly diagnostic procedure and we are all familiar with terms as, e.g. arterial and portovenous phase. Different CM phases in CT is to high extent based upon an understanding of the pharmacokinetics of iodinated CM. As small water-soluble non-protein bound molecules these CM are distributed by the blood circulation and throughout the extracellular space. With modern CT-systems there are often more CM phases employed in protocols for gaining even more information, e.g. tumour vascularity, pancreatic parenchymal enhancement and mucosal delineation. In early CT, mostly of technical reasons, protocols seldom took advantage of using lower voltage than 120 kV. As iodine is not ideal for the photon spectrum obtained from such high energy, nowadays lower kV is more often included in protocols. Another important reason for optimisation of CM use is the risk of CM-induced nephropathy (CIN) and how this could be balanced but still obtaining diagnostic information. By taking all above into consideration, the lecture will give an overview about the patient, CM, scanning factors and CM enhancement. The lecture will give few protocols, if any, ready to bring home, but instead understanding with "longer half-life" how CM protocols are setup on the basis of factors as CM distribution, iodine attenuation, risk of adverse events, and more. By this approach, one can become familiar and understand any CM protocol for CT.

Learning Objectives:

1. To understand the pharmacokinetics of iodinated contrast media.
2. To learn about patient, contrast medium and scanning factors associated with contrast enhancement and scan timing.
3. To become familiar with protocols for optimised contrast enhancement.

A-595 16:30

B. MRI

G.M. Bongartz; Basle/CH (gbongartz@uhbs.ch)

Contrast media for Magnetic Resonance Imaging are mainly based on Gadolinium (Gd) or other metallic compounds like Iron (Fe) or Manganese (Mn). All of these do not actively alter the magnetic signal upon intravascular application but rather enhance relaxivity of neighbouring molecules. The impact of all contrast media for MRI on the signal intensity is strong and thus the overall amount of contrast media given is much less compared with iodinated contrast media. Gd is by far most frequent in clinical use. Due to its toxicity it must be fixed in stable chelates. Recently, Nephrogenic Systemic Fibrosis (NSF) as an unexpected side-effect of Gd-compounds in renally impaired patients has been detected and led to certain Gd-specific restrictions or contraindications for medical use. As a key consequence, restrictive use of Gd compounds in renally impaired patients is mandatory, which meanwhile let the disease more or less disappear. Special preparations of Gd compounds enable tissue-specific application (like hepatocyte-specific contrast). Following the injection of this contrast media, both documentation of the vascular perfusion as well as of cellular activity is possible. Similarly, Fe compounds may be applied to characterise the reticulo endothelial system. Mechanisms for contrast and examples for typical application will be given.

Learning Objectives:

1. To understand the differences between iodinated contrast agents and gadolinium chelates and their impact on contrast medium administration.
2. To learn about injection and scanning protocols for optimised vascular and parenchymal enhancement.
3. To review the influence of tissue-specific contrast media on the injection and scanning protocols.

Author Disclosure:

G. M. Bongartz: Research/Grant Support; Bayer Healthcare Switzerland.

A-596 17:00

C. PET/CT

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

Optimisation of iodinated contrast media administration during PET-CT acquisition. When a CT scan of a combined PET/CT is performed as a full diagnostic CT, including iodinated contrast media administration, the diagnostic quality of the examination is improved. Nevertheless, the possibility that contrast-enhanced CT used for attenuation correction may introduce errors in the standardised uptake value (SUV) will be discussed during this lecture. Different optimised contrast-enhanced CT protocols will then be discussed.

Learning Objectives:

1. To become familiar with the role of contrast-enhanced CT in PET/CT.
2. To understand the influence of CT contrast-enhancement on attenuation correction of PET images.
3. To learn about the importance of adequately timing the injection of CT and PET agents for optimal PET/CT.

16:00 - 17:30

Room E1

Musculoskeletal

RC 1910

Intra-articular imaging

A-597 16:00

Chairman's introduction

A.H. Karantanas; Iraklion/GR (akarantanas@gmail.com)

Intraarticular imaging is a difficult task because of the small size of the anatomic structures and the curved shape of the articular surfaces. Technological advances during the past two decades have improved our ability of imaging the joints. The most important of them include high-field MRI scanners and MDCT technology. Common joint disorders afflicting wide age groups include degeneration, inflammation and trauma. Early depiction of disease allows accurate treatment planning in trauma, early suppression of inflammation in rheumatologic disorders, and monitoring of degeneration in osteoarthritis. Depiction of early signs of disease activity or recurrence improves the efficiency of newer treatments. The importance of updated imaging is highlighted by the fact that new surgical techniques are applied in the cartilage and meniscus. Modern imaging allows clear depiction of the involved joint structure: synovium, articular cartilage, labrum and subchondral bone. The high spatial and contrast resolution provided currently with MRI and CT highlights findings which are clinically irrelevant. Radiologists should be familiar with the technical prerequisites for achieving a high-quality examination, as well as the pitfalls and variants that might simulate disease. Thorough knowledge of the above will allow the application of the proper imaging technique in each individual clinical scenario.

A-598 16:05

A. Standard MR techniques

C. Faletti; Turin/IT (faletti@atlink.it)

In the evaluation of the musculoskeletal apparatus and in particular that of osteoarticular pathology, it is essential that the magnetic resonance examination be modulated on the basis of clinical requirements. That is the most suitable plane and sequence to evidence the underlying mechanisms/alterations at the source of the symptomatology has been chosen. Basically, the structures that are to be evidenced are represented by fibrous-connective tissue, cartilage, synovial tissue and bone and the modifications that may be caused on these by the varying pathologies must be taken into consideration. The morphology of the structure is best defined with the use of spin-echo sequences, in particular that of T1/PD-T2 weighted images. The sequences that exploit the suppression of fat, or fat-water separation, do seem to be the most suitable for a panoramic and comprehensive evaluation of the joint under study, as the various components may be observed in such a way so as to make a complete and satisfactory primary diagnostic codification on the underlying problem. Depending on the individual requirements, specific sequences may be added, such as those that give more detailed information/evaluation of cartilage damage, or a better view of flogistic synovial processes, with, for example, the enhancement of a paramagnetic contrast medium. Diagnostics may be hampered by the use of lower magnetic fields, such as permanent magnets. Also in this case, the solution is a modulation of the various characteristics of the different sequences and the intrinsic possibilities of the equipment available.

Learning Objectives:

1. To become familiar with the techniques used in standard MR.
2. To learn about the strengths/weaknesses of standard MR along with diagnostic problems related to anatomical variation.

A-599 16:28

B. CT arthrography

C.W.A. Pfirrmann; Zurich/CH

With modern multidetector CT scanners, CT arthrography with multiplanar reconstruction in high resolution is possible. CT arthrography is performed with intra-articular injection of non-diluted iodinated contrast material. CT arthrography of virtually any joint from head to toe is possible. There are several indications and advantages for CT arthrography. Imaging time with CT arthrography is much faster than MR. This is especially advantageous for anxious patients. Also for patients with claustrophobia, CT is often a better option. CT arthrography has the advantage of high contrast between cartilage and contrast material. Therefore, CT arthrography may be superior in defining cartilage defects. In the postoperative patient, artefacts from metal may be present in or near the joint. With CT arthrography, these artefacts are often less pronounced, compared to MR imaging. Assessment of bony structures may be easier with CT arthrography compared to MR arthrography. Small osseous fragments, such as glenoid rim fractures may be difficult to see with MR arthrography, with CT these fragment or calcifications may be easily seen. CT arthrography is a valuable alternative in patients that have a contraindication for MR imaging. For example, the diagnosis of a meniscal tear is possible in the same way using CT arthrography as with MR imaging. In the shoulder, CT arthrography is well suitable for the assessment of labral lesions, cartilage damage and rotator cuff tendons using the same diagnostic criteria as with MR arthrography.

Learning Objectives:

1. To become familiar with the techniques used in CT arthrography.
2. To learn about the strengths/weaknesses of CT arthrography.

Author Disclosure:

C. W. A. Pfirrmann: Advisory Board; Advisory Board Orthopaedic Diagnostics, Siemens.

A-600 16:51

C. MR arthrography

J. Kramer; Linz/AT (kramer@ctmri.at)

MR arthrography (MRA) is a relatively simple procedure, requires no anesthesia, and is essentially devoid of complications. With some experience, it is easy to perform and is a strong aid in patients when conventional MR exams don't provide the needed information for sufficient therapy. MRA, by virtue of its ability to demonstrate accurately intra-articular structures and especially pathologic alterations of these structures (e.g. labral lesions - shoulder, hip; partial articular-sided cuff tears), adds an important component to the radiologist's armamentarium. Although not appropriate for all patients, MRA plays an important role in the evaluation of patients with suspected intra-articular pathology who have equivocal clinical and conventional MR imaging findings. However, even nowadays, clinical use of MRA is limited due to several reasons: the conversion of a non-invasive procedure into an invasive, albeit minimally invasive, procedure; increased cost and time required to perform MRA compared with conventional MR imaging; and the need to obtain patient's consent for performing a MRA exam since the use of intra-articular gadolinium compounds has not yet been approved generally. By the way, the experience to perform MRA's has to be part of radiologists training program.

Learning Objectives:

1. To become familiar with the techniques used in MR arthrography.
2. To learn about the strengths/weaknesses of MR arthrography.

Panel discussion:

Which imaging technique for which clinical scenario?

17:14

16:00 - 17:30

Room E2

Oncologic Imaging

RC 1916

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

A-601 16:00

Chairman's introduction

C. Matos; Brussels/BE (cmatos@ulb.ac.be)

Since a large number of neuroendocrine cells may undergo malignant transformation, gastroenteropancreatic neuroendocrine tumours (GEP-NET) are a heterogeneous group of cancers that differ in their biology and clinical presentation. Diagnosis of these tumours has been improved by advances in pathology and classification, and by tumour imaging with the combined use of structural imaging techniques and functional imaging techniques. Multimodality imaging is increasingly recognised not only in detecting and staging disease but also in characterising biological patterns of lesions that may be relevant to the selection and delivery of therapy. In this refresher course, the complex nature of GEP-NET and the intrinsic uses and limitations of each diagnostic imaging modality will be underlined. Insights to hybrid structural and molecular imaging techniques will be provided and discussed.

A-602 16:05

A. Tumour biology, pathogenesis and classification

B. Wiedenmann; Berlin/DE (bertram.wiedenmann@charite.de)

Neuroendocrine tumour cells are characterised by the coexpression of neuronal and epithelial proteins and cellular organelles such as synaptic vesicles containing synaptophysin of neurons and intermediate filaments/cytokeratins of the epithelial cells. Based on presence of secretory vesicles and the continuous, uncontrolled vesicular release of biogenic amines, neuropeptides and hormones, patients suffer in half of the cases of so-called functional symptoms and syndromes. Examples are the carcinoid syndrome (excessive release of serotonin) or the Zollinger-Ellison syndrome (excessive release of gastrin). Activation or inhibition of certain G-protein coupled receptors (e.g. somatostatin receptors) or channel proteins (R-type calcium channels) can lead to the control of the hypersecretion or so-called functionality of the affected patients. Medical interference with signal transduction pathways involving tyrosine kinase receptors as such mTor and channel proteins can lead to an inhibition of cellular and tumour growth. These observations have led to the establishment of new therapies, especially for pancreatic NETs using especially mTor and tyrosine kinase inhibitors. Whereas the tumorigenesis is unknown in the case of sporadic NETs, hereditary NETs appear to develop via a menin mutation through the intermediate stage of hyperplasia before they develop the full metastatic potential. Based on the above given tumour biological and histopathological findings, a rather robust classification for NETs has been developed by the European Neuroendocrine Tumour Society (ENETS) using a TNM-classification together with a grading-system. Furthermore, the formerly used terms such as APUDOMA, Neurocrestoma, Carcinoid, etc have been largely replaced by the meanwhile generally accepted term neuroendocrine tumour.

Learning Objectives:

1. To learn about 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:

B. Wiedenmann: Advisory Board; Novartis, Pfizer, IPSEN. Consultant; Lexicon Pharmaceuticals. Investigator; Novartis, IPSEN. Speaker; Novartis, Pfizer, IPSEN.

A-603 16:28

B. The current role of nuclear medicine techniques

C.M. Deroose; Leuven/BE (christophe.deroose@uzleuven.be)

This presentation will focus on the pivotal role of nuclear medicine in the diagnosis and treatment of neuroendocrine tumours (NETs). The metabolic and molecular imaging capabilities of both positron emission tomography (PET) and single photon emission tomography (SPECT) have made a great impact in the clinical management patients with these tumours. One of the post-prominent posterchilds of molecular imaging in oncology is scintigraphy of the somatostatin receptor (SSR).

¹¹¹In-DTPA-octreotide has a substantial value in detection, diagnosis and staging of NET and more particular in gastroenteropancreatic NETs. Newer SSR-binding radiopharmaceuticals have been developed for PET, mainly with gallium-68 as radiolabel, with higher affinity and more advantageous pharmacokinetics. When used with high-resolution and rapid-throughput multimodal whole body imaging of modern PET/CT cameras these tracers provide the current state of the art SSR imaging. We will also discuss the clinical value of metabolic tracers, such as [¹⁸F]-FDG for glucose metabolism imaging, [¹⁸F]-DOPA and [¹¹C]-HTP ([¹¹C]5-hydroxytryptophan) for amino acid metabolism imaging. The clinical merits and indications of these tracers will be explained. The continuously evolving quest to develop tracer for other receptor systems expressed on NETs will be illustrated, e.g. bombesin, VIP, CCK and glucagon-like peptide receptor ligands. Finally, the role of imaging as selection for metabolic and peptide receptor radionuclide therapy will be discussed.

Learning Objectives:

1. To learn about the cellular properties of 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-604 16:51

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

V. Vilgrain, M.-P. Vullierme, P. Ruzsiewicz, A. Sauvanet; 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 hypervascularization 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 imaging is needed. The latter includes somatostatin receptor scintigraphy, FDG PET and more recent functional tools such as PET using ⁶⁸Ga and ¹⁸F-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 localisation and staging.

Panel discussion:

The future of hybrid imaging

17:14

16:00 - 17:30

Room F1

Special Focus Session

SF 19

Tablet-computers in radiology: friend or foe?

A-605 16:00

Chairman's introduction

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

Tablets in radiology represent a novelty. Since the introduction of the tablets in 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 apps stores (Apple and Android), and let radiologists and non-radiologists to handle DICOM images on the Tablet, a 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 full patient's record and presumably the possibility to report. In view of this rapid technological development again radiology fall in the middle of storm and is asked to find solution to problem: are the Tablets suitable to read and report DICOM images? And which kind of images (CT, MRI, x-ray, etc.)? How can we manage the portability of patient's data (security issues, data loss, etc.)? Which will be the impact on teleradiology? All these issues will be addressed by the panel of experts that will speak in the special focus session.

Session Objectives:

1. To give an overview of current tablet-computer technology and its practical use in radiology.
2. To discuss the pros and cons of using tablet-computers.
3. To analyse specific and critical areas of utilisation (DICOM images reading and teleradiology).

A-606 16:05

Tablet-computers: a technical overview

J. Fernandez-Bayó; Sabadell/ES (jfernandezB@tauli.cat)

Since their introduction in 2001, tablet PCs have evolved extensively. They have become very popular, filling the gap between laptop computers and smart mobile phones. We will review technical aspects like the processors, storage space and memory, size and weight, connectivity and networking, software, autonomy, and battery life in different devices. Special focus will be on the displays and different possible uses in radiology.

Learning Objectives:

1. To learn about PC evolution: from desktops, to laptops and tablets.
2. To appreciate the portability of a tablet-computer.
3. To become familiar with the hardware features with a specific focus on displays and networks.

A-607 16:23

Radiological features of the tablet-computer

P. Sacco¹, L. Faggioni²; ¹Siena/IT, ²Pisa/IT (lfaggioni@sirm.org)

Tablet devices are more and more becoming a part of everyday life, with portability, versatility, connectivity, and user-friendliness being their main advantages. Hospital informatisation and filmless radiology have led to an efficient standardisation of digital images generated by the various imaging modalities, which has further catalysed the diffusion of mobile devices in health enterprises. The high screen resolution, high wireless connection speed and large processing power of current tablets allow displaying medical images with a sufficient quality for image review and analysis in clinical practice. Retrieving examinations from the PACS, accessing radiology information systems, reporting, taking notes and memos, and sending messages are only some of the many possible uses of tablets. Today radiologists can choose from a lot of apps and web services available on tablets, such as learning resources (e.g. textbooks, journal articles, atlases, databases, lessons and podcasts), tools for remote connectivity (e.g. file sharing, audio- and videoconferencing, instant messaging), apps and tools designed to create presentations, process images, and review cases. For these reasons tablets can often provide a convenient, fast and versatile alternative to laptops. Examples of applications of tablets in radiology will be presented and discussed.

Learning Objectives:

1. To appreciate the radiological features available on a tablet-computer.
2. To become familiar with radiological atlases, databases, social networks.
3. To learn how the tablet-computer can help at a congress and prepare presentations.

A-608 16:41

Reading DICOM images on the tablet

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

The purpose is to review the different techniques allowing review and evaluation of DICOM images on hand-held tablets and mobile devices. Mobile devices such as smart phones and touchscreen tablets have taken the market by storm and are becoming major players in medical informatics providing convenient solution for physicians on the move. The resolution and processing power of these devices allow nowadays displaying medical images with sufficient resolution for image review and analysis in clinical practice. There are however different types of software solutions that can be implemented for such tasks. Two major different design are: (1) online web-based applications where the device serves as a "thin-client" to display images rendered and manipulated on a remote computer and (2) local applications that reside on the mobile device and can run independently after images have been downloaded on the device. The first solution requires the user to be constantly connected to the network to be able to display and manipulate images, while the

second solution can continue to function after disconnecting from the network. It is undeniable that portable devices will become a major component of our technical environment and will significantly change workflow and clinical practice. Current solutions may not be adequate yet for routine diagnostic tasks but they provide convenient mobile solutions for on-call and remote consultations.

Learning Objectives:

1. To understand the DICOM readers available for tablet-computers.
2. To become familiar with the different approaches to DICOM reading (local vs remote) and the PACS/tablets integration.
3. To appreciate the pros and cons of DICOM image-reading with tablet-computers in regards to image quality and displays.

A-609 16:59

Mobile teleradiology with tablet-computers: a critical appraisal

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

Over the past few years several applications and viewers have been developed for smartphones and tablet computers with the purpose of using them for remote reviewing and interpretation of radiology images. With tablet computers such as the iPad, DICOM images can be viewed from any location within or outside the hospital. Other key clinical applications include reviewing images with patients at their bedside, teleconsulting with and distribution of images to colleagues. The usefulness and accuracy of mobile devices is however still limited by hard- and software. Their use for reviewing patient information also introduces new questions about issues, such as security, confidentiality, integrity, availability and accountability. These issues and potential solutions will be discussed in more detail during this presentation.

Learning Objectives:

1. To learn about mobile teleradiology within and outside the hospital.
2. To become familiar with the potential risks of mobile teleradiology (data security, confidentiality, etc).

Panel discussion:

Are we ready and confident enough to use tablet-computers in clinical practice? How and when?

17:17

16:00 - 17:30

Room F2

Breast

RC 1902

Breast ultrasound

Moderator:

M. Müller-Schimpfle; Frankfurt a. Main/DE

A-610 16:00

A. Physics and practical aspects of high-quality hand-held and automated breast US

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

Ultrasound (US) is the adjunct method of choice to mammography in breast imaging. Over the past two decades, US technology has undergone profound advancements and refinements. US has therefore become an assessment tool with a defined field of indications as well as a unique set of diagnostic descriptors for breast lesion differentiation. The ACRIN 6666 study has demonstrated the special benefit of US in patients at risk with dense breast tissue. The BI-RADS lexicon for Ultrasound, in its second edition, expanded the role of breast US. Further enhancement of image quality as well as the recent advent of automated breast US has even fueled scientific discussions of a potential role of US for breast cancer screening. Automated breast US, which is based on computed generation of a 3D imaging data set obtained from many parallel 2D images, offers a different approach with a variety of benefits. Images are obtained by the sonographer in standardised fashion, whole breast data sets can be reviewed at any time after the examination, reducing operator dependence, and image fusion with, i.e. MRI is easily possible. The basic physical background, the significance as well as important aspects of practical use of hand-held and automated breast US will be explained and illustrated by respective imaging examples. Emphasis will be laid on strengths and potential weaknesses of both US technologies with regard to breast imaging.

Learning Objectives:

1. To understand the physics of hand-held and whole breast US.
2. To become familiar with the practical technique of hand-held and whole breast US.
3. To appreciate the clinical applications of hand-held and whole breast US including automated screening.

A-611 16:30

B. Complicated cysts and complex-cystic lesions: differentiation and management

G. Rizzato¹, C.F. Weismann²; ¹Gorizia/IT, ²Salzburg/AT
(christian.weismann@inode.at)

At ultrasound (US) cysts are categorized as simple, complicated or complex. A complicated cyst contains low-level internal echoes or intracystic debris that shifts with changes in patient position. In some cases, the content is thicker and simulates a hypoechoic solid mass. The term complicated only describes the US appearance and does not indicate that pus or blood is responsible for the internal echoes. Complicated cysts do not contain solid mural nodules. Only in some cases of inflammation, there may be a thickened wall, generally uniform. History and clinical examination may be very helpful. Color flow mapping (CFM) may add further information and elastography can solve the problem showing the typical aspect of fluid containing masses. A solid component places the cystic lesion into the category of complex breast cysts. Complex patterns include irregular thickened walls, intracystic masses, thickened septa and discrete solid component. Masses may be predominantly solid with only small cystic foci. Complex cystic masses have a substantial chance of malignancy, up to 30 percent. Again history may be useful as long as CFM. But there is a general agreement that aspiration and/or core biopsies are mandatory. Multiple samples must be acquired in different locations. If pathology report is discordant with US findings patients can be further evaluated with magnetic resonance or US follow-up.

Learning Objectives:

1. To learn about the US appearance of complicated cysts and complex-cystic lesions.
2. To consolidate knowledge on differential diagnosis for these respective lesions.
3. To understand the diagnostic algorithm for a work-up of these lesions.

A-612 17:00

C. The use of ultrasound in the evaluation of the nipple-areolar complex

R. Salvador; Barcelona/ES (rafasalvador@telefonica.net)

Nipple and areola can be well examined by any clinician. Ultrasonography can add new findings mostly related to the main ducts merging at the retroareolar region. A thorough description of the anatomical aspects of the region, and its pathological benign and malignant conditions will be described. Duct ectasia, infection, ductal papillomas, hyperplasia, and DCIS, as well as Paget disease of the nipple and some other skin pathologies can arise in this area of the breast. A description of the US techniques to review the region, including the use of Doppler US, Elastography, 3D ultrasound so called Automated Breast Ultrasound Scan (ABVS) and other techniques that have been used not only to diagnose, but to treat some diseases. US ductography and percutaneous sampling or excision of papillomas will also be done.

Learning Objectives:

1. To understand the normal anatomy of the nipple-areolar complex.
2. To become familiar with conditions commonly affecting the nipple-areolar complex.
3. To appreciate the value of US for diagnosis and management of these conditions.

Author Disclosure:

R. Salvador: Advisory Board; Member of the Medical Advisory Board of Philips Healthcare.

16:00 - 17:30

Room G/H

Neuro

RC 1911

Multiple sclerosis: 2013 update

Moderator:

E. Tali; Ankara/TR

A-613 16:00

A. Differential diagnosis of multiple T2-HI white matter lesions

A. Rovira-Cañellas; Barcelona/ES (alex.rovira@idi-cat.org)

Focal white matter T2 hyperintense lesions (T2-HI) are commonly observed MRI abnormalities not only in the elderly, but also in middle age and young patients. In addition to physiological ageing brain changes, a large list of different disorders should be considered in patients presenting with T2-HI such as hypoxic-ischaemic

vasculopathies (atherosclerotic and hypertensive small vessel disease, CADASIL, Fabry's disease, Susac's syndrome), multiple sclerosis and variants, primary and systemic vasculitis, sarcoidosis, adult forms of leukoencephalopathies, trauma and radio chemotherapy, and acquired metabolic conditions (hepatic encephalopathy, alcoholism), among others. While it is recognised that a combination of findings from clinical history, physical examination, and laboratory tests is commonly required to correctly establish a firm and clear aetiological diagnosis of T2-HI, 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, spinal cord, brainstem and cerebellar involvement, large-vessel disease). In addition to these conventional MRI-based features, non-conventional MR techniques (diffusion, MR spectroscopy, and perfusion) may also provide in some cases useful diagnostic information. Knowledge of these features will assist the diagnostic work-up of patients presenting with T2-HI 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.

Learning Objectives:

1. To learn about recognition patterns that might be helpful in suggesting the most likely etiology of brain multifocal T2 lesions.
2. To understand the role of spinal cord imaging in the differential diagnosis.
3. To appreciate a neuroradiologic diagnostic strategy for multiple white matter lesions of unknown origin.

Author Disclosure:

A. Rovira-Cañellas: Advisory Board; NeuroTEC, Bayer-Schering Pharma. Board Member; American Journal of Neuroradiology, Neuroradiology. Research/Grant Support; Bayer-Schering Pharma. Speaker; Bayer-Schering Pharma, Sanofi-Aventis, Biogen Idec, Novartis.

A-614 16:30

B. New developments in the diagnosis of multiple sclerosis

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

Although the diagnosis of multiple sclerosis (MS) can be made on clinical grounds alone, MRI is frequently used to demonstrate dissemination in time (DIT) or space (DIS) in patients presenting with a clinically isolated syndrome (CIS) suggestive of MS or to provide prognostic information early in the disease course. In the 2010 updated criteria, DIS can be demonstrated by the presence of one or more asymptomatic T2 lesions in minimally 2 of 4 crucial anatomical locations: juxtacortical, periventricular, infratentorial or in the spinal cord. Compared to the 2005 revision of the McDonald criteria, a second reference MRI after 30 days is no longer required for demonstration of DIT; new T2 and/or gadolinium-enhancing lesions on follow-up MRI compared to the baseline scan, but irrespective of the timing of this baseline scan, are sufficient for DIT. In fact, simultaneous presence of asymptomatic gadolinium-enhancing and non-enhancing lesions at any time is sufficient for demonstration of DIT, even at presentation. MS can thus be diagnosed according to the 2010 revisions of the McDonald criteria based on a single scan in patients with a typical CIS.

Learning Objectives:

1. To understand the 2010 revision of the McDonald criteria for MS.
2. To become aware of MRI red-flags in the diagnostic process.
3. To become familiar with new developments in pulse-sequences and field-strength.
4. To understand how to use spinal cord imaging in a diagnostic setting.

A-615 17:00

C. Imaging of MS treatment-related complications

M.M. Thurnher; Vienna/AT (majda.thurnher@medunivien.ac.at)

The findings of recently published studies on MTR and diffusion in white matter in MS and other white matter diseases further strengthen the key position of magnetic resonance imaging (MRI) not only in diagnostic work-up of all forms of suspected demyelinating diseases, but also in post-treatment monitoring. Until 2005, progressive multifocal leukoencephalopathy (PML) was exclusively reported in patients with AIDS or in immunosuppressed patients with malignant diseases. In 2004, the α -antegrin inhibitor Natalizumab (Tysabri®) was introduced for the treatment of relapsing-remitting MS. Soon after that, cases of PML have been described in multiple sclerosis (MS) patients treated with natalizumab. Current studies suggested that 1 in 1,000 persons would develop PML after approximately 18 months of treatment. Furthermore, PML was also reported in a patient with Chron's disease treated with natalizumab. Immune reconstitution inflammatory syndrome (IRIS) has been also reported in natalizumab-associated PML. IRIS is a syndrome that emerges when the immune system recovers after an immune deficiency state. Typical for

the IRIS phenomenon, as the patient deteriorates clinically, the PML lesions on MR enlarge and increased gadolinium enhancement can be seen within days to weeks. In this lecture, imaging characteristics and typical patterns of therapy-associated PML in MS and IRIS will be discussed.

Learning Objectives:

1. To become familiar with therapy options in multiple sclerosis (MS).
2. To understand therapy induced complications.
3. To understand the pathophysiology of immune reconstitution inflammatory syndrome (IRIS).
4. To become familiar with imaging findings in IRIS.

16:00 - 17:30

Room I/K

Chest

RC 1904

Phenotypes in obstructive airway disease: how should I image, analyse and report?

Moderator:

P.A. Gevenois; Brussels/BE

A-616 16:00

A. Asthma and associated conditions

P.-Y. Brillet; Bobigny/FR

Asthma is a chronic inflammatory disorder of the airways responsible for recurrent episodes or airflow limitation. It is associated with airway hyperresponsiveness and remodelling. The role of CT is limited to patients with severe disease or for differential diagnosis. CT is important for the diagnosis of associated conditions (mainly, allergic bronchopulmonary aspergillosis and Churg Strauss syndrome). Special attention should be paid to acquisition protocols in young patients. Usual findings include bronchial (thickening of bronchial wall, decrease of lumen and distal bronchiectasis) and bronchiolar (mucoid impactions, air trapping) abnormalities. The role of imaging for characterisation of phenotypes will be discussed.

Learning Objectives:

1. To learn more about the imaging findings in asthma and associated conditions, especially with low-dose and expiratory CT.
2. To appreciate the potential to grade the severity of the disease from CT.
3. To learn how to report findings indicative of asthma and associated conditions.

Author Disclosure:

P.-Y. Brillet: Speaker; Novartis.

A-617 16:30

B. Chronic obstructive pulmonary disease (COPD)

N. Sverzellati; Parma/IT (nicolasve@tiscali.it)

Chronic obstructive pulmonary disease (COPD) is one of the leading causes of morbidity and mortality worldwide. It is a heterogeneous disease affecting the airways, the parenchyma as well as the vasculature with different severity during the course of the disease. Computed tomography (CT) with aid of dynamic expiratory scanning has become the standard modality to visualize and objectively quantitate emphysema and airways disease. Differentiating between an emphysema-predominant and an airway-predominant phenotype via CT may clearly impact follow-up strategy and therapeutic decision making in clinical practice. It is also important to realize that a low-dose CT examination allows now a complete phenotypical definition of COPD. In addition, recent evidences suggest that both CT and magnetic resonance imaging (MRI) may provide useful measures of the presence and severity of pulmonary vascular disease for clinical correlation.

Learning Objectives:

1. To learn more about the imaging findings in COPD, including low dose and expiratory CT.
2. To become familiar with the concept of CT phenotyping: airway obstruction vs. alveolar destruction.
3. To appreciate the radiological findings of remodelling of airways and pulmonary vasculature.

A-618 17:00

C. Cystic fibrosis and other bronchiectatic diseases

M.U. Puderbach; Heidelberg/DE (m.puderbach@dkfz.de)

Several different diseases go along with the development of bronchiectasis. Bronchiectasis may result from chronic infection, proximal airway obstruction, or

congenital bronchial abnormality. In cystic fibrosis, bronchiectasis is one of the key features of lung involvement. Bronchiectasis can present with a variety of non-specific clinical symptoms, including hemoptysis, cough, and hypoxia. Bronchiectasis is defined as localised or diffuse irreversible dilatation of the cartilage-containing airways or bronchi. The imaging gold standard for bronchiectasis is thin-section CT. Morphologic criteria on thin-section CT scans include bronchial dilatation with respect to the accompanying pulmonary artery (signet ring sign), lack of tapering of bronchi, and identification of bronchi within 1 cm of the pleural surface. Bronchiectasis may be classified as cylindric, varicose, or cystic, depending on the appearance of the affected bronchi. It is often accompanied by bronchial wall thickening, mucoid impaction, and small-airways abnormalities. Besides CT, nowadays MRI of the lung is able to image the relevant morphological features of bronchiectasis. In addition, functional changes due to bronchiectasis can be studied.

Learning Objectives:

1. To learn more about the imaging findings in bronchiectasis, especially at MRI.
2. To appreciate the role of imaging in primary diagnosis, surveillance and therapy monitoring.
3. To become familiar with the role of imaging in surgical planning.

16:00 - 17:30

Room N/O

Head and Neck

RC 1908

Temporal bone: imaging the most common symptoms and signs

Moderator:

T. Beale; London/UK

A-619 16:00

A. Conductive hearing loss: what's behind it?

A. Trojanowska; Lublin/PL (agnieszka30@yahoo.com)

New computed tomography techniques and new magnetic resonance sequences have led to an important improvement in temporal bone imaging. Computed tomography is the method of choice for imaging of conductive hearing loss, which can be caused by several factors, including developmental anomalies, middle ear inflammation, tumours, and temporal bone fractures. However, in some cases, magnetic resonance imaging can add important information. High-resolution computed tomography plays a critical role in the evaluation and management of conductive hearing loss. It is possible to demonstrate osteolysis, osteosclerosis and demineralization changes in otic capsule and ossicular chain. CT and MR may also visualize tumour, post-inflammatory changes in tympanic cavity and temporal bone trauma. MR is especially helpful when evaluating the presence of cholesteatoma in the middle ear and mastoid. Because of the ability of CT to demonstrate the detailed anatomy of temporal bone, thorough diagnosis of congenital malformations and anatomical variants is possible.

Learning Objectives:

1. To review the most common causes of conductive hearing loss.
2. To become familiar with the imaging findings in patients with conductive hearing loss.
3. To differentiate the most frequent causes of conductive hearing loss.

A-620 16:30

B. Sensorineural hearing loss: a challenge for radiologists

J. Casselman¹, B. De Foer²; ¹Bruges/BE, ²Antwerp/BE (jan.casselman@azbrugge.be)

MR is the modality of choice in patients with sensorineural hearing loss (SNHL) and the complete auditory pathway from the cochlea to the auditory cortex must be studied in these patients. The labyrinth, internal auditory canal (IAC) and cerebellopontine angle (CPA) are best studied using submillimetric heavily T2W images, showing the intralabyrinthine fluid and nerves. But submillimetric Gd-enhanced T1W images or 3D-Flair images remain more sensitive. The auditory pathway in the brainstem is best studied with a multi-echo sequence (m-FFE/medic/merge) or T2W TSE sequence and the auditory cortex is best studied on T2W TSE images. The most frequent pathology in the labyrinth is: labyrinthitis, intralabyrinthine schwannoma, congenital malformation, post-traumatic lesions. Unenhanced (trauma, hemorrhagic labyrinthitis) and Gd-enhanced T1W images are needed in these patients and both submillimetric T2W images and CT images are needed in the pre-operative work-up of cochlear implant candidates. Cochleovestibular schwannomas, meningiomas, epidermoid tumours and facial nerve neuritis are the most frequent lesions detected in the IAC and CPA. Contrast-enhancement is crucial in these patients although

T2W-images are needed to confirm the presence of all nerve branches in the IAC and to distinguish epidermoid cysts from arachoid cysts. Multiple sclerosis, infarction, tumour and trauma are the lesions which are most often found along the central auditory pathway (brainstem/cortex). Contrast administration and DWI images are needed in the acute setting. In mixed hearing loss (sensorineural and conductive), otosclerosis must be excluded on CT. The above-mentioned imaging techniques and pathology will be illustrated and discussed.

Learning Objectives:

1. To learn which imaging techniques should be used.
2. To become familiar with the different causes of sensorineural hearing loss.
3. To recognise and differentiate the imaging findings in the most frequent causes of sensorineural hearing loss.

A-621 17:00

C. Tinnitus and vertigo: diagnostic algorithm

R.B. de Bondt; Zwolle/NL (rbjdebondt@gmail.com)

Tinnitus: a buzzing or ringing in the ear, may be pulsatile or non-pulsatile, subjective or objective. Evaluation of patients with tinnitus requires a detailed history to determine if the patient also has hearing loss, vertigo, or headaches; a complete medical examination including a neurologic and ENT examination with audiologic evaluation. Accurate distinction of these entities and strategies determines the most appropriate imaging study. Vertigo: dizziness, is classified central or peripheral and might originate from different pathology of which the location is very difficult to differentiate on clinical examination. Therefore, a systemic radiological work up is mandatory based on the clinical setting. Imaging strategies - which modality when to use - and imaging protocols will be discussed. Most common pathology responsible for tinnitus or vertigo will be displayed.

Learning Objectives:

1. To learn the most common causes.
2. To understand imaging strategies.
3. To become familiar with typical imaging findings.

16:00 - 17:30

Room P

Vascular

RC 1915

Lower extremity venous insufficiency

A-622 16:00

Chairman's introduction

D.J. West; Stoke-on-Trent/UK (davidwest@veincentre.com)

Venous disease is very common and potentially lethal. In the United States, a first VTE happens in approximately 1 in every 1000 persons each year. This rises to 500 per 1000 at the age of 80. Leg ulcers resulting from superficial and/or deep venous insufficiency occur in approximately 1% of population at some time in their lives usually over 65 years. Varicose veins adversely affect the quality of life of approaching 50% of the population. Rare venous disorders are challenging to diagnose and treat. Despite all this, venous disease is the cinderella among vascular diseases and too little attention is paid to its accurate management and appropriate treatment. Consequently, there are innumerable unnecessary deaths from VTE and untold distress from chronic ulceration which is still managed primarily by bandaging. Interventional radiologists are well trained and equipped to make a major impact in the management of most venous disease. It is a challenging and rewarding area and well suited to an introduction to "real" clinical care.

Author Disclosure:

D. J. West: Owner; veincentre ltd.

A-623 16:05

A. Venous anatomy and ultrasound

H. Moschouris; Piraeus/GR (hipmosch@in.gr)

Chronic venous insufficiency (CVI) is a common vascular disease with significant clinical impact. Physical examination is not always adequate for the diagnosis and for the assessment of the extent of CVI; therefore, imaging investigation (with ultrasonography-US, as the primary modality) is very often required. US examination is performed with legs in a dependent position. Veins are interrogated in a segmental manner from groin to foot, with a linear, high frequency transducer. Lower limb veins can be divided in three systems, which can be readily appreciated by US: superficial and deep veins lie respectively, above and beneath the

hyperechoic muscular fascia, while perforating veins traverse muscular fascia and connect deep with superficial veins. B-mode depicts anatomic detail (relevant to venous wall, valves, diameter, intraluminal content, course, tributaries). Retrograde flow (reflux) which is the diagnostic hallmark of CVI, is detectable by Color Doppler; however, reflux is more reliably and quantitatively assessed by Pulsed-Wave Doppler. Reflux-provoking maneuvers include Valsalva (for proximal deep veins and saphenofemoral junction), Parana maneuver and distal manual compression with rapid release. Automatic inflation/deflation devices ensure more standardised and reproducible compression, but are not routinely used. Reflux lasting more than 0.5 seconds in superficial and perforating veins (and more than 1.0 second in deep veins) is indicative of insufficiency. In addition to its role for the diagnosis, for venous mapping and for postoperative evaluation, US is an integral part of the modern interventional treatments of CVI. In this context, US is indispensable for patient selection, intraprocedural guidance and follow-up.

Learning Objectives:

1. To become familiar with normal venous anatomy the indications for imaging and the US techniques.
2. To learn about the typical and atypical appearances of venous pathology.
3. To understand the potential pitfalls and limitations of US.

A-624 16:28

B. Rare venous diseases of the lower extremities

M. Greiner¹, P. Lemasle¹, A. Bisdorff-Bresson²; ¹Neuilly sur Seine/FR, ²Paris/FR (milka.greiner1@free.fr)

Rare venous diseases of the lower extremities are challenging to diagnose due to their numerous and heterogeneous presentations and their lack of knowledge. They can be parted in: 1) local and simple venous malformations which can be truncular such as persistence of marginal, sciatic, lateral embryonic veins, venous aneurysms or extra truncular. The later are low-flow venous malformations and carry a high risk of recurrence when stimulated by trauma, hormonal changes or non-appropriate treatment. 2) Complex vascular malformations in which complete understanding of the malformation is needed before venous treatment. They are rare disorders of vascular development, present at birth but not always early diagnosed. They are often more complex than they appear. They include glomuvenous malformations, Klippel-Trénaunay Syndrome and other combined malformations without arterio-venous shunt. The differential diagnosis with regional or diffuse high-flow malformations with arterio-venous shunt such as Parkes-Weber Syndrome is not always easy and traditional eponyms have become obsolete. This topic highlights the differences in clinical appearance which allow the diagnosis in most of the cases, the place of the imaging study which confirms the diagnosis and which is important because in all these anomalies imaging instead of biopsy is now the standard for diagnostic confirmation and the main decision makings. Rare venous diseases of the lower limbs have to be known in order to establish appropriate treatment and follow-up and to avoid disastrous therapeutic consequences.

Learning Objectives:

1. To become familiar with anatomic variants.
2. To learn about anatomy with specific congenital disorders, such as persistent sciatic vein Klippel Trénaunay-Weber syndrome.
3. To become familiar with differential diagnosis and pitfalls in the diagnosis of the above conditions.

A-625 16:51

C. CT venography and MR venography

G. O'Sullivan, D.G. Lohan; Galway/IE (gerard.osullivan2@hse.ie)

Both CT and MR venography are assuming greater significance in assessing particularly central venous structures prior to endovenous intervention. Obviously, they are both more expensive and less widely available than ultrasound and should not be used on every patient. Therefore, which patients should undergo CTV or MRV? In our institution, it is only symptomatic patients with limb swelling, ulceration, or significant post-thrombotic syndrome sequelae who merit either of these techniques. A detailed discussion of CT and MR-imaging parameters, contrast media injection protocols and flow dependent and independent techniques will be undertaken. A variety of pitfalls and artefacts can cause misinterpretation and these will be discussed with examples.

Learning Objectives:

1. To learn about its indications and pros and cons compared to US.
2. To become familiar with imaging parameters, contrast media protocols and flow dependent and flow independent techniques.
3. To become familiar with pitfalls and artefacts that affect correct evaluation of imaging findings after endovascular treatments.

Panel discussion:

Which imaging modality is best for planning endovascular management?

17:14

16:00 - 17:30

Room Q

Paediatric

RC 1912

Normal variants in paediatric imaging: not to be confused with disease

Moderator:

O.E. Olsen; London/UK

A-626 16:00

A. 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 optimisation for paediatric 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. A summary of the most frequent conditions that may lead to misinterpretation of findings will be provided here.

Learning Objectives:

1. To learn about normal variants in the neonatal and child's brain.
2. To understand the typical imaging characteristics of normal variants that should suffice for correct interpretation.
3. To become familiar with the differentiation between normal variants and disease.

A-627 16:30

B. Chest and abdomen

S.G.F. Robben; Maastricht/NL (s.robben@mumc.nl)

Many radiologists are reluctant to examine children because: a) they cry, b) do not listen, c) struggle, d) urinate, vomit and loose their stools all over the place, e) have annoying parents and f) demonstrate an enormous amount of normal variations. This is the rationale of the existence of paediatric radiologists. This refresher course intends to clarify item f). Unfortunately items a-e cannot be changed.

Learning Objectives:

1. To learn about normal variants in the neonatal and paediatric chest and abdomen.
2. To familiarise oneself with the imaging appearances of common normal variants.
3. To understand how to differentiate between normal variants and disease.

A-628 17:00

C. Musculoskeletal

F. Saez; Bilbao/ES (fersaez@seram.org)

The skeleton of a child is a developing system with a variety of changing normal appearances. Imaging studies, especially plain films, are requested for many clinical reasons, and the radiologist is in the position to determine if an image is a normal finding or we are dealing with a lesion. The way physis and epiphysis grow, ossify, and fuse constitutes a great source of physiologically bizarre appearances, which the radiologist must be familiar with. This talk will concentrate on the plain film diagnosis of some of the most common musculoskeletal variants. Other imaging modalities will also be shown when appropriate for the case. Irregularities, asymmetries, partial fusions, hypo- or hyper-dense bone areas, accessory bones, prominent normal structures, external artifacts, and potential fracture lines are the most often encountered pseudolesions. A defective radiological technique may also be potentially misleading. Patient age, location of the supposed "abnormality" and lack of significant local symptoms are key factors. Usually plain films, correlated with regional clinical findings, are the only imaging method that is required. However, in certain doubtful situations, ultrasound, CT, MRI, Bone Scan, or even biopsy, may

be needed to reach the right diagnosis. Unnecessary overuse of these imaging modalities, and the subsequent family anxiety that ensues from this overuse, should be avoided with careful analysis of the x-ray and clinical findings.

Learning Objectives:

1. To learn about normal variants in the neonatal and paediatric musculoskeletal system.
2. To familiarise oneself with the imaging appearances of common normal variants.
3. To understand how to differentiate between normal variants and disease.
4. To learn how to integrate age, location and clinical history with the radiological features before establishing a diagnosis.