

Abstracts

A

Postgraduate Educational Programme

Session numbers are prefixed by CC, E³, EF, EM, HL, MC, MS, NH, OL, PC, RC, SF, SA, TF


Presentation numbers are prefixed by the letter A
Sessions and abstracts are listed by days.
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B

Scientific Sessions

Session numbers are prefixed by SS

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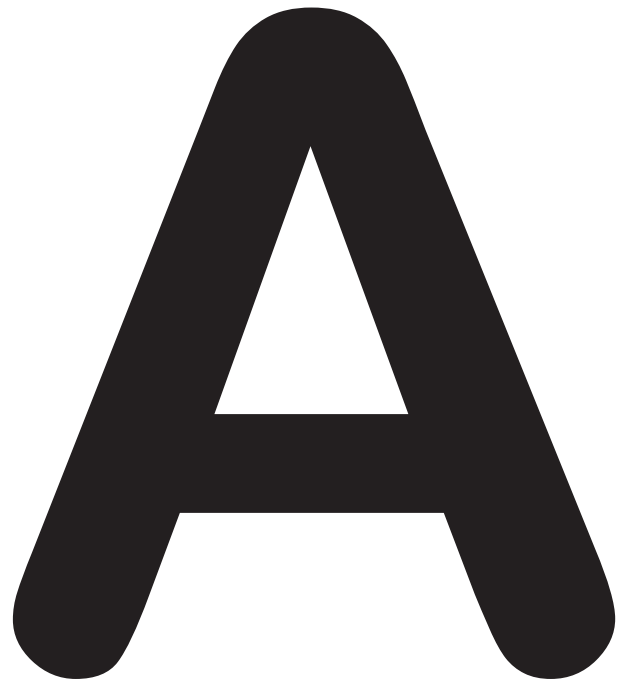
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Postgraduate Educational Programme

Wednesday, March 2

09:15 - 09:45

Room C

1st ESR/EANM Joint Pre-Congress Workshop on PET/CT

WS 1a

Instrumentation and technique

A-001 09:00

Welcome on behalf of the ESR
É. Breatnach; Dublin/IE

A-002 09:07

Welcome on behalf of the EANM
P. Bourguet; Rennes/FR

A-003 09:15

Radiology perspective

T.R.C. Johnson; Munich/DE

For PET-CT, the CT exam is generally performed as standard whole-body exam from the base of the skull to the upper thighs. Standard parameters are non-ionic iodinated intravenous contrast material at 0.5 g/kg bodyweight with a venous delay of 70 seconds after injection and 3-5 mm thick continuous axial reconstructions with medium soft convolution kernels. CT images frequently contain important diagnostic information beyond mere 'anatomic landmarking', so generally a diagnostic, contrast enhanced normal-dose CT should be performed except if a recent diagnostic CT scan is available for fusion. Then, a low-dose CT is sufficient for attenuation correction. A difference from routine CT protocols is the expiratory position to match the respiratory position of PET acquisition. Also, negative oral contrast material should be applied and the whole body should be included in the field of view to allow effective attenuation correction of PET images. Diagnostic reading has to include lung, soft tissue and bone windows. Optimally, the assessment should be performed by one reader evaluating CT and PET images simultaneously on multiplanar reformats.

Learning Objectives:

1. To get acquainted with standard CT examination parameters for oncological imaging including the requirements for an effective attenuation correction.
2. To see the diagnostic value of CT beyond 'anatomical landmarking'.
3. To learn effective ways to interpret PET-CT examinations.

A-004 09:30

Nuclear medicine perspective

T. Beyer; Zurich/CH

Combined PET/CT images were first proposed as early 1984. Since 1998 PET/CT became available for broader clinical testing. Since its commercial introduction in 2001 more than 5'000 PET/CT systems were installed worldwide. PET/CT is a logical and technical consequence of early, manual or semi-automatic efforts to align functional and anatomical images for easier and improved diagnosis. PET, or positron emission tomography, is an emission tomographic imaging method based on the application of radioactively labelled biomolecules in order to measure and quantitate signalling or metabolic pathways. CT, computed tomography, on the other hand, uses an external ionising radiation transmission source to generate projection data of the transmitted radiation, thus helping to generate high spatial resolution images of the anatomy of the subject. Both sets of information can be combined easily in a PET/CT, whereby both the PET and CT components can be operated in close spatial proximity within a single gantry without cross-talk effects. Through the combination of CT and PET overall examination times of oncology PET studies are reduced by 30%. In addition, PET instrumentation has been advanced to include time-of-flight measurements for improved signal-to-noise ratio, extended axial field-of-view-coverage for higher sensitivity and novel image reconstruction for improved contrast. Today, high-quality one-stop shop staging with PET/CT is possible in 10 min, or less.

Learning Objectives:

1. To illustrate the origin of combined PET/CT imaging.
2. To motivate the strength of PET: high spatial sensitivity, quantification and functional information.
3. To appreciate the difference between "contrast" and "tracer" imaging.
4. To highlight novel developments in PET imaging: time of flight (TOF), extended axial field-of-view.

09:45 - 10:15

Room C

1st ESR/EANM Joint Pre-Congress Workshop on PET/CT

WS 1b

Radiation exposure

A-005 09:45

Radiology perspective
H.-C. Becker; Munich/DE

Computed tomography is the main contribution to diagnostic medial radiation exposure to the public. In the year 2001, CT accounted for only 6% of all radiation-associated examinations; however, at the same time it accounted for 47% of the total radiation exposure. Since the beginning of this century numerous international surveys had been performed with the aim to define diagnostic reference levels in European countries. Radiation exposure by CT has increased particularly by cardiac CT examination, what has caused awareness to utilise all strategies for radiation protection in CT. Modern CT scanners are equipped with automated anatomical or organ sparing exposure control. It is the CT investigators responsibility to check the clinical indication, limit the scan range and decide for the appropriate scan protocol with the least radiation exposure. Newer technical developments in CT scanner hard and software will enable to further reduce the dose from CT. All these strategies are essentially necessary since the number of CT investigations and the scope of clinical indications are expanding with advancing medical progress.

Learning Objectives:

1. To understand the meaning of diagnostic reference values.
2. To become aware of dose intense CT protocols.
3. To learn about strategies for radiation protection in CT.

A-006 10:00

Nuclear medicine perspective

S.P. Mueller; Essen/DE

Different radiopharmaceuticals labelled with positron emitting radioisotopes are used to study a multitude of molecular processes using a positron-emission-tomography (PET) scanner which nowadays is typically integrated with a CT scanner (PET/CT). This lecture will enable the attendee to comprehend that the radiation exposure from PET depends on the biodistribution and kinetics of the radiopharmaceutical, the physical half-life of the positron emitting radioisotope used for labelling, and the injected activity, leading to an understanding that there is no generic "radiation exposure from PET or PET/CT".

Learning Objectives:

1. To learn that the comparison of doses for different radiopharmaceuticals is based on the concept of the effective dose which expresses the total stochastic risk from the non-uniform radiation exposure to individual radiosensitive organs in terms of a uniform whole body radiation dose.
2. To understand that the effective dose from certain radiopharmaceuticals may be reduced by simple means, e.g. if it is renally eliminated by frequently voiding the bladder, and that the effective doses for the most prevalent radiopharmaceuticals lie within the typical range of other diagnostic nuclear medicine tests and compare favourably to the radiation exposure from the CT portion of a whole-body PET/CT scan.

10:15 - 10:30

Room C

1st ESR/EANM Joint Pre-Congress Workshop on PET/CT

WS 2

FDG PET

A-007 10:15

Physiology, normal distribution and pitfalls

A. Hertel; Fulda/DE

The successful use of PET/CT imaging with FDG requires thorough understanding of FDG physiology, distribution in order to cope with possible and common pitfalls. FDG is normally distributed throughout the body following deoxy-glucose consumption and excretion. Main organ of uptake is the brain. Excretion via kidneys results in intense uptake of the genito-urinary system. Prior to imaging the following questions should be

answered: Is FDG suitable for the underlying cancer involved? Some tumours have none or low FDG uptake which should not be included in FDG PET/CT imaging like prostate cancer, mucinous gastric cancer, most neuro-endocrine cancers including the majority of differentiated primary thyroid cancers and renal cancer. Is the patient properly prepared? This requires adequate fasting of at least 10 hours and a sufficiently low blood glucose level under 150 mg/dl. Is the suspicious abnormal focus suitable for FDG imaging? Routine PET scanner have a physical resolution of around 5 mm. In the lung without breath triggering structures in the lower lobes should be larger than 8-10 mm. Various organs exhibit a wide range of physiological FDG uptake (salivary glands, floor of mouth, brown fat in the neck, atherosclerosis in large vessels, stomach, colon and guts, bone marrow). Intense studying of these different conditions requires own 3D judgment on the dedicated work station by each and every doctor using PET/CT.

Learning Objectives:

1. To learn about patient preparation is essential for avoiding common pitfalls: tumour history, current therapy (chemo affects bone marrow, surgery produces uptake in scars), other diseases or habits like smoking (FDG uptake in mediastinal lymph nodes due to chronic bronchitis).
2. To become familiar with FDG uptake that can cause benign processes. This includes inflammation/abscesses, sarcoidosis or recent radiotherapy (inflammatory). Also intense regular brain uptake is suitable for Alzheimer diagnosis but not for small brain metastasis (gold standard MRI).
3. To become familiar with proper technique. This includes correct patient positioning, check for patient movement and correct positioning when using FDG PET/CT for radiotherapy planning (this should be done commonly with the radio-oncologist).

11:00 - 11:45

Room C

1st ESR/EANM Joint Pre-Congress Workshop on PET/CT

WS 3a

Head and neck including cancer of unknown primary (CUP)

A-008 11:00

Radiology perspective

S. [Bisdas](#); *Tübingen/DE*

Cross sectional techniques, like CT and MRI, as well as hybrid imaging, like PET-CT, are the main diagnostic radiological approaches in the TNM staging of head and neck cancer, including cancer of unknown primary (CUP).

Learning Objectives:

1. To consolidate knowledge about the first-choice diagnostic modalities for the different anatomic sites of head and neck cancer, including CUP syndrome.
2. To appreciate the clinical indications and problems in patients referred for head and neck imaging.
3. To understand from a radiological point of view the advantages and shortcomings of each modality concerning the T, N, and M staging.
4. To choose the most appropriate diagnostic modality for any head and neck disease, including CUP syndrome.

A-009 11:22

Nuclear medicine perspective

R. [Hustin](#); *Liège/BE*

Most head and neck tumours (HNT) are squamous cell carcinomas, which display highly increased FDG uptake with great consistency. On the other hand, recent advances in the PET/CT technology have lead to significant improvement in terms of spatial resolution, with either lower injected dose of tracer or shorter acquisition time. This review will first discuss the methodological aspects of PET/CT when applied to HNT imaging. Clinical indications will then be reviewed, including the staging of proven tumours, the evaluation of carcinomas of unknown origin, the assessment of the response to treatment and the contribution of metabolic imaging to the planning of radiation therapy.

Learning Objectives:

1. To determine acquisition parameters adapted for HNT imaging, for both the PET and the CT part of PET/CT.
2. To recognise the diagnostic performances of FDG PET/CT in the TNM staging of HN tumours.
3. To discuss the role of FDG PET/CT in the clinical algorithm for evaluating the response to chemoradiotherapy, according to the tumour stage and location.
4. To understand the concept of metabolic target volume in radiation therapy.

11:45 - 12:30

Room C

1st ESR/EANM Joint Pre-Congress Workshop on PET/CT

WS 3b

Lung cancer

A-010 11:45

Radiology perspective

F. [Gleeson](#); *Oxford/UK*

PET-CT is now recognised as a routine investigation in patients with lung cancer prior to radical treatment for attempted cure. However, PET-CT is an expensive and limited resource, and its use needs to be targeted to maximise its benefits. This presentation will review its use and compare its benefits to CT. It will specifically focus on both the added advantages PET has when compared to CT and also the value of using the information on PET-CT scans in an additive manner by using the information available from both the PET and the CT components of a PET-CT scan.

Learning Objectives:

1. To learn when PET-CT should be performed in lung cancer.
2. To understand the significance of the CT appearance and PET characteristics of lung cancers.
3. To become familiar with the significance of FDG nodal avidity.
4. To become familiar with the ability of PET-CT to detect metastatic disease.

A-011 12:07

Nuclear medicine perspective

H.C. [Steiner](#); *Zurich/CH*

Combined positron-emission tomography and computed tomography (PET-CT) has become an established method for staging of patients with non-small-cell lung cancer (NSCLC). Glucose use is markedly accelerated in NSCLC, resulting in high tumour uptake of the radiolabeled glucose analogue fluorine-18 fluorodeoxyglucose (FDG). It has been shown that combined PET-CT imaging is superior in preoperative staging to CT alone and PET alone (1). The advantage is mainly based on a more sensitive and specific assignment of the lymph-node stage (N stage) and the accurate detection of occult distant metastases. However, limitations of PET-CT imaging are well known (FDG negative tumours, FDG uptake in inflammatory cells). New PET radiotracers as fluoroethyltyrosine (FET), fluoroalphanethyltyrosine (FMT), and deoxyfluorothymidine (FLT) overcome the limitations of FDG. The addition of PET-CT to the diagnostic work-up in patients with potentially resectable NSCLC has been shown to significantly reduce both the total number of thoracotomies and the number of futile thoracotomies (2). PET-CT can also be used for the accurate definition of the radiotherapy treatment field and for monitoring response of chemotherapy and radiotherapy.

Learning Objectives:

1. To understand the role and limitations of PET/CT in staging of lung cancer.
2. To discuss the utility of PET/CT in radiotherapy target definition.
3. To describe the role of PET/CT in therapy monitoring.
4. To compare different PET radiotracers for lung imaging.

13:30 - 14:15

Room C

1st ESR/EANM Joint Pre-Congress Workshop on PET/CT

WS 4a

GI tumours

A-012 13:30

Radiology perspective

A. [Ba-Ssalamah](#); *Vienna/AT*

The use of PET-CT, which is a combination of positron emission tomography (PET) and computed tomography (CT), has dramatically grown in the daily clinical routine. The synergistic advantage of adding CT is that the attenuation correction required for PET can also be derived from the CT data, leading to a more comfortable examination and higher patient throughput. Furthermore, the integration of both techniques provides precise localisation of lesions on the PET scans, with relevant functional information within the anatomic and morphologic reference frame provided by contrast-enhanced-CT, thus increasing the sensitivity and specificity

of the examination. Therefore, for oncologic applications, PET-CT has already gained widespread acceptance for the initial staging of cancer, the management of recurrent cancer, and for monitoring the response to therapy. The development of a large variety of radiotracers is an evolving procedure. The most frequent used radiotracer in clinical practice, 18 F FDG, is based on the identification of the fundamental aspects of tumour glucose metabolism. New radiotracers, with promising potential for PET-CT, are also currently available to visualise specific cellular and molecular tumour pathway and more being developed.

Learning Objectives:

1. To appreciate the advantage of a combined PET-CT technique.
2. To consolidate our knowledge of optimal examination protocols and to be aware of the pitfalls that may be encountered using this technique.
3. To understand the indications for PET-CT in the diagnosis, staging, and therapy monitoring of a large variety of GI tumours.
4. To become familiar with the different radiotracers to obtain a tailored and personalized diagnosis for the large variety of GI tumours.

A-013 13:52

Nuclear medicine perspective

T.F. Hany; Zurich/CH

FDG-PET/CT imaging is getting more established in the work-up of several abdominal malignancies of the gastro-intestinal tract. The main advantage lies in the comprehensive evaluation of the patient, including all body compartments and therefore detection of pivotal, therapy deciding lesions. The performance of FDG-PET/CT in the evaluation of primary tumours of the GI-tract is characterised by a high sensitivity in the detection of distant metastases. Secondary liver tumours like metastases from the GI-tract are detected by FDG-PET/CT at a high rate, making this imaging technology a primary tool in the evaluation of patients with suspicion of recurrent colon cancer. Further, full integration of contrast-enhanced CT protocols improve the diagnostic confidence and reduce the sometimes cumbersome diagnostic pathway for patients. FDG-PET/CT can be reliably used for therapy response assessment. New tracers like Ga-68-DOTA-TATE or F-18-DOPA will bring significantly improved diagnostic confidence in the notoriously difficult evaluation of patients with neuroendocrine small bowel tumours.

Learning Objectives:

1. To understand the correct applications of FDG-PET/CT imaging in GI tumours.
2. To learn the limits of PET/CT imaging in esophageal cancer imaging.

14:15 - 15:00

Room C

1st ESR/EANM Joint Pre-Congress Workshop on PET/CT

WS 4b

Urogenital tumours

A-014 14:15

Radiology perspective

C. Nicolau; Barcelona/ES

Integrated positron emission tomography (PET)/CT provides combined metabolic and anatomic information of malignancies. The addition of CT to PET for urogenital purposes is very useful. CT should be performed with oral and intravenous contrast agent administration as a full diagnostic technique. If performed under these conditions, this technique can help to avoid PET pitfalls including focal retained activity in ureters and urinary bladder, and increased uptake in physiologic and benign pelvic processes such as endometrial uptake in the menstrual phase, leiomyomatosis, endometriosis or infection. We will describe the use of PET/CT in the characterisation, staging and surveillance of urogenital malignancies including kidney, prostate, bladder, uterine cervix, endometrium and ovaries. PET/CT is internationally accepted as the most useful surveillance imaging tool in patients with ovarian cancer, and its use as a problem-solving modality has also rapidly grown in the rest of urogenital malignancies.

Learning Objectives:

1. To learn the appropriate protocols and settings of a diagnostic CT in PET/CT for urogenital purposes.
2. To describe advantages and limitations of integrated PET/CT for urogenital purposes.
3. To describe the main indications of PET/CT for diagnosis, staging and surveillance of urogenital cancers.
4. To discuss the role of PET/CT with respect to other imaging techniques in the diagnostic algorithms of urogenital cancers.

A-015 14:37

Nuclear medicine perspective

B.J. Krause; Munich/DE

To understand the potential of molecular imaging with hybrid imaging technologies such as PET/CT of imaging urogenital tumours and especially prostate cancer. To learn more about the metabolic pathways underlying the choline signal in prostate cancer imaging. The role of PET/CT in the detection of recurrent prostate cancer and patients with advanced disease. To become familiar with the most common indication of PET/CT with radioactively labelled choline derivatives in prostate cancer patients, i.e. relapse of disease and biochemical recurrence. PET/CT with choline derivatives at present is the imaging modality with the highest sensitivity to diagnose the recurrence. PET/CT with choline derivatives has major implications on patient management by allowing to individualise the therapeutic strategy, i.e. curative vs. palliative treatment. In localised disease curative therapy options such as salvage radiotherapy or salvage lymphadenectomy can be considered. In the case of disseminated disease anti-hormonal therapy or chemotherapy can be initiated. In the case of radiation therapy choline PET/CT might enable a custom tailored radiation field for local as well as for distant disease. To become familiar with the future developments in molecular imaging prostate cancer: (1) new tracers will be introduced which will allow to diagnose prostate cancer with higher sensitivity and specificity. (2) New hybrid imaging technologies are emerging such as SPECT/CT and especially MR/PET that will also contribute to higher accuracy in diagnosing patients with prostate cancer. (3) Molecular imaging techniques have a high potential for assessment of therapy response with the view towards individualisation of therapies in prostate cancer patients.

15:30 - 16:15

Room C

1st ESR/EANM Joint Pre-Congress Workshop on PET/CT

WS 5

Lymphoma

A-016 15:30

Radiology perspective

M. O'Connell; Dublin/IE

From initial staging, to response evaluation to restaging, CT and PET/CT have complementary roles. Contrast CT to include solid organ assessment is used at initial diagnosis, followed by low dose PET/CT in the initial staging of Hodgkin's disease and in some cases of Non Hodgkin's Lymphoma. Response evaluation is typically performed after two cycles of chemotherapy using low dose PET/CT. Protocols for restaging lymphoma vary according to the type of tumour and local protocols. Lymphoma can present with unusual patterns in some organ systems for example in urinary tract, colon or the central nervous system. This presentation also discusses the role of MRI in staging and ultrasound in biopsy. A dual qualified reader can read PET and CT components as a one study leading to synergy in interpretation of imaging findings and cost benefits. This will also allow a comparison with previous MRI, CT and PET/CT imaging studies. It is also important that PET/CT readers attend and contribute to Multidisciplinary Team Meetings (MDM) in order to ensure the full impact of PET/CT investigations.

Learning Objectives:

1. To outline the role of CT in staging lymphoma in the era of PET/CT.
2. To examine the role for MRI and ultrasound in lymphoma staging.
3. To outline some of the less common patterns of lymphoma presentation on CT that are identified at PET/CT.

A-017 15:52

Nuclear medicine perspective

A.K. Buck; Munich/DE

PET and PET/CT are non-invasive, 3-dimensional imaging modalities which have become standard of care in patients with malignant lymphomas. These modalities have been extensively studied for staging, restaging, monitoring response to therapy, surveillance after definite treatment, and assessment of transformation. More recently, PET tracers have been suggested as surrogate markers for cancer drug development.

Learning Objectives:

1. To understand in which clinical scenarios PET and PET/CT imaging are superior to standard imaging modalities or other diagnostic tests.
2. To learn the diagnostic accuracy and predictive potential of PET and PET/CT for staging/restaging Hodgkin's disease and non-Hodgkin's lymphoma.

3. To become familiar with typical imaging findings of vital lymphoma in lymph node basins and non-lymphatic tissues (bone, bone marrow, spleen, liver, soft tissues).
4. To understand what kind of pitfalls can reduce the sensitivity and specificity of PET/CT.
5. To become familiar with current state of the art data acquisition protocols and data postprocessing.
6. To learn about new technological developments that are underway (i.e. new radiotracers enabling molecular imaging of lymphoma such as proliferation markers and new scanner developments such as PET/MR).

shown promising results in the management of various cancers where FDG has limited value. These radiotracers have more specific mechanism of uptake and is likely be investigated in the near future.

Learning Objective:

1. To consolidate knowledge of oncological applications, characteristics and future aspects of non - FDG PET tracers in the daily clinical practice.

A-020 16:45

Concluding remarks from the ESR and the EANM
É. Breatnach¹, W. Langsteger²; ¹Dublin/IE, ²Linz/AT

A-021 17:00

Test and quiz with evaluation
É. Breatnach¹, W. Langsteger²; ¹Dublin/IE, ²Linz/AT

16:15 - 16:45

Room C

1st ESR/EANM Joint Pre-Congress Workshop on PET/CT

WS 6

Future aspects

A-018 16:15

Overview of future developments in CT

T.R.C. Johnson; Munich/DE

Computed tomography remains the workhorse of clinical cross sectional imaging due to its good availability, enormous speed, high spatial resolution and sufficient tissue contrast to evaluate most diseases based on morphology. Compared to PET and SPECT, room for improvement remains in sensitivity and specificity for certain diseases and, compared to ultrasound and MRI, in dynamic imaging. However, already today there are new CT techniques which can provide diagnostically equivalent information as SPECT or PET but with higher spatial resolution, in shorter acquisition time and without radioactive tracers. One of these techniques is CT perfusion imaging with repeated low-dose acquisitions of the same organ. With this method, a detailed evaluation of brain perfusion is feasible e.g. for stroke assessment, or of tumour perfusion, e.g. to assess early therapy response. Another option is Dual Energy CT which does not require additional dose but can provide additional important diagnostic information similar to PET or SPECT. Examples are the evaluation of lung ventilation and perfusion with xenon gas and iodine contrast. For oncological imaging, the evaluation of tumour perfusion based on spectral identification of iodine is an attractive option to increase specificity without additional dose or radioactivity. Similarly, it is feasible to assess myocardial perfusion along with coronary CT angiography. For some diseases, even the molecular substrate can be identified with this technique, e.g. uric acid in gout patients. These new techniques provide significant advantages in oncological imaging and may further add to disease characterisation if combined in PET-CT.

Learning Objectives:

1. To understand the strengths of current CT technology in oncological imaging based on morphology.
2. To learn about the diagnostic value of CT beyond anatomical referencing.
3. To appreciate new technology such as dynamic perfusion imaging and Dual Energy CT as options to improve disease characterisation.

A-019 16:30

Tracers beyond FDG in daily routine

M. Beheshti; Linz/AT

The ability of positron emission tomography (PET) to study different biological processes opens up new windows for both researches and daily clinical use. Addition of computed tomography (CT) to PET improves detection efficiency and results in better localization of the lesions. The aim of this review is to consolidate knowledge of oncological applications of PET tracers other than [(18)F]fluoro-2-deoxy-D-glucose (FDG) in the daily clinical practice. FDG, as a non - specific tracer, has limited value in the assessment of different cancers such as prostate cancer, neuroendocrine tumours (NET), brain tumours, hepatocellular Carcinoma (HCC), and some types of breast cancers. Hence, due to high sensitivity of PET in performing non-invasive functional studies, further investigations and developments are warranted for defining specific PET radiotracers and their clinical applications regarding different tumour entities. Oncological non-FDG PET tracers can be generally categorized into 3 groups: those labeled with F-18, C-11 and other non-FDG tracers. Fluorine-18 and C-11 are labeled with different amino acids, substrates involved in fatty acid synthesis, protein synthesis, amino acid transport substrate and tracers linked to nucleic acid synthesis. These tracers are also labeled with specific ligands for receptor imaging. The other non-FDG radiotracers can be labeled with Ga-68, Cu-60, Cu-64, etc. and are suggested to use in detecting cell hypoxia, bone metabolism and receptor. Many of these have

Postgraduate Educational Programme

Thursday, March 3

14:00 - 15:30

Room B

Interactive Teaching Session

E³ 120

Commonly missed diagnosis in musculoskeletal conditions

A-022 14:00

Commonly missed diagnosis in musculoskeletal conditions

F. Kainberger¹, K. Bohndorf²; ¹Vienna/AT,

²Augsburg/DE (franz.kainberger@meduniwien.ac.at)



Many structures of the musculoskeletal system are prone to overuse and degeneration. Thus, stress-related injuries may mask the clinical appearance of many other entities. Documentation of the patient's history and the knowledge of certain laboratory findings are of enormous help to differentiate overuse syndromes and arthritis from tumours, infections, vascular diseases, or others. With standardised imaging protocols all relevant anatomic areas have to be included for documenting the effects of biomechanical stress, the symmetric manifestation of arthritis, the spread of tumours and infection, or trauma. The anatomic distribution of traumatic and stress-related injuries is influenced by "kinetic chains". Bone marrow or soft tissue oedema and many other imaging findings act as footprint patterns for the differential diagnosis. Likewise in inflammatory disorders, the distribution pattern is often characteristic for common and uncommon forms of rheumatic diseases or of infections. In tumours, the structure ("matrix") and their borders are important features. In conclusion, a standardised diagnostic process bases on the analysis of distinct clinical and anatomic patterns. It also includes the recognition of patterns of misinterpretation.

Learning Objectives:

1. To learn about the differential diagnosis between stress injuries, inflammatory processes, necrosis and tumours.
2. To recognise the consequences of insufficient consideration of clinical information and symptoms in the interpretation of imaging studies.
3. To recognise the consequences of inappropriate imaging requests.
4. To understand the importance of a systematic approach to the interpretation of imaging, particularly radiographs.

14:00 - 15:00

Room Z

The Beauty of Basic Knowledge:

Interpretation of the Chest Radiograph

MC 21A

Interpreting the chest radiograph: basic concepts

A-023 14:00

Interpreting the chest radiograph: basic concepts

J. Cáceres; Barcelona/ES (josecac@gmail.com)

All conventional radiology is based in the interplay of four basic densities: air, fat, soft tissues and calcium. The chest radiograph is an excellent method for detecting pulmonary abnormalities: we see the process because of the superposition of a soft tissue density on the air density of the lung. The silhouette sign can be rephrased as: to detect a lesion in conventional radiography, its density should be different from that of the surrounding tissues. The modern approach to conventional chest radiograph aims to detect the presence of abnormalities and to decide if additional procedures are necessary.

Learning Objectives:

1. To review the significance of radiographic densities.
2. To evaluate the role of the chest radiograph in the detection of diseases.
3. To understand the role of chest radiography as a filter for cross-sectional imaging.

16:00 - 17:30

Room B

Interactive Teaching Session

E³ 220a

Common radiological problems: incidental abdominal masses

A-024 16:00

A. The incidental adrenal mass

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

With the increasing use of abdominal cross-sectional imaging, incidental adrenal masses are being detected more often. The important clinical question is whether these lesions are benign adenomas or malignant primary or secondary masses. Benign adrenal masses such as lipid-rich adenomas, phaeochromocytomas, myelolipomas, adrenal cysts and adrenal haemorrhage have pathognomonic cross-sectional imaging appearances. However, there remains a significant overlap between imaging features of some lipid-poor adenomas and malignant lesions. The nature of incidentally detected adrenal masses can be determined with a high degree of accuracy using computed tomography and magnetic resonance imaging alone. Positron emission tomography is also increasingly used in clinical practice in characterising incidentally detected lesions in patients with cancer. The performance of the established and new techniques in CT, MRI and to a lesser extent PET, that can be used to distinguish benign adenomas and malignant lesions of the adrenal gland will be reviewed.

Learning Objectives:

1. To appreciate the range of adrenal pathology that can present incidentally and recognise their imaging features.
2. To appreciate the need to characterise these lesions in the clinical context of the patient's management.
3. To become familiar with the specialised CT and MRI techniques required to establish the true nature of an incidentally detected indeterminate adrenal mass.

A-025 16:45

B. Renal mass

M. Prokop; Nijmegen/NL (M.Prokop@rad.umcn.nl)

With the increasing use of imaging, incidentally detected renal masses are very common. While masses detected by CT or MR usually can be properly classified, renal masses detected by ultrasound frequently require further workup. The following considerations determine the diagnostic workup: simple cysts are very common but may present atypically. Renal cell carcinomas may be cystic but usually display at least a small solid component. Renal cell carcinomas have a bad prognosis when metastasized but metastases hardly every develop before the tumour has reached 3 cm in diameter. Differentiation between solid tumours by imaging alone is exceedingly difficult, save for the identification of angiomyolipomas in adults. This course will discuss suitable diagnostic algorithms based on the initial presentation of the mass. Typical imaging findings of various benign and malignant renal masses will be presented. The role of the Bosniak classification will be illustrated. Newer developments such as a wait-and-see approach or primary biopsy for small solid renal masses will be discussed.

Learning Objectives:

1. To learn how to detect and characterise a renal mass.
2. To understand how to apply adequate protocols according to the clinical situation.

16:00 - 17:30

Room C

Interactive Teaching Session

E³ 220b

Lung cancer: what the radiologist must report

A-026 16:00

A. Staging

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

Definition of stage is essential for an accurate management of neoplastic patient. A recent review of NSCLC (non-small cell lung cancer) staging system has underlined limitations of the previously accepted classification. Staging system is based on the

assessment of disease extent. Non-invasive imaging modalities (CT and PET-CT) play a central role in this attempt and in providing indications for further invasive procedures. Radiologists should know what to report and how to perform a proper radiological work-up to define the correct stage in each patient. They should also be aware of the actual role of invasive modalities (transbronchial and transesophageal ultrasound, mediastinoscopy) in staging lung cancer.

Learning Objectives:

1. To learn about the new lung cancer staging system.
2. To understand the proper use of different imaging modalities and invasive procedures for staging lung cancer.
3. To understand the rationale of lung cancer staging.
4. To understand the value of diagnostic and invasive procedures (chest x-ray, CT and PET/CT) during lung cancer follow-up.
5. To learn diagnostic criteria and imaging pitfalls during the management of tumour recurrence and treatment complications.

A-027 16:45

B. Follow-up

N. Howarth; *Chêne-Bougeries/CH (nigel.howarth@grangettes.ch)*

Carcinoma of the lung is one of the most frequent neoplasms in the Western world. Most radiologists know how to diagnose lung cancer. With advances in imaging technology and treatment options, it is essential to know how to evaluate response to treatment and complications. In treated patients, signs of recurrence should be distinguished from undercurrent diseases and post-radiotherapy changes. The value of diagnostic (chest x-ray, CT and PET/CT) and invasive procedures (bronchoscopy, radiofrequency ablation) will be discussed. Integrated PET/CT imaging has an established role in the management of cancer patients and is now recommended for all patients with curative non-small cell lung cancer. PET/CT provides information essential for staging and prognosis, for choice of management and monitoring of treatment and for the detection of recurrence. Radiologists should understand important aspects of molecular imaging to improve their contribution to patient management. Imaging pitfalls must be recognised to avoid both false-positive and false-negative interpretation. Specific examples will be discussed to demonstrate how the combined information of images of human anatomy upon which biological information within body structures is added improves delineation of disease, can guide surgical and radiation planning and biopsy, help in the management of tumour recurrence and of treatment complications. The need for close collaboration with nuclear medicine specialists will be promoted.

Learning Objectives:

1. To learn about the new lung cancer staging system.
2. To understand the proper use of different imaging modalities and invasive procedures for staging lung cancer.
3. To understand the rationale of lung cancer staging.
4. To understand the value of diagnostic and invasive procedures (chest x-ray, CT and PET/CT) during lung cancer follow-up.
5. To learn diagnostic criteria and imaging pitfalls during the management of tumour recurrence and treatment complications.

16:00 - 17:30

Room D1

KISS (Keep It Simple and Straightforward): Musculoskeletal MRI

CC 216

The hand and wrist

Moderator:

R. Schmitt; *Bad Neustadt a. d. Saale/DE*

A-028 16:00

A. How I do it

J.-L. Drapé; *Paris/FR (jean-luc.drape@cch.aphp.fr)*

MRI of hand and wrist require some specificities: high spatial resolution, perfect immobility, and homogeneous fat suppression. These goals are reached with: phased array dedicated wrist coil, extended arm upon the head close to the center of the magnet, firm contention devices, avoid obliquity of the wrist (magic angle phenomenon) and small field of views (FOV) with high spatial resolution and short acquisition times. In case of "mysterious" painful wrist a first axial STIR or T2 FSE FS sequence ("bone scan" sequence) is compared with an axial FSE T1 sequence to assess both soft tissues and bones. A coronal 3D PD FS may be added to assess ligaments and cartilage. Intravenous injection of gadolinium is not mandatory but is often helpful for mechanical pathologies. The three planes may be systemati-

cally acquired. Some indications need to modify the protocol. Wrist ligaments: MR arthrography with very thin 3D slices, tendon ruptures: retractions may be extensive and require two successive coil positioning, synovial cyst: thin 3D sagittal T2-wi FS to depict tiny pedicles, Kienböck disease: intravenous gadolinium injection in coronal and sagittal planes (subtraction may be helpful), carpal tunnel syndrome: double obliquity slices along the median nerve, dynamic studies to detect tendon instability (pronosupination or metacarpophalangeal joint flexion), rheumatoid arthritis: T1 FS sequences with gadolinium to assess polysynovitis, eventually MR angiography and bilateral study, finger pathologies: dedicated microcoil with small FOV (up to 2 cm) if the abnormalities remain focal.

Learning Objectives:

1. To understand the influences of patient positioning, scan parameters and magnet/coil technology on image quality.
2. To learn how to optimise scan protocols to maximise patient throughput without compromising diagnostic quality.
3. To recognise how and when to modify scan protocols to answer specific clinical questions.

A-029 16:25

B. Normal variants and pitfalls

J. Hodler; *Zurich/CH*

The wrist and hand are characterised by variability of bones, fibrocartilage, ligaments, muscles and neurovascular structures. Coalitions (most commonly lunotriquetral, prevalence of 0.1%), ulnar impaction positive variance of the ulna, carpe bossu and an accessory medial lunate facet associated with osteoarthritis are typical variants of bone. The triangular fibrocartilage complex (TFCC) and the interosseous ligaments often present with small defects. Radial TFCC defects are present in 64% of symptomatic but also in 46% asymptomatic wrists. In addition, their prevalence increases with age, apparently without increasing symptoms. Accessory muscles are common and may clinically mimic a neoplasm. Disease may also be mimicked by imaging artifacts. Magic angle effects cause increased tendon signal and may thus lead to the incorrect diagnosis of tendinopathy. The lunate appears to be more dorsally tilted on sagittal MR images than on standard radiographs (radiolunate angle $\sim 20^\circ$ larger on MR images). This value increases to $\sim 37^\circ$ if the wrist is positioned in ulnar deviated as is commonly the case when the wrist is examined in the "superman position", with the arm above the head. Magic angle artefacts are commonly encountered in the wrist. The extensor and flexor pollicis longus are especially prone to such artefacts, due to their oblique course approaching the critical 55° with regard to the B_0 field. In conclusion, variability is rather the rule than the exception in the hand and wrist. Only part of the findings have clinical meaning. Technical aspects add another dimension of variability.

Learning Objectives:

1. To become familiar with the normal anatomy.
2. To be able to identify normal variants.
3. To appreciate the range of pitfalls that may simulate pathology.

A-030 16:50

C. Identifying and reporting abnormal findings

L. Cerezal; *Santander/ES (lcerezal@gmail.com)*

Wrist pain and dysfunction are common disabling complaints that may be caused by a broad spectrum of disorders. These injuries may be the result of a single incident, such falling on an outstretched hand, or the result of repeated overuse, especially ongoing athletic or occupational activities. Diagnosis and management of wrist disorders represent one of the most clinically challenging processes. Clinically, they are usually nonspecific, and similar findings can be found among the different pathologic conditions in the wrist, so accurate diagnosis is a key element for successful treatment plan. Outcome may be improved by timely implementation of various treatment options. Recent advances in diagnostic imaging have improved our ability to establish a noninvasive anatomic diagnosis. In this presentation, we review MR imaging findings of the most common injuries of the wrist, with special emphasis on key findings for an accurate diagnosis and its differential diagnosis. Finally, we will review the proper terminology to describe pathological findings and how to structure a radiological report clearly and concisely allowing efficient communication with clinicians.

Learning Objectives:

1. To review the imaging appearances of common abnormalities.
2. To understand the use of terminology to describe pathological findings.
3. To learn how to structure a radiological report to ensure clarity and brevity.

16:00 - 17:30

Room D2

Interventional Radiology

RC 209

The trauma patient

Moderator:

A. Nicholson; Leeds/UK

A-031 16:00

Chairman's introduction

A. Nicholson; Leeds/UK (tonynick@tonynick.karoo.co.uk)

In this session we would like to explore the patient journey from accident to the emergency room and onto definitive imaging and intervention either by surgery or by image guided. Outcomes will be considered and the evidence presented. By the end of the session delegates will have a better understanding of team working, imaging organisation and appropriateness of intervention.

A-032 16:05

A. Imaging modalities and logistics

J. Ferda; Plzen/CZ (ferda@fnplzen.cz)

The imaging of the trauma stratifies the severity and the treatment strategy. The leading modalities in low-energy trauma are x-ray and ultrasound. The different approach has to be used in high-energy trauma - the silent life-threatening injury must be actively searched. Although the first examination on the site of the accident could estimate whether the severe trauma is present, the imaging must confirm or exclude it. Besides fast transport to the trauma centre has the extraordinary impact on survival the diagnostic algorithm. The installation of CT, ultrasound and x-ray directly within the emergency department is extremely important for the trauma management. If the focused assessment sonography for trauma (FAST) is replaced by whole body CT, the life-threatening injury is detected at fastest. Protocol includes imaging of non-enhanced CT head and cervical spine followed by the contrast-enhanced CT of the entire thorax, abdomen and pelvis, in cases of lower extremities trauma covering whole body. CT could be performed also under resuscitation, because whole imaging takes about three to five minutes. Following findings listed recently according to their impact on survival must be confirmed or excluded: intracranial injury, cervical spine trauma, aortic injury, overpressure pneumothorax, severe bleeding in the abdominal cavity, organs injury, peripheral vascular trauma, bone trauma; the trauma team including anaesthesiologist, surgeon and radiologist discusses the findings and plans of the treatment.

Learning Objectives:

1. To understand appropriate triage of trauma patients to imaging.
2. To learn the appropriate imaging techniques.
3. To review imaging appearances.

A-033 16:28

B. Management of arterial trauma

M. Katoh; Homburg/DE (marcus.katoh@uks.eu)

Over the last two decades, spiral-CT has become a highly reliable imaging modality to diagnose haemorrhage in trauma, while the role of catheter angiography has changed from a diagnostic to a therapeutic modality. Traumatic injuries of the heart and aorta lead to sudden death occurring at the accident site, whereas uncontrollable haemorrhage from larger arteries and parenchymal organs is the most frequent cause of mortality during the first 4 h following severe trauma. In patients with ruptured aorta or major arteries, stenting and temporary balloon occlusion may contribute to saving lives, while transcatheter embolisation may prevent exsanguination in haemorrhage from visceral organs, arteriovenous fistulas, and secondary onset haemorrhage. However, a haemodynamically stable patient is a prerequisite for all angiographic interventions. Definite haemostasis using the above-mentioned techniques can be obtained in 80-100% (major and periphery arteries) and 82-100% (visceral organs), respectively. Possible complications following angiographic haemostatic interventions depend very much on the treated vessel bed but are, in general, as low as 5%.

Learning Objectives:

1. To understand potential treatment options and when to treat and when not to treat.
2. To learn about the different embolisations and other interventional treatment techniques.
3. To review results and possible complications.

A-034 16:51

C. Solid organ trauma

J. Cazejust; Paris/FR (julien.cazejust@sat.aphp.fr)

In abdominal trauma, spleen and liver are the most frequently affected organs. Initial FAST-US is especially dedicated to patient with haemodynamic instability, in which the presence of a massive haemoperitoneum prompts for surgery without any further examination. In other cases, the management of the patient is more and more conservative, associating supportive care and interventional radiology, while surgery is seldom performed. The severity of the injury is best assessed by multidetector CT, which can only be performed in a patient with controlled haemodynamic parameters. MDCT protocol should adapt to the purposes: thin slices allow multiplanar reconstruction, iodine injection provides detection of bleeding, as well as road mapping when intervention is necessary. Arterial phase is mandatory, although bleeding can sometimes be more conspicuous on portal venous phase. Hepatic or splenic lesions range from simple contusion or minor laceration to organ fracture (linear lesion > 3 cm), vascular avulsion or complete devascularisation, according to the AAST classification. The optimal patient selection for angiography and embolisation is still matter of debate. However, intervention might be necessary shortly after CT when active bleeding is seen in a haemodynamically unstable patient; or in case of any vascular lesion (post-traumatic false aneurysm or arteriovenous fistula). Many different types of embolic materials are available (temporary material such as gelfoam pledget or permanent material such as coils, particles, occlusion device, glue or onyx). In all cases, a close follow-up is necessary, as well as multidisciplinary concertation with regard to potential recurrence.

Learning Objectives:

1. To review causes and imaging appearances of solid organ trauma.
2. To review various IR methods of treatment.
3. To review results and appropriate follow-up strategies.

Panel discussion:

Do we need IR in the ER? 17:14

Does it make sense to have a level one trauma centre without IR on call day and night and an interventional angio suite in close relation to the emergency rooms? What is the optimal size of population as basis for a trauma centre? When is IR the first choice in the trauma patient and what are the most important limitations of emergency IR in the trauma patient?

16:00 - 17:30

Room E1

Special Focus Session

SF 2

Child abuse: right images, right behaviour, right words

Moderator:

M.I. Argyropoulou; Ioannina/GR

A-035 16:00

Chairman's introduction

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

Imaging is important in the diagnostic approach of child abuse. Its role is to identify lesions typical of child abuse, to date and to evaluate the extent of injury and to elucidate imaging findings mimicking non-accidental trauma. Skeletal injuries such as classic metaphyseal lesions, posterior rib fractures, spinous process, scapular and sternal fractures represent a strong radiologic indicator of abuse. Radiographic skeletal survey, using high detail preferentially digital imaging systems represent an important part of the diagnostic work up of these patients. Bone scintigraphy, CT and MRI may offer additional valuable information. Central nervous system injuries are life threatening and represent the principle cause of fatalities of the abused child. Subdural haemorrhagic collections of different ages, retinal haemorrhage, subarachnoid haemorrhage, cortical contusion, hypoxic ischaemic injury and diffuse axonal injury represent lesions that may be found in the context of child abuse. The imaging modalities that are useful to detect these lesions are CT and MRI. In the radiologic report all abnormalities should be described separately and in detail and the differential diagnosis should be given. But how far the radiologist can go, in suggesting the diagnosis of abuse? The radiologic report is a document that can be used in the court. How the radiologist's testimony should be prepared for the court?

Session Objectives:

1. To learn about current imaging practices in the evaluation of suspected child abuse.
2. To learn about imaging changes which permit a firm diagnosis of child abuse.
3. To become familiar how to construct a comprehensive report providing evidence of child abuse.

A-036 16:05

How to image and detect patterns of skeletal injury indicating child abuse

P.K. Kleinman; Boston, MA/US (Paul.Kleinman@childrens.harvard.edu)

In infants, skeletal injury may form the basis for the diagnosis of abuse. The first step is the acquisition of a skeletal survey utilising meticulous technique adhering to a rigorous imaging protocol. A proper interpretation is ensured when the radiologist is familiar with the various patterns of skeletal injury, their specificity for abuse and those entities which may simulate inflicted injury. Appreciation of the lesion morphology, the fundamental pathologic alterations and mechanism of injury are essential in assessing the significance of the findings and placing them in the clinical context. Dating fractures poses a significant challenge, but in most cases, injuries can be placed in a certain time frame, especially if a follow-up skeletal survey is obtained. Although radiography forms the basis of skeletal imaging, ultrasound, CT, scintigraphy and MRI may clarify findings and optimise diagnosis and management. The radiology report must be constructed with care and the language should be crafted with the expectation that the radiologist may be called to testify in court, a daunting challenge in an often highly adversarial environment.

Learning Objectives:

1. To learn about the appropriate imaging protocols and quality for skeletal survey in suspected child abuse.
2. To learn about patterns of skeletal injury typical of child abuse.
3. To become familiar with findings that point to alternative diagnoses.

A-037 16:28

Imaging strategies to fully determine intracranial injury resulting from child abuse

C. Adamsbaum, C. Rey-Salmon; Paris/FR (c.adamsbaum@svp.ap-hop-paris.fr)

Radiologists play a key role in the early diagnosis of abusive head trauma (AHT). Symptoms are various and may range from coma to asymptomatic children. Changing elements of the history provided previous injuries, bruising in non-ambulatory children and delay in seeking care raise a high index of suspicion. The most common finding in AHT is of multifocal subdural haematomas over the cerebral hemispheres, the convexity, the posterior interhemispheric fissure and the posterior fossa. The haematomas are often associated with hypoxic-ischaemic injury and retinal haemorrhages. CT is the first diagnostic examination to be used for patients with acute injury. It can reveal intracranial haemorrhage, fracture and soft tissue swelling with a high degree of sensitivity. CT should be repeated after a time interval if the findings are doubtful or if there is a discrepancy with the neurological picture. MRI (including T1, T2, T2*, diffusion sequences and cervical spine examination) is required to fully determine intracranial injury as it can exquisitely demonstrate hypoxic-ischaemic injuries by showing areas of cytotoxic oedema. It is impossible to date precisely a haematoma whose pattern is influenced by numerous factors. However, the main point is to determine the presence of 'age-different' lesions. This not only provides a strong argument for the diagnosis but also suggest repetitive violence and thereby, a high risk for further injury unless protective action is undertaken. Brain imaging must be performed in all siblings younger than 2 years, living in the same conditions as the index case.

Learning Objectives:

1. To learn about imaging protocols designed to:
 - a) detect acute treatable conditions
 - b) depict fully and determine the timing of all injuries.
2. To become familiar with imaging findings that are highly suggestive of child abuse.
3. To learn about head trauma that may simulate child abuse.

A-038 16:51

What is the information required by any court and how the radiological reports should be phrased

S. Chapman; Birmingham/UK (stevechapman@doctors.org.uk)

This presentation will describe the role of a paediatric radiologist as an expert witness (as opposed to a witness to fact). The expert has an overriding duty to the court that takes precedence over any obligation from whom the expert has received instructions or by whom the expert is paid. Particular duties include advice that conforms

to current best practice, restriction of opinions to one's own expertise, expression of opinions that take into consideration all of the material facts, and the readiness to change that opinion if additional information becomes available. Any unusual, contradictory or inconsistent features of the case should be highlighted. The expert should highlight whether a proposition is a hypothesis (in particular a controversial hypothesis) or an opinion deduced in accordance with peer-reviewed technique, research and experience accepted as a consensus in the scientific community. He/she should indicate whether the opinion is provisional (or qualified), stating the qualification and the reason for it, and identify what further information is required to give an opinion without qualification. When there is a range of opinion on any question to be answered by the expert, (a) the range of opinion should be summarised, (b) highlight whether that range of opinion includes an 'unknown cause' (because of limited facts of the case or limited research/peer-reviewed publications), and (c) give reasons for the opinion expressed. Reprints of scientific publications will assist the court, but will also enable the attorneys to undertake a more robust cross examination!

Learning Objectives:

1. To learn about imaging findings in relation to whether or not abuse has occurred.
2. To understand in which cases the diagnosis of child abuse should be raised in the radiology report.
3. To become familiar with the terms that should be used when highly specific imaging indicators are identified in an otherwise normal infant.

Panel discussion:

The radiologist at the eye of the storm 17:14

Imaging plays a central role in the diagnosis of child abuse. Is there any risk of the radiologist having a detrimental impact on either the welfare of the patient or the judicial process by either under-diagnosing or over-diagnosing child abuse?

16:00 - 17:30

Room E2

State of the Art Symposium

SA 2

Ovarian cancer: update and what's next

Moderator:

R. Forstner; Salzburg/AT

A-039 16:00

Chairman's introduction

R. Forstner; Salzburg/AT (r.forstner@salk.at)

Ovarian cancer continues to be a challenge to radiologists and clinicians, as it is one of the most lethal female tumours. This is mainly due to its diagnosis in an advanced stage in the majority of patients. However, new developments can be observed: new insights in tumour biology, advances in imaging and new concepts of ovarian cancer treatment and surveillance. Furthermore, a multidisciplinary expert team approach has also substantially changed the management of patients with suspected ovarian cancer. The findings of radiology are becoming pivotal in a more individualised patient care. The role of radiology includes (a) characterisation of sonographically indeterminate adnexal masses, (b) staging as guidance for surgery and treatment planning (including identification of sites of non optimal resectability) in suspected ovarian cancer, (c) assessment of recurrent disease, and (d) in selected cases image-guided biopsy. In this session we provide an update on the aetiology and current concepts of treatment of ovarian cancer and on the contribution of radiology in characterisation and staging in patients with the working diagnosis of ovarian cancer. The panel discussion will focus on the role of radiology in multidisciplinary conferences in suspected ovarian cancer.

Session Objectives:

1. To learn about new concepts in etiology and treatment of ovarian cancer.
2. To become familiar with optimised imaging protocols to diagnose ovarian cancer.
3. To learn about the value of CT and PET/CT as a basis for treatment planning in ovarian cancer.
4. To appreciate the role of the radiologist in multidisciplinary consensus conferences.

A-040 16:05

Ovarian cancer: update and role of radiology

J.A. Spencer; Leeds/UK (johnspencer50@hotmail.com)

Ovarian cancer is known as the 'silent killer'. It is usually diagnosed late and most women have disease disseminated to the peritoneum (and/or pleura) at presentation. Standard treatment comprises cytoreductive surgery followed by platinum-based chemotherapy. An alternative is neoadjuvant chemotherapy followed by interval debulking surgery (IDS) then completion chemotherapy. Data from the EORTC 55971 trial show this to be as effective as the standard of care. There are strong genetic predispositions to ovarian, fallopian tube and primary peritoneal cancers. There is linkage with breast cancer in women with BRCA gene mutations and with colon cancer with the HNPCC gene. Ongoing trials are screening women in the general population and at high risk of the disease. These use the serum tumour marker CA125 followed by US as screening tools. MR imaging is an effective tool to assess sonographically indeterminate adnexal masses and offers an earlier diagnosis of cancer than interval reassessment with US. CT is the most commonly used modality for assessment of disease extent prior to surgery. Image-guided biopsy is necessary prior to starting neoadjuvant chemotherapy. The EORTC 55955 and MRC (UK) OV05 trials of women with treated ovarian cancer have shown no outcome advantage for women treated early at 'CA125 relapse' of disease versus later with clinical or CT evidence of relapse. This questions the role of CA125 in follow-up and argues against investigation of the 'CA125 +ve, CT -ve' woman with more expensive and scarce imaging resources such as CT-PET and DCEMR.

Learning Objectives:

1. To become familiar with clinical features of ovarian cancer.
2. To learn about the etiology of ovarian cancer, including genetic predisposition and the current research into screening.
3. To become familiar with new concepts of treatment ovarian cancer and surveillance of the treated patient and their impact for the use and choice of imaging modalities.

A-041 16:28

Imaging of adnexal masses: is it feasible to diagnose ovarian cancer?

I. Thomassin-Naggara; Paris/FR (isabelle.thomassin@tnn.aphp.fr)

Adnexal masses can be depicted by many imaging modalities (US, CT, MR and PET-FDG). However, the characterisation of adnexal tumours is mainly based on two techniques: US and MRI. For complex adnexal masses, MR imaging add to conventional criteria of malignancy common to all imaging modalities (bilaterality, tumour diameter larger than 4 cm, predominantly solid mass, cystic tumour with vegetations, and secondary malignant features, such as ascites, peritoneal involvement, and enlarged lymph nodes) specific features based on the characterisation of the solid tissue (including vegetation, thickened irregular septa, and solid portion) of the adnexal tumour. Signal intensity of solid tissue on T2 sequence (fibrous tissue), perfusion (neoangiogenesis), and diffusion (cellularity) are combined to make a decision tree analysis. Low T2 signal, absence of high b1000 signal, and time intensity curve type 1 are predictive of benignity whereas high T2 signal and time intensity curve type 3 are predictive of malignancy. Combining common classical features and specific MR features for predicting malignancy, MR imaging has a high degree of accuracy (96%) for characterising complex adnexal tumours. This high diagnostic confidence rate may help young women wishing to preserve childbearing potential to opt for conservative surgery and avoid the systematic removal of benign complex adnexal masses in menopausal women.

Learning Objectives:

1. To understand the role of ultrasonography in assessing and managing complex adnexal lesions.
2. To learn how to optimise the MRI protocol and how to improve the characterisation of indeterminate complex adnexal masses.
3. To understand the added value of functional sequences (DCE MRI and DWI) in diagnosing adnexal masses.

A-042 16:51

Staging ovarian cancer: what technique is the best?

E. Sala; Cambridge/UK (es220@radiol.cam.ac.uk)

Although ovarian cancer is formally staged surgically, the FIGO committee encourages the use of imaging techniques to assess the important prognostic factors such as resectable disease and lymph node status. Therefore, cross-sectional imaging by means of CT, MRI and PET/CT plays a crucial role in staging, treatment selection and treatment planning in patients with ovarian cancer. CT is the modality of choice for staging ovarian carcinoma as it is a relatively quick, readily available whole body imaging technique and has a reported accuracy of 70-90%. CT plays

a crucial role in identifying patients with unresectable disease thus triaging them to neo-adjuvant chemotherapy rather than primary surgery. Accurate evaluation of CT images and a detailed reporting of the site, volume and extent of metastatic disease guide the surgeon to areas of disease they may be difficult to identify surgically leading to an optimal cytoreductive surgery. MRI is best reserved as a problem solving modality. Multiphase dynamic contrast-enhanced MRI and diffusion weighted MRI improve the evaluation of pelvic side wall invasion and detection of small peritoneal and serosal implants leading to higher staging accuracy compared to CT and standard multiplanar T2W sequences. The role of PET/CT in primary staging of ovarian carcinoma is controversial. However, PET/CT is the integrated functional/anatomical modality of choice in detecting relapse with its greatest utility in women with rising CA 125 levels and negative CT results. Furthermore, PET/CT can modify the assessment of the distribution of recurrent ovarian cancer, which may, in turn, alter patient management.

Learning Objectives:

1. To understand the role of CT in staging of ovarian cancer with emphasis on treatment selection and treatment planning.
2. To appreciate the added value of dynamic contrast-enhanced and diffusion-weighted MRI in staging ovarian cancer.
3. To understand the role of PET/CT in staging of primary ovarian cancer and detection of tumour recurrence.

Panel discussion:

The illustrated role of the radiologist in multidisciplinary consensus conferences 17:14

Multidisciplinary cancer conferences have become standard of care. They serve to optimise treatment and as educational forums. It is therefore important to know the role of the radiologist in this multidisciplinary setting for a patient with suspected ovarian cancer. What are the considerations for defining the individualised, appropriate treatment regimen in ovarian cancer? Furthermore, in which setting may radiology alter treatment by providing image-guided biopsy.

16:00 - 17:30

Room F1

Functional Imaging of Tumours: How to do it

MC 222

Basics you should know

Moderator:

J. Stoker; Amsterdam/NL

A-043 16:00

A. Tumour angiogenesis and perfusion parameters

D. Sahani; Boston, MA/US (dsahani@partners.org)

Angiogenesis is an essential process whereby tumours derive vascular supply from adjacent tissue to sustain tumour growth and metastatic spread. Newer targeted antiangiogenic therapies differ significantly from current therapies for cancer in that they their mechanism of action is not cytotoxic. The methods of dose selection are either invasive, such as biopsy and histology, or time consuming, such as tumour shrinkage and time to disease progression, both of which take months to assess and fraught with other limitations. Moreover, cancer is a very variable disease, which means that some patients will respond to a particular therapy while others will not. There is, therefore, a great need to establish surrogate markers for drug response that are both rapid and reliable, not only for clinical trials of new drugs but also to aid in the selection of optimal treatment for individual patients. Angiogenic vasculature is typically dilated, tortuous, disorganised and more permeable and the flow within tumours is spatially and temporally heterogeneous. Although microvessel density count has been established as a prognostic indicator for many cancers, it is invasive, has several other limitations and often impractical. On the other hand, imaging is non-invasive and can assess much larger volumes than can biopsies. Dynamic CT and MRI using a kinetic model can derive tumour vascular characteristics by capturing temporal changes in contrast enhancement reflecting the tumour vascular physiology. Various approaches for data acquisition and processing have been described with their inherent benefits and limitations.

Learning Objectives:

1. To understand the mechanism and triggers of tumour angiogenesis.
2. To know the physiological parameters of tissue microcirculation.
3. To understand the principles of dynamic contrast enhanced imaging.

A-044 16:30

B. Diffusion imaging

B. Taouli; New York, NY/US (bachir.taouli@mountsinai.org)

Diffusion-weighted MRI (DWI) is a promising technique in oncology. It can be used for in vivo quantification of the combined effects of capillary perfusion and diffusion. Using echoplanar imaging (EPI), DWI is possible with fast imaging times minimising the effect of gross physiologic motion from respiration and cardiac movement. In this lecture, we will discuss the acquisition, post-processing and quantification methods and results of DWI in abdominal and pelvic tumours. We will also review the mechanisms associated with diffusion changes in tumours. MRI-pathologic correlation will be shown. Finally, limitations and future directions of the technique will be reviewed.

Learning Objectives:

1. To understand the physical basis of diffusion.
2. To understand the basis of diffusion measurement with MRI.
3. To understand why diffusion imaging provides information on the structure and viability of solid tumours.

A-045 17:00

C. Metabolic imaging using PET/CT

G. Antoch; Düsseldorf/DE (antoch@med.uni-duesseldorf.de)

Diagnostic potentials - as well as limitations - associated with morphological cross-sectional imaging on the one hand and functional imaging on the other are increasingly well understood. It has become obvious that in many cases both kinds of imaging complement one another. Hence, hybrid PET/CT imaging must be considered one of the most promising new developments in medical imaging. However, some questions have to be raised and challenges have to be met to avoid overrating PET/CT in oncology. PET/CT with [¹⁸F]-2-fluoro-2-deoxy-D-glucose (FDG) as a radioactive tracer has been reported to be more accurate than either imaging modality alone and sometimes even more accurate than CT and PET read side by side. However, the clinically important question should rather be the following: Does this higher accuracy have an impact on patient management? Furthermore, some tumours do not have an increased glucose metabolism making them FDG-PET negative. The most recently launched line of PET/CT scanners combines high-definition PET with high-end multislice CT. These imaging systems not only provide a higher diagnostic accuracy based on detection of smaller lesions with CT and PET, but also offer integration of complex CT protocols into the PET/CT scan. These protocols include CT perfusion, three-dimensional CT image reconstruction or virtual fly-through. The aim of this talk is to give an overview concerning PET/CT in oncology. The mechanism of radionuclide uptake, different tracers, the indications of PET/CT in oncology and its accuracy will be addressed.

Learning Objectives:

1. To understand why uptake of the tracer provides information on the viability of solid tumours.
2. To learn whether PET/CT is able to give reliable quantitative information.
3. To know whether PET/CT is a valuable tool for tumour response to treatment.

16:00 - 17:30

Room F2

Breast

RC 202

Breast US

Moderator:

E. Azavedo; Stockholm/SE

A-046 16:00

A. The role of US in screening, diagnosis and staging of breast cancer

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

Breast ultrasound (US) is an invaluable adjunct to mammography and also the most frequent modality used for guidance in interventional procedures and in the evaluation of additional lesions seen in breast MRI. Its role as a diagnostic tool in breast cancer will center the discussion of this talk. US B-Mode's value as a screening technique has not been established, although new advances in sonography (volumetric ultrasound) will very possibly change this view. US signs have been validated throughout many published papers in the literature and are very helpful in order to decide the management of palpable and non-palpable lesions, their positive and negative predictive value being very high. After a diagnosis of invasive breast

cancer, US should be used in order to guide the biopsy of the probably malignant lesion and also in order to stage the disease, locally as well as in the axilla. Local staging should include the size of the lesion as well as the presence or absence of multifocal, multicentric or contralateral disease. US is also the technique of choice to determine the lymph node status of the patient. After a breast MRI is performed for a more accurate map of the disease's extension, second-look ultrasound is also very frequently used to evaluate all the additional lesions detected by breast MR, with a very high diagnostic yield.

Learning Objectives:

1. To review the efficacy of US in screening for breast cancer.
2. To appreciate the additional role of US in staging of breast cancer.
3. To review its accuracy in diagnosis of breast cancer with different clinical presentations.

A-047 16:30

B. The role of US in premalignant and benign lesions

I. Günhan-Bilgen; Izmir/TR (isilbilgen@hotmail.com)

The goal of breast US is to make a more specific diagnosis than can be made with clinical findings and mammography (MG) alone and to prevent as many unnecessary biopsies as possible and to find cancers missed by MG. In addition to its well known role of distinguishing cystic from solid masses, US can differentiate among types of normal tissues and characterise complex cysts and solid nodules. Benign solid nodules may have specific US findings such as pure and intensely hyperechoic texture, oval shape, parallel orientation, circumscribed margin and presence of a complete thin capsule. Also, the absence of any malignant finding is necessary. Specific benign diagnosis will be reviewed in the lecture. Premalignant breast lesions are atypical ductal hyperplasia (ADH), atypical lobular hyperplasia (ALH), lobular carcinoma in situ (LCIS), phylloides tumour, radial scar and juvenile papillomatosis. Specific premalignant diagnosis will be reviewed in the lecture. To increase US specificity, it is necessary to improve US technique by following US guidelines published by ACR. Use of dynamic procedures (movement of the breast, focal compression), Doppler US, compound imaging (in evaluation of margin and internal echotexture), tissue harmonic imaging (in visualisation of a lesion against a fatty background) and elastography (in differentiation of complicated cysts from solid nodules) are helpful if used appropriately. In addition to its role in the detection and characterisation of lesions, US is also used to guide interventional procedures, such as cyst aspiration, abscess drainage, biopsy and galactography.

Learning Objectives:

1. To learn the US features of benign and premalignant lesions.
2. To understand the role of US in the management of premalignant and benign lesions.
3. To learn how to avoid unnecessary biopsies.

A-048 17:00

C. New technologies in US

R. Salvador; Barcelona/ES (rafasalvador@telefonica.net)

The European and American guidelines include breast ultrasound in a restricted diagnostic scenario for breast cancer diagnosis. The fourth edition of the European guidelines (2006) reviewed in 2008 refers to US in only twice. ACR in its 2007 ACR Practice guideline reduces breast ultrasound examination to seven situations. Evaluation of the axilla and ultrasound as a screening tool on high risk women is considered an area of research. The progression of US makes guidelines become obsolete very fast. Its application still remains pending on the results of clinical trials. Image smoothing on sono-CT or multiple frequency transducers will produce images, eventually with more diagnostic information. Second tissue harmonics will produce sharper and more clear images. CAD systems, Doppler and contrast Doppler will help in diagnosis. 3D with the new software and automatic probes constitute a very promising work in progress. They will make a dramatic change in our workload. The radiologist will be released of performing the exam, to review the images in the workstation. Sonoelastography has evolved from the manual to the actual automatic shearwave. This system measures the transversal transmission of sound in biologic tissues. It is a new and promising technology, probably more objective and non-operator dependant, that is able to differentiate benign from malignant conditions. All of these systems will be reviewed and evaluated for its actual situation. The problem now is how to introduce new terms, new descriptors, and new technologies in the BI-RADS system, once clinical evidence is demonstrated.

Learning Objectives:

1. To understand the new technologies in breast US.
2. To appreciate advantages and disadvantages of these methods.
3. To understand the potential role of new technologies in breast imaging.

16:00 - 17:30

Room G/H

Neuro

RC 211

Introduction to the brain

Moderator:

T. Stosic-Opinca; Belgrade/RS

A-049 16:00

A. Brain anatomy made easy

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

The anatomy of the brain is often perceived as being complicated. Especially the cortex is seen as an irregular arrangement of variable structures, which are difficult to differentiate and to identify. We will review the overall subdivision of the brain into lobes and describe their boundaries and their major gyri and sulci. We will then describe the location of specific functions. 1. Primary sensorimotor cortex: motor is located in the precentral gyrus, sensory in the postcentral gyrus around the central sulcus (CS), hence the importance of always correctly identifying the CS. We will present 4 interlocked methods to identify the CS in the axial plane (a) knob, (b) lateral axial, (c) medial axial, (d) gyral/cortical thickness and 3 to identify it in the sagittal plane (a) lateral sagittal, (b) hook, (c) medial sagittal. 2. Primary auditory cortex (A1): centred at the postero-medial part of Heschl's gyrus (HG), we will present simple landmarks in each of the 3 planes: (a) axial: adhaesio interthalamica, (b) sagittal: omega/heart shape of HG, (c) coronal: omega shape of HG. 3. Primary visual cortex (V1): Centred on the calcarine sulcus, we will discuss the characteristic shape that allows the identification of this structure in all 3 planes. At the end of this lecture, you will know the subdivision of the cortex; the methods and landmarks necessary to identify the primary sensorimotor, speech, auditory, and visual areas.

Learning Objectives:

1. To recapitulate basic brain anatomy.
2. To be able to correlate different anatomic locations to CT and MR images.
3. To consolidate knowledge of the important landmarks for anatomic structures on images.

A-050 16:30

B. Pattern recognition and normal variants to know

M.M. Thurnher; Vienna/AT (majda.thurnher@meduniwien.ac.at)

Magnetic resonance imaging (MRI) has undergone a rapid development in the last decade with numerous new techniques. Nevertheless, pattern recognition of brain lesions based on signal intensities on conventional MR sequences (T1- and T2-weighted, FLAIR) is the first step in diagnostic "work up". Good examples for pattern recognition are lesions with T1-shortening ("bright" on T1WI) such as: fat containing lesions (lipoma), melanoma, lesions with colloid content, calcifications, and haemorrhagic metastatic lesions. T2-shortening ("dark" on T2WI) in enhancing lesions is suggestive of lymphoma and certain infections (tuberculosis, fungal abscesses). Flow void (absence of signal) reflects high velocity flowing blood or CSF, and will help in diagnosing vessel abnormalities and related pathologies. The purpose of this lecture is to refresh knowledge on patterns and normal variants useful for clinical practice. A simplified "pipeline" consisting of easy consecutive steps will be introduced.

Learning Objectives:

1. To learn important normal variants of different structures and lesions in the brain.
2. To learn about recognition patterns that might be helpful in suggesting the most likely etiology of common brain lesions.
3. To consolidate the key imaging findings in different types of lesions and normal variants.

A-051 17:00

C. Clinical symptoms correlated to brain anatomy

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

Diagnostic neuro-imaging heavily depends on a thorough understanding of brain anatomy in relation to the brain's function. Clinical neurological symptoms and deficits not only give us an indication of the brain area(s) involved but may also direct us towards the use of specific imaging techniques, such as diffusion tensor imaging and tractography, as well as functional magnetic resonance imaging (fMRI). Specific imaging findings, on the other hand, may direct clinical management in a neurologically intact patient, such as the decision to resect a brain tumour in or near an eloquent brain area. Again, specific imaging techniques may be used

to gain additional functional information. Functional imaging techniques such as diffusion tensor imaging and tractography as well as fMRI are increasingly used and relied on in clinical practice. With diffusion tensor imaging and tractography the location, course and integrity of the major white matter tracts can be depicted, while with fMRI the brain's cortical function is visualised. Despite major technical advances, these techniques are still time consuming, labour intensive and have several limitations. They therefore need to be used and interpreted with care. The purpose of this lecture is to review the functional anatomy of the brain in a clinically relevant context and to illustrate when additional functional imaging techniques may be indicated. The most important eloquent brain areas are addressed and include the motor, visual and language systems.

Learning Objectives:

1. To learn classic neurological and other clinical symptoms in correlation to brain anatomy.
2. To understand which neurological/clinical symptoms the patient might have based on the imaging findings.
3. To consolidate which imaging techniques are the best to answer the clinical question based on the patient's clinical/neurological symptoms.

16:00 - 17:30

Room I/K

Cardiac

RC 203

Cardiac imaging: what's up Doc?

Moderator:

C. Peebles; Southampton/UK

A-052 16:00

A. 3 T cardiac imaging: twice as good?

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

Routine clinical cardiac MRI requires speed and efficiency as a result of physical motion. Consequently, the challenges and benefits of rapid MRI are nowhere more apparent than in the field of cardiovascular MR imaging. To meet these challenges, one must balance the competing constraints of signal-to-noise ratio (SNR), contrast-to-noise ratio (CNR), spatial resolution, temporal resolution, scan time, and image quality. One of the main determinants of SNR is the static magnetic field strength. Hence, cardiovascular MRI at 3.0 T or more holds the promise to overcome some of the SNR limitations and to extend the capabilities of cardiac MRI. All studies in cardiac MRI at higher field strength have proven the feasibility of cardiac MRI for the comprehensive assessment of cardiac morphology and function. The studies demonstrated a significant SNR increase, but also outlined image-quality problems associated with B₁-field inhomogeneities and specific absorption rate (SAR) constraints. With regard to acquisition speed, parallel imaging MRI capabilities form an important enabling factor, especially if enough SNR is available. Therefore, the combination of higher field strength and parallel imaging strategies may help to overcome several of the present limitations in cardiac MRI like cardiac perfusion and coronary artery imaging. The present indications, advantages and limitations of cardiac MRI at 3.0 T will be discussed.

Learning Objectives:

1. To learn the advantages of cardiac MR at 3 T.
2. To understand how to optimise protocols and reduce artefacts.
3. To be aware of areas that need improvement.

A-053 16:30

B. Cardiac CT: how low can dose go?

S. Leschka; St. Gallen/CH (sebastian.leschka@kssg.ch)

The risks associated with the exposure of ionising radiation has raised increasing concerns in the radiological community. The recent years have shown an overall increase in the use of CT for the imaging of the heart and the coronary arteries. The downside of this increased use of cardiac CT is the increase in the collective radiation dose with cardiac CT which have been reported to be associated with an effective radiation dose of 20 mSv or more. Increased awareness of the radiation dose with cardiac CT led to the development of several effective radiation dose reduction strategies including prospective ECG gating technique, anatomy and ECG-based tube current modulation, high pitch acquisition, and adaptation of the CT scanning parameters to the body habitus. However, the dose reduction strategies should be selected carefully on an individual patient basis in order to avoid serious image quality impairment by noise and artefacts. The lecture outlines the different radiation dose saving techniques currently used in clinical practice,

the required conditions in whom they may be successfully used, and how these techniques could be implemented in the daily clinical practice.

Learning Objectives:

1. To review the different dose reduction techniques used on cardiac CT.
2. To understand the clinical impact, if any, of dose reduction.
3. To recognise when the dose is too low and the noise too high.

A-054 17:00

C. Cardiac post-processing: latest tricks

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

Proper linking of the data acquisition to the patients ECG is among the crucial prerequisites for successful cardiac imaging. While cardiac CT data acquisition itself does not impose any effect on the patients' ECG, inherent physical effects in the MR environment does show impact on the ECG trace and may hamper proper R-peak delineation. In addition, patient-related factors such as arrhythmia might affect image quality (IQ). Dose saving strategies in cardiac CT limit the possibilities of retrospective IQ optimisation and as such more emphasis is recommended prior to data acquisition which is mainly related to patient selection/heart rate control. In cardiac MR a high amplitude ECG without influence of magnetic or scanning effects is of outmost importance. Arrhythmia also remains a challenge that might be overcome by arrhythmia-rejection algorithms or real-time imaging. Suboptimal contrast enhancement ought to be avoided by proper planning and timing as the majority of post-processing algorithms is based on signal behaviour. In the unfortunate situation of suboptimal contrast enhancement often only the use of standard post-processing tools is possible while semi-automated tools for cardiac post-processing may fail or necessitate substantial user interaction. The use of straight forward visualisation techniques is recommended for diagnosis while complex visualisation tools may add on confidentiality but are mainly suited for case presentations. Coronary evaluation is typically performed using centerline tools allowing for the easy assessment of CAD. While these tools potentially allow for estimation of the degree of diameter and area stenosis, accuracy though may still be limited.

Learning Objectives:

1. To learn how to reduce ECG trigger artefacts on CT and MR.
2. To learn how to compensate for suboptimal contrast enhancement.
3. To learn how to choose appropriate visualisation techniques.

16:00 - 17:30

Room L/M

Professional Challenges Session

PC 2

Radiology and nuclear medicine: really a joint venture

Moderators:

É. Breatnach; Dublin/IE
P. Bourquet; Rennes/FR

A-055 16:00

Chairmen's introduction

É. Breatnach¹, P. Bourquet²; ¹Dublin/IE, ²Rennes/FR (ebreatnach@mater.ie)

This is the second session between ESR and EANM at each Society's Annual Congress. Few would argue but that patient's interests are best served by cross-fertilisation and open communication between specialties. This is particularly true for radiology and nuclear medicine. This session elaborates on clinical scenarios where cross-fertilisation between both specialties is particularly important. The session will elaborate the radiologist and nuclear medicine perspectives on two common clinical scenarios, i.e. tumour response to therapy and evaluation of Alzheimer's disease.

Session Objectives:

1. To appreciate how nuclear medicine and radiology provide complementary information.
2. To learn how each method can enhance the mutual performance of the radiologist and nuclear medicine physician.
3. To learn about recent advances in the field of tumour evaluation and early detection of Alzheimer's disease.

A-056 16:05

Evaluation of tumour response to therapy: the role of radiology

M. O'Connell; Dublin/IE (oconnellm@mater.ie)

Evaluation of response to treatment allows an early assessment of tumour response typically after 2-4 cycles of chemotherapy. This evaluation is most commonly performed with PET/CT during therapy for high grade non-Hodgkin's lymphoma. This review presentation looks at the potential roles that CT, regional MRI and whole body MRI do and could play in response evaluation from a radiology perspective. The presenter is a radiologist who is clinical director of a medium volume PET/CT centre. The talk focuses on discrepancies between CT and PET findings in tumour response and on tumours or situations where CT is the primary modality to determine tumour response. Potential roles for whole body MRI in response evaluation and assessment of solid tumours by MRI are examined. At a general level, the role of the radiologist as part of the multidisciplinary oncology meeting (MDM), including when and where to use image-guided biopsy in response evaluation and the use of RECIST versus PRECIST criteria is discussed. The aim of the presentation is to outline the role of CT in tumour response evaluation in the era of PET/CT and to explore potential roles particularly for whole body MRI in tumour assessment. The presenter hopes to encourage radiologists to get fully involved in MDM discussions regarding CT, MRI and PET/CT evaluation.

Learning Objectives:

1. To learn the standard method (tumour measurements) for the evaluation of tumour response to treatment.
2. To understand the limits of international standard.
3. To become familiar with methods that provide functional or structural information, like perfusion CTMR or DW-MRI.

A-057 16:23

Evaluation of tumour response to therapy: the role of nuclear medicine

A. Chiti; Milan/IT (arturo.chiti@humanitas.it)

also
EPOS

The high costs and possible side effects of chemotherapy and radiation therapy treatments favour the use of effective ways to monitor the treatment efficacy in oncology. Molecular imaging demonstrated to be effective in evaluating the response after and during the course of therapy, in order to assess chemo-sensitivity and chemo-resistance of a particular neoplasm. The use of PET-CT in this setting can vary from very sophisticated and complex quantitative evaluation to simple qualitative analyses. In malignant lymphoma, international criteria for monitoring response to therapy have recently been revised, and FDG now plays a central role in defining tumour response. In a variety of solid tumours, studies have indicated that FDG PET-CT may provide early and accurate assessment of tumour response, suggesting that it could play a significant role in personalising the treatment of malignant tumours. Performed during and after therapy for HL and aggressive NHL, FDG PET results have a high prognostic value and correlate with survival. FDG PET has been incorporated into revised response criteria for aggressive lymphomas, and several ongoing trials are under way to investigate the value of treatment adaptation based on early FDG PET results for HL and aggressive NHL. Many technical aspects must be taken in consideration to avoid critical errors in evaluating response. From patient preparation to image acquisition a series of possible pitfalls must be avoided. In the clinical practice, the most widely used parameter is the SUV, which can improve the accuracy of qualitative image assessment in many clinical settings.

Learning Objectives:

1. To understand why PET-CT can be used to assess tumour viability.
2. To become familiar with the principles of signal quantification and to discuss its advantages and limits.
3. To learn about the incoming tracers that might enhance the role of PET-CT in the evaluation of tumour response.

A-058 16:41

Alzheimer's disease: the role of radiology

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

Neurobiological changes in Alzheimer's disease (AD) occur in an stereotypical pattern that begins in the medial temporal lobe (MTL) years before the clinical manifestation (brain reserve). Brain atrophy is a marker of neurodegeneration that reflects the neurobiological disorder and is correlated with the neuropsychological changes at all stages of the disease. Other imaging markers may reflect changes in microstructural (diffusion), functional (perfusion) or metabolic (MRS) domains that would provide additional information but are awaiting wider validation. In the early stages of AD, the most effective MRI markers are those that reveal atrophy in MTL, particularly the measures of the hippocampus. The MTL atrophy mea-

sure are helping to propose new diagnostic criteria for AD, allowing a diagnosis of probable AD in predementia stages, when memory loss criteria are attached to Imaging criteria (MRI or PET) or measures of amyloid/tau in CSF. The use of atrophy markers (global or MTL) increases the effectiveness in clinical trials (both by reducing the size of the sample and increasing the statistical power) and is therefore contributing significantly to the development of new treatments. The association of multiple markers of structural and functional imaging (MRI and PET) and the use of advanced computational analysis techniques will allow better management of AD but it needs a broader validation and know the most efficient combination of biomarkers at each stage of the disease, including the preclinical period.

Learning Objectives:

1. To become familiar with the early signs that enable the detection of Alzheimer's disease.
2. To understand the specific role of MRI and to learn the appropriate protocols.
3. To learn about the new developments in radiological detection of Alzheimer's disease.

A-059 16:59

Alzheimer's disease: the role of nuclear medicine

K. [Tatsch](#); Karlsruhe/DE (Klaus.Tatsch@klinikum-karlsruhe.de)

Scientists, researchers and clinicians all benefit from molecular imaging in dementia providing exciting new insights into their basic biology and pathophysiology. Targeting specific aspects of neurotransmission, metabolism, inflammation or plaque formation - just to mention some of the current molecular approaches - increasingly gains impact on establishing the correct diagnosis, following the course of dementia or developing CNS drugs. This talk will highlight the molecular targets and major PET and SPECT tracers for application in dementia, and will update on the results of the clinical imaging studies published in recent years. Typical imaging patterns of Alzheimer's disease (AD) will be discussed, including also the diagnostic discrimination from other types of neurodegenerative dementias such as frontotemporal dementias, Lewy body dementia, and others. Assessment of MCI patients and the probability of transition in manifest dementia (predominantly AD) will be addressed together with its prognostic relevance. Furthermore, recent advances in analysing tools which further improved the high diagnostic accuracy already reached by visual assessments will be presented. Even though in competition with other modalities, 'standard FDG' PET has shown to be a robust and both, sensitive and specific marker in the diagnostic work-up of dementia. FDG information will be markedly extended in clinical practice by specific amyloid imaging in the near future when these tracers are approved and thus generally available.

Learning Objectives:

1. To become familiar with the nuclear medicine method that enables detection and evaluation of Alzheimer's disease.
2. To learn about the potential development of functional studies using nuclear medicine.
3. To understand how nuclear medicine and radiology can provide complementary information.

Panel discussion:

The advantages of working together for nuclear medicine and radiology 17:17

16:00 - 17:30

Room N/O

Head and Neck

RC 208

An insight into middle ear pathologies

Moderator:

T.J. [Vogl](#); Frankfurt a. Main/DE

A-060 16:00

A. Normal anatomy and congenital malformations of the middle ear

C. [Czerny](#); Vienna/AT (christian.czerny@meduniwien.ac.at)

Imaging of the middle ear is either performed by CT and/or MRI. As the normal middle and external ear consists mostly of bony structures and air, CT in the bone-window-level setting is the method of choice to delineate the normal anatomic structures. Especially, high-resolution MDCT in bone-window-level setting excellently depicts even subtle normal as well as abnormal osseous structures. However, pathologic conditions are also well delineated such as those of inflammation or cholesteatoma. In this lecture, the normal anatomic structures of the external and middle ear will be explained and

shown on MDCT-images in the axial, coronal, and sagittal plane. Variants of the normal anatomy, which are important to describe and to know are also shown. Some of these variants are also delineated on MR images. In the second part of the lecture, the different expressions of congenital malformations of the external and middle ear will be explained. The different findings of the severity of the malformations will be shown and their importance for further clinical-therapeutical procedures will be explained.

Learning Objectives:

1. To review the normal anatomy of the external auditory canal and middle ear.
2. To become familiar with the most frequent malformations of the middle ear.
3. To learn about imaging protocols.

A-061 16:30

B. Cholesteatoma and chronic infection

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

Imaging investigation of cholesteatoma is required before surgery. If no surgery has been performed previously, CT will provide information about the location of the lesion (epi, pro, meso, retro, hypotympanum), the partial or total destruction of the ossicles, and possible extension to the inner ear. If there is no doubt about any of these factors CT is sufficient. In doubtful cases an MRI examination is performed to confirm or refute the presence of cholesteatoma using T1 sequences without IV contrast medium, and diffusion weighted imaging with or without high resolution T2, depending on the age of the patient. In postoperative recurrent cholesteatoma, MRI is becoming the modality of first choice for detecting cholesteatomas, appearing : low in signal on T1 sequences, high in signal on diffusion weighted imaging. However, care is required since performing diffusion weighted imaging without T1 may lead to false positives. A granuloma with a slightly or markedly increased T1 signal is often associated with a high signal on diffusion. Measurement of ADC is useful for detecting cholesteatomas, infected cholesteatomas or abscess. Finally whilst MRI is the first examination in the follow-up of postoperative patients, the use of contrast medium is not necessary in most of the cases.

Learning Objectives:

1. To learn about different causes of hearing loss within the external auditory canal and middle ear.
2. To learn about a template for a structured report.

A-062 17:00

C. Implants and postoperative findings in the middle ear

B. [Verbist](#); Leiden and Nijmegen/NL

Many conditions which affect the function of the middle ear may require surgical intervention. Postoperative imaging will be requested either to evaluate complete removal of diseases (eg in cholesteatoma) or because of new, persisting or recurrent complaints of the patient (e.g. vertigo after stapes replacement). In this presentation, different surgical procedures will be reviewed including the indications for a certain surgical approach as well as the different types of prosthesis. The normal postoperative imaging appearance of the most common surgical techniques will be shown. It will be discussed whether CT or MRI should be performed to answer the clinical questions. An overview of possible failures and complications will be given.

Learning Objectives:

1. To become familiar with typical implants.
2. To review expected and unexpected postoperative findings.
3. To learn about a template for a structured report.

16:00 - 17:30

Room P

Vascular

RC 215

Extracranial vascular malformations: imaging strategies prior to endovascular therapy

Moderator:

J.E. [Jackson](#); London/UK

A-063 16:00

Chairman's introduction

J.E. [Jackson](#); London/UK (james.jackson@imperial.nhs.uk)

The management of patients with vascular malformations is often suboptimal. The reasons for this are many but include confusion regarding classification, uncertainty about the most appropriate imaging of the various forms of malformation and a

poor understanding of the indications for intervention. This session will concentrate upon these important topics and will also address some technical aspects of endovascular therapy.

A-064 16:05

A. Pathology, correct anatomical classification and clinical work-up

H. Kubiena; Vienna/AT (harald.kubiena@meduniwien.ac.at)

Patients presenting with vascular malformations mostly are nomadic and hopeless individuals looking for help. Finally having reached a "multidisciplinary specialist-group" after a sometimes long and misleading trip throughout the ocean of "single-players" of different specialities these patients do not ask for any more diagnostics - they strongly claim for therapy. Vascular malformations are congenital lesions, although merely seen at birth they become evident throughout the individuals growth. These developmental errors can affect all components of the vascular tree in any area of the body. The therapeutic goal must be defined rather as "control" than "cure" of this disease. To make this point understandable for both patients and colleagues a fundamental understanding of the pathogenesis and natural course must be created. In special cases of complex vascular malformations the precise diagnosis and the information about all potential side-effects as well as risk-factors of progression enables these patients to manage their daily life. Therefore, indications for treatment vary depending on the specific type of slow flow or high flow lesion, location, pain, functional and cosmetic impairments and general side-effects of each particular lesion, since no single specialist has enough knowledge to diagnose or treat vascular anomalies beyond the border of his distinct speciality multidisciplinary working-groups emerged at these interdisciplinary interfaces. Their common language in classifying and their overall understanding of pathogenesis, prognosis offer these mostly hopeless patients a custom-fit treatment addressing their symptoms.

Learning Objectives:

1. To understand the pathology of capillary, venous, lymphovenous and arteriovenous malformations.
2. To understand the haemodynamics of vascular malformations.
3. To discuss the clinical symptoms and the indications for treatment.

A-065 16:28

B. Imaging of capillary, venous, lymphovenous and arteriovenous malformations

L. Schultze Kool; Nijmegen/NL (l.schultzekool@rad.umcn.nl)

Imaging of vascular malformations should be directed by clinical assessment of the type of malformation to be expected, clinical symptoms and need for treatment. In order to make the proper decision of the required imaging modality or treatment, it is essential that the (interventional) radiologist is a member of a dedicated vascular malformation team. Imaging needs to be tailored to the individual patient although general rules can be applied. Duplex ultrasound together with a clinical assessment is often sufficient to make a proper diagnosis. This is especially true for the paediatric population. If more information about the extent of the lesion is needed, MR is often used in case of low flow lesions (venous/lymphatic), and MRA or CTA in case of high flow lesions. Angiography is mandatory if an AVM is diagnosed and treatment is planned. High frame rate imaging and selective injections are the only options for a proper evaluation of the nidus architecture of the AVM. There are exceptions that warrant deviating from the above general rules. In this lecture, both the general rules and the exceptions will be discussed.

Learning Objectives:

1. To consolidate knowledge of the various imaging techniques including their potential for visualising the anatomy and haemodynamics.
2. To learn criteria for classification of vascular malformations.
3. To learn reporting standards for vascular malformations.

A-066 16:51

C. Technical aspects of endovascular treatment

P.C. Rowlands; Liverpool/UK (peter.rowlands@rlbuht.nhs.uk)

Vascular malformations are uncommon conditions with a wide spectrum of appearance and symptoms. Incorrect diagnosis and management is common. Best outcomes are obtained in centres with a high caseload and multidisciplinary management. The disciplines include interventional radiology, plastic surgery, dermatology, anaesthesiology, vascular surgery and others. Accurate diagnosis by clinical assessment and non-invasive imaging is key to procedural planning. Low flow and high flow lesions are managed very differently and are discussed separately below. Low flow lesions may be associated with symptoms varying from trivial to significantly affecting quality of life. Patients with lesions with mild

symptoms may require explanation and reassurance only. Lesions with a mainly cutaneous element may be treated with laser. Deeper lesions are usually treated with several episodes of sclerotherapy. Agents such as alcohol, polidocanol and STD will be discussed and the relative advantages and issues explained. Informed consent is vital, and the approach to this will be outlined. High flow lesions are frequently associated with severe cosmetic changes, invasion of surrounding tissues, haemorrhage, and high output cardiac failure. Lesions may be life threatening. In the extremities peripheral ischaemia and ulceration due to steal of blood by the arteriovenous malformation is common. Informed consent will again be discussed, as potential for major complications is high. Key to endovascular management of these lesions is an understanding of the nidus, arterial inflow and venous outflow. The role of liquid and solid embolic agents and specifics of transarterial, venous and direct approaches will be discussed.

Learning Objectives:

1. To learn the principles of endovascular treatment including sclerosing and embolisation materials and catheterisation techniques.
2. To discuss the hazards and complications of treatment.
3. To discuss the endpoints of treatment.

Panel discussion:

Who should decide management? 17:14

AVMs pose a major problem regarding classification and treatment. A case report discussed by the panellists demonstrates how these patients should be approached. The importance of establishing an interdisciplinary outpatient clinic is also presented. The most important organisational steps for providing an efficient clinical service are given. In addition, the most common pitfalls and complications of treatment are illustrated.

16:00 - 17:30

Room Q

Computer Applications

RC 205

Computer-aided detection/diagnosis

Moderator:

E. Pietka; Gliwice/PL

A-067 16:00

Chairman's introduction

E. Pietka; Gliwice/PL (epietka@polsl.pl)

Computer-aided detection/diagnosis (CAD) is recognised as a workstation or a system developed in order to assist the radiologists (clinicians) in performing their daily diagnostic tasks. Clinically implemented CADs are available at workstations and (if DICOM compliant) may serve as a plug-in to PACS. The three-layer CAD system includes: (1) image analysis procedures whose development requires a medical and technical knowledge, (2) a database module that is managed by experienced radiologists and IT professionals, and (3) graphical user interface (GUI) that enables a user-friendly access to the data, the processing tools, and the results. A modern CAD development involves a multidisciplinary team whose members are experts in medical and technical fields. A close collaboration of all experts is required at all stages of system life-cycle. At each stage the physicians knowledge and experience are indispensable. It includes medical analysis of the diagnostic problem, data collection, image analysis evaluation, and clinical verification. Design, testing, and evaluation have to be successful in order to ensure CAD implementation in a daily clinical routine. In this session three experts will share their experiences in the area of the overall CAD architecture, its evaluation, validation and acceptance by clinicians, advantages and restrictions of solutions and clinical implementation in lung, breast and colon cancer. Reading paradigm (primary, concurrent, second) in oncology as well as results of CAD clinical implementation will be presented. Perspectives in clinical CAD implementation in diagnosis and treatment will be discussed.

Session Objectives:

1. To understand what the radiologist should know about CAD.
2. To understand the role of the radiologists in CAD development.
3. To learn about the main challenges for CAD implementation.
4. To understand the impact on radiological practice.

A-068 16:05

A. The role of CAD in modern-day imaging

A. Todd-Pokropek; London/UK (A.Todd@ucl.ac.uk)

The use of CAD in medicine is an important and growing area of research. Firstly good data must be acquired including not just images but associated information. The first step in that of preprocessing, notably (but not only) noise reduction. The data are then passed onto the segmentation step. Often this step is semi-automatic requiring some manual intervention. Conventional edge detection methods are not often of value, but Active Shape and Appearance Models, the use of Markov Random Fields etc are commonly used. The next step is that of feature extraction both of shape and texture. These data are then submitted to one of several classifiers such as Artificial Neural Networks (including MTANNs) Support Vector Machines (SVM) and data reduction using Principle and Independent Component Analysis, and Multiple voting techniques such as ADABOOST are also of value. The output may simply be returned to the observer (clinician) or as further input for a decision support system. Examples considered will be in breast imaging (mammography), lung nodule detection, virtual colonoscopy and lumbar spine. The use of the CAD system as a simultaneous assistant or as a second reader is important. The use of CAD in therapy is of increasing importance. The assessment of such CAD system (evaluation and validation) is still controversial. The difficulty of bringing systems both instrumentation and software for use in clinical practice is often underestimated and there have been some notable failures. Some example of 'failures' will be given.

Learning Objectives:

1. To review several current CAD systems and architecture from a general point of view.
2. To understand the problems of evaluation, validation and acceptance by clinicians.
3. To learn about potential future applications such as assessment of therapy.
4. To become familiar with the potential implications of advances such as the Grid.

A-069 16:28

B. Emergence of open-source software

O. Ratib; Geneva/CH

In the recent years, open source software (OSS) has grown in numerous areas of software development including in highly specialised markets such as medical applications. This new paradigm in software development has proven to be cost effective and successful in many areas including medical imaging applications. It is particularly promising in advanced image display and analysis applications where the rapid increase in demand cannot be matched by traditional expensive commercial solutions. The evolution of radiology imaging modalities from 2D sectional acquisition to 3D volumetric acquisition and even higher dimensions with functional data and the emergence of multimodality scanners such as PET/CT scanners calls for new and innovative display and visualisation tools. By combining multiple new technologies and open-source projects it is possible to develop a new generation of high-performance 3D DICOM viewers that were traditionally only accessible on expensive 3D workstations restricting their use to specialist radiologists. An example of such open source project is the OSIRIX software for multimodality image analysis and processing. It provides the necessary tools for navigating and processing very large datasets of multimodality imaging. It can be implemented outside radiology departments and provide a solution for increasing needs and requirements of clinicians, surgeons and other specialists. Open source software platform can provide cost-effective framework for the development and wide distribution of advanced image processing and image analysis tools. It can ensure sustainability and large diffusion of specialised analysis tools that would otherwise be very difficult to distribute and maintain outside its original development lab.

Learning Objectives:

1. To learn about the advantages and restrictions of open-source solutions.
2. To understand how open-source solutions could be implemented.
3. To learn about specific open-source tools.
4. To understand the legal aspects of clinical applications of open-source software.

A-070 16:51

C. CAD in oncology: from principles to clinical implementation

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

CAD has been developed to help radiologists in detecting pathology. In the era of screening radiologists are asked to read a large amount of x-ray, CT and MRI examinations; readers fatigue increases the risk of interpretation errors; therefore, systems that help radiologists in detecting pathology are welcome. CAD is the natural solution; however, is it ready to be used in the clinical and especially in the screening setting? How it works? CAD uses algorithms that identify specific shapes and densities into a DICOM image. The CAD compares this features with an internal database and through a learning curve reach a decision and marks the pathological findings. Which are the oncological applications of CAD. Three fields actually seems to be well established and promising: detection of polyps in CT colonography, breast lesions in x-ray mammography, and nodules in CT of the lungs. These 3 oncological applications of CAD will be discussed in the presentation.

Learning Objectives:

1. To review the principles of current CAD systems in the detection of lung, breast and colon cancer.
2. To understand the reading paradigm (primary, concurrent, second) in oncologic applications of CAD.
3. To understand the results of CAD clinical implementation.
4. To learn about future perspectives of CAD in oncology (which other applications?).

Panel discussion:

The take-home points 17:14

1. Modern CAD system architecture
2. Open source solutions: advantages and restrictions
3. CAD clinical implementation
4. Future perspectives of CAD

18:30 - 18:50

Room A

Plenary Session

OL

Opening Lecture

Presiding:

Y. Menu; Paris/FR

A-071 18:30

Water: radiologists' best friend?

D. Le Bihan; Gif-sur-Yvette/FR (denis.lebihan@gmail.com)

At the onset of the 21st century humankind is focusing its attention on a very small molecule, as controlling CO₂ in the atmosphere is becoming a major goal, economically, socially and politically. Yet, there is another small molecule which is going to play a more prominent role in the near future. H₂O, especially in its liquid form, the 'Blue Gold', is just indispensable to our lives. Water makes 60 to 70% of the human body weight and is crucial to the working of the biological machinery. Still, how such a tiny molecule with its 105° 'magic' angle could have been at the origin of life remains largely a mystery. Different organisms have adopted different strategies in the way they get the most out of water, depending on their environment, and water contributes to the biodiversity. Faulty mechanisms in the use of water by tissues may lead to severe diseases or death. Clearly, water deserves to be seen as the prime 'biological molecule', and radiologists have long recognised its importance from the days of 'dry' (bone and air) radiology to the advent of CT which allowed contrast from 'wet' tissues to be explored. With MRI one went one step further, as magnetisation of water is the sole source of contrast. Life has led to intelligence, and recent MRI studies have suggested that water may also actively contribute to the mechanisms underlying brain function. Could the 'molecule of life' also be the 'molecule of the mind'? Clearly, water must be radiologists' best friend.

Learning Objectives:

1. To comprehend how the structure of the water molecule makes it important to life.
2. To understand the importance of water in biological and cellular processes.
3. To become familiar with the different ways water is responsible for image contrast in radiology.

Friday, March 4

08:30 - 10:00

Room A

State of the Art Symposium

SA 3

The 3 P's of CT colonography: polyps, protocols and politics

Moderator:

S. Halligan; London/UK

A-072 08:30

Chairman's introduction

S. Halligan; London/UK (s.halligan@ucl.ac.uk)

Now that the diagnostic performance of CT colonography has been well-established, this state-of-the-art symposium will deal with issues related to the implementation of CT colonography in day to day clinical practice. The lecturers will deal with the diagnostic performance of CT colonography, the technical requirements necessary to obtain high quality diagnostic data, the factors that underpin a high-quality service (including reader training), how implementation differs across different countries, and the possible impact of new developments, including computer-assisted detection (CAD).

Session Objectives:

1. To review current technical prerequisites for acquisition of high-quality CTC data and its visualisation.
2. To learn about political and turf-battle issues surrounding implementation of CTC technology.
3. To recognise the characteristics of a high-quality service, both for patients and doctors.
4. To understand the benefit of CAD assistance for data interpretation.

A-073 08:33

CT colonography in 2011: how far has it come

P. Lefere; Roeselare/BE (radiologie@skynet.be)

Two decades ago spiral CT technology initiated a new era in diagnostic imaging with virtual colonoscopy or CT colonography (CTC) as a major innovation. Introduced by David Vining in 1994, CTC was rapidly endorsed as a potential tool for colorectal cancer screening. After an initial pioneering period defining the basic CTC principles, the advent of multi-slice CT significantly improved spatial and temporal resolution, allowing for isotropic image reconstruction with detailed 3D rendering of the colonic wall and very short acquisition times, reducing motion artefacts. Furthermore, application and refinement of (ultra-) low dose technique almost completely tackled the issue of radiation dose. These improvements have resulted in the perfect optical colonoscopy imitator with reliable fly through of the colon in a timely manner. Consecutively, the primary 3D reading paradigm with 2D problem-solving is getting more and more adept, although in experienced hands primary 2D-read with 3D-problem solving is a solid contender. To improve depiction of the colonic wall new 3D visualisation methods were developed. These technical improvements with the application of state-of-the-art CTC technique have resulted in a very good performance of polyp detection. In three multi-centre studies, totalising 3775 patients, sensitivity ranged between 78-91% and 90-92% and specificity between 84-93% and 84-98% for lesions > 6 mm and > 10 mm, respectively. Finally, it may be expected that further refinements of CAD, laxative-free CTC with electronic cleansing and dual energy CT will bring CTC to the next level and will enhance it as the reliable and cost-effective tool for colorectal cancer screening.

Learning Objectives:

1. To review the evolution of CT colonography since its introduction, with a focus on data acquisition and methods of data visualisation and interpretation.
2. To review the currently achievable test characteristics of CTC (sensitivity, specificity, accuracy) via reference to current trial data.
3. To become familiar with imminent developments that may further enhance CTC test characteristics.

A-074 08:51

Current status of reimbursement

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

Current status of reimbursement for CT colonography (CTC) is extremely heterogeneous, both within and outside Europe. In the US, in 2009, the Centers for Medicare and Medicaid Services denied coverage for CTC for colorectal cancer

(CRC) screening. The reason was that the data from the major multicenter trials showing benefits in CRC screening by the use of CTC are not applicable to the average Medicare population because of the differences in age; and the older the age the larger the number of polyps with a consequent increase in colonoscopy referral, leading to exam duplication. This is the same policy of almost all the private contractors in the US as well as the European countries, where both private and public payers are not covering CTC for CRC screening. Reason is that even optical colonoscopy is not considered a screening test in Europe, where authorities recommend the use of faecal occult blood test (FOBT). In some European countries, for example in Italy, CTC is integrated into mass screening projects performed with FOBT as a substitute of barium oenema in the case of incomplete optical colonoscopy performed in individuals with a positive FOBT. The situation is different for other clinical conditions and, in particular, for those patients with a previous incomplete optical colonoscopy, due to obstructing neoplasm, aberrant anatomy, previous surgery, etc., where CTC is fully reimbursed. And the same occurs in most countries when there is an absolute contraindication to invasive colonoscopy or preoperative cancer staging and localisation is needed.

Learning Objectives:

1. To become familiar with differences in reimbursement for CTC within and outside Europe, and to detail how this differs for symptomatic and asymptomatic patients.
2. To understand how differences in reimbursement impact on implementation of CTC.
3. To understand broader political issues related to reimbursement, namely turf-battles with other health professionals.
4. To become familiar with potentially imminent changes in reimbursement.

A-075 09:09

Quality, training and accreditation

D. Burling; London/UK (burlingdavid@yahoo.co.uk)

CT colonography has evolved rapidly and disseminated widely over the last decade. The ability to provide an accurate whole colon examination with near perfect completion rates, use of reduced laxative bowel preparations and extra-colonic organ review has attracted very considerable interest amongst the wider radiological and gastro-enterological community. Inclusion of CT colonography in several core radiological training programmes confirms its evolution from super-specialist technique (performed in only a few centres) to mainstream. However, evidence supports highly variable performance, which is perhaps unsurprising given the complexity of both technique and interpretation methods - both which require specific training. Notably, attendance at a training workshop generally represents the beginning of a radiologist's experience of CT colonography. Indeed, most delegates rapidly progress from unconscious to conscious incompetence, acknowledging the need for a planned implementation strategy prior to offering CT colonography in their routine clinical practice. Thankfully a decade of intensive research and large volume clinical experience has equipped the radiological community with knowledge and experience to inform successful CT colonography implementation strategies. By combining this experience with training and accreditation practices developed for colonoscopy, the prospect of a robust quality assurance framework is realistic and necessary to reassure both service commissioners and the general public alike. Step one: the publication of international CT colonography standards, co-authored by eminent radiologists from across Europe and beyond has been achieved. This talk will review the likely next steps.

Learning Objectives:

1. To learn about trial data that quantify the benefit of training individuals to interpret CTC.
2. To become familiar with a quality framework necessary for optimised CTC data acquisition, interpretation, and patient satisfaction, with reference to the BSGAR/RCR/ESGAR guidelines.
3. To learn how the above may be implemented practically.
4. To learn about issues around potential accreditation for CTC, both practical and political.

A-076 09:27

CAD: friend or foe?

S. Halligan; London/UK (s.halligan@ucl.ac.uk)

Computer-assisted detection (CAD) for CT colonography is now widely available in Europe from a number of different vendors. This presentation will detail factors that potential users will need to know in order to properly evaluate CAD systems, use them in clinical practice, and evaluate their likely impact. The different ways in which the performance of CAD systems can be assessed will be discussed and the difference between weak methodologies (e.g. internal validation) and more valid assessments (e.g. external validation) will be explained. The different possibilities

for integrating the CAD system into day to day clinical workflow will be explained, particularly second-read CAD and concurrent CAD. Finally, the clinical impact of CAD and the different reading paradigms will be quantified with reference to the peer-reviewed indexed literature.

Learning Objectives:

1. To understand what CAD is and how it is integrated into clinical interpretation of CTC.
2. To review trial data that quantifies the benefit of CAD assistance to observers tasked with interpreting CTC.
3. To learn which observer groups may benefit most from CAD, and its impact on training schedules.

Panel discussion:

In 2011, should CTC now be the primary method of colorectal investigation in my hospital? 09:45

CTC is now established in clinical practice but other viable methods for colonic investigation remain; namely barium enema and colonoscopy. CTC has attracted most attention as a screening method for colorectal cancer and adenomas, but a role is also advocated for symptomatic patients, not only because it can detect symptomatic cancer but because disease outside the colon may underpin symptoms. The panel will debate whether the barium enema should be abandoned completely and, if so, will discuss the relative positioning of CTC and colonoscopy for investigation of symptomatic patients.

08:30 - 10:00

Room B

Interactive Teaching Session

E³ 320a

Thoracic infections: what the radiologist must report

A-077 08:30

A. Pulmonary infections

T. Franquet; Barcelona/ES (tfranquet@santpau.es)

Community acquired pneumonia (CAP) is a major health care problem because of their high morbidity and mortality rates. Patients exposed to non-hospital risks who develop pneumonia have been traditionally categorised as having community-acquired pneumonia (CAP). Healthcare-associated pneumonia (HCAP) is a new designation for pneumonias affecting individuals residing in non-hospital health care facilities, patients undergoing outpatient procedures or therapies, and patients who have been recently discharged from the hospital setting. When the diagnosis of CAP or HCAP is suspected, imaging studies are mandatory for the evaluation of affected patients. A nosocomial pneumonia is defined as one not acquired in a hospital or a long-term care facility. It occurs most commonly among ICU patients, predominately in individuals requiring mechanical ventilation. Pulmonary infection is a major cause of morbidity and mortality in patients with impaired immune function. Increasing numbers of patients are becoming immunosuppressed, because of solid organ and hematopoietic stem cell transplantation, the use of immunosuppressive agents for treating a host of inflammatory diseases, or congenital and acquired diseases such as acquired immune deficiency syndrome (AIDS). Mildly impaired host immunity as it occurs in chronic debilitating illness, diabetes mellitus, malnutrition, alcoholism, advanced age, prolonged corticosteroid administration and chronic obstructive lung disease have also been regarded as predisposing factors of pulmonary infections. The rapid diagnosis and treatment of pulmonary infections are essential. Combination of pattern recognition with knowledge of the clinical setting is the best approach to pulmonary infectious processes.

Learning Objectives:

1. To learn how to recognise pulmonary infections in immunocompetent and immunodepressed patients.
2. To learn how to recognise infections of the chest wall, pleura and mediastinum.

A-078 09:15

B. Non-pulmonary chest infections

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

Acute mediastinitis is a potentially life threatening but fortunately rare condition that requires prompt diagnosis and treatment. Spontaneous or iatrogenic oesophageal rupture is the by far most common cause. Other causes include post-surgical medi-

astinitis and extension of infection from adjacent spaces (neck, pharynx, pleura or retroperitoneum). Typical cases including the role of radiologic findings with respect to sensitivity and specificity, and important differential diagnosis will be discussed. The distinction between a parapneumonic pleural effusion and an empyema based on radiologic findings is often impossible. Features suggesting a "complicated" course requiring interventional or even surgical treatment at some point will be discussed. Features of empyema and lung abscess at CT will be illustrated as well as CT indices of severity of empyema and its effect on the underlying lung that allow some prediction of functional outcome after surgical decortication. An empyema necessitatis describes a chronic empyema that attempts to decompress through the chest wall. Infectious agents include tuberculosis, actinomyces, staphylococcus and various types of fungi. It has to be differentiated from other mostly neoplastic diseases that cross fascial planes such as lymphoma or Pancoast tumour.

Learning Objectives:

1. To review the most common conditions or infectious agents that cause non-pulmonary thoracic infections.
2. To learn about the role of various imaging techniques including ultrasound, CT and MRI for the assessment of chest wall, pleural or mediastinal infections.
3. To be aware of the differential diagnosis and to know about imaging features that are helpful in this matter.

08:30 - 10:00

Room C

Abdominal and Gastrointestinal

RC 301

Abdominal lymphoma

Moderator:

A. Rahmouni; Creteil/FR

A-079 08:30

A. Solid organs

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

Most lymphomas arise in lymph nodes or other lymphatic tissues. Extranodal lymphomas arise in tissues normally devoid of lymphoid tissue. Involvement of so-called extranodal organs is a common finding after staging investigation, however, and a substantial part of NHL even arises in these sites. The latter form is often referred to as primary extranodal NHL. Splenic lymphoma is common in both Hodgkin disease and non-Hodgkin lymphomas but it may be difficult to detect by imaging techniques because lymphoma nodules in the spleen are often smaller than 1 cm. Splenic enlargement alone is not a good indicator of lymphomatous involvement. Primary hepatic lymphoma is rare compared with disseminated diseases at both nodal and extranodal sites. Several forms of hepatic involvement can be seen including mass lesions/nodules, diffuse infiltrative form and extrahepatic involvement of the hepatic ligament. Lymphomatous involvement of liver hilum nodes often infiltrates along the hepatic artery and portal vein toward the head of the pancreas and produces an infiltrative bulky mass that involves the liver, pancreas and duodenum. Primary pancreatic lymphoma is very rare and can be difficult to differentiate from pancreatic adenocarcinoma. Definitive pathological diagnosis of lymphomas is often obtained using image-guided biopsy. This non-invasive procedure is important as the prognosis and management of lymphomas differ greatly from that of adenocarcinoma or metastatic diseases. Staging (Ann Arbor classification or modifications) and response to therapy is primarily by CT. Indications for 18 F-PET/CT include lymphomas that are routinely FDG avid, diffuse large B-cell lymphomas and Hodgkin disease.

Learning Objectives:

1. To review the pathways of spread in liver and spleen lymphoma.
2. To learn the various imaging features of liver and spleen lymphoma and their differential diagnoses.
3. To learn to identify the accuracy of each imaging modality to assess staging and response to therapy.

A-080 09:00

B. Hollow abdominal viscera

R.M. Mendelson; Perth/AU (richard.mendelson@health.wa.gov.au)

Primary gastrointestinal lymphomas are nearly always NHLs, classified pathologically by the REAL/WHO system. Correlation of radiological morphology with histology is relatively poor, but characteristic subtypes are discussed. The key issue is differentiating indolent and aggressive lymphomas. Most gastric lymphomas are

B-cell, MALT type. Radiological features depend on histological grade. Small intestine lymphoma patterns are categorised as multiple nodules, infiltrative, polypoid, endo-exoteric and mesenteric-invasive. Rare primary colonic lymphomas may be focal or diffuse. Gastrointestinal lymphomas are great mimickers with a wide differential diagnosis including: in the stomach, Menetrier's disease, hypertrophic gastritis and carcinoma; in the small intestine, Crohn's disease, mastocytosis and metastatic disease (nodular form); inflammatory disease and carcinoid (infiltrative form); GISTs and serosal metastases (cavitating form); TB, Crohn's disease, carcinoid and carcinoma (fistulation). However, 'aneurysmal dilatation' strongly indicates lymphoma. The 'hamburger' sign of mesenteric lymph node enlargement is characteristic. Staging (Ann Arbor classification or modifications) and response to therapy is primarily by CT. Indications for ¹⁸F-PET or PET/CT include lymphomas that are routinely FDG avid, diffuse large B-cell and Mantle cell lymphomas. PET's role in other NHLs is less clear. PET can show occult advanced disease, assess therapeutic response, detect relapse, and differentiate fibrosis/necrosis from tumour. Although there is no convincing evidence that baseline FDG uptake intensity is an independent prognostic factor, changes in uptake reflect chemotherapeutic response; post-therapy residual uptake correlates with poor prognosis. Post-therapy negative PET has high NPV for residual disease. Interim PET may be more accurate than end-of-therapy PET for predicting progression-free survival.

Learning Objectives:

1. To know the various imaging features of gastrointestinal tract lymphoma.
2. To recognise the differential diagnostic criteria from other diseases.
3. To learn to identify the accuracy of each imaging modality to assess staging and response to therapy.

A-081 09:30

C. Genitourinary tract involvement

J.A. Spencer; Leeds/UK (johnspencer50@hotmail.com)

Lymphoma can involve any part of the genitourinary (GU) tract. Manifestations include a focal mass, multifocal masses or a diffuse process. Lymphoma is one of the great mimics. When should one suspect a diagnosis of lymphoma? 1. With immunocompromised patients, e.g. after organ transplantation from post-transplant lymphoproliferative disorder (PTLD) or with HIV infection. 2. In childhood and adolescence when lymphoma is relatively more common and, with multifocal masses in the same organ, e.g. the testis or kidney. 3. Bland homogeneous masses. 4. Diffuse processes infilling whole anatomic spaces, e.g. the perinephric space. 5. Disease crossing several tissue planes. 6. Bulky disease with few symptoms. The primary modality for investigation will be determined by the symptoms or clinical signs which prompt medical attention. Obtaining a tissue diagnosis at the earliest possible opportunity is key to planning therapy. The radiologist can do this by a variety of routes using US or CT guidance and should alert the surgeon to the need for deep biopsies when a submucosal process seems likely. With prior lymphoma the likelihood that any new GU problem reflects disease recurrence is guided by expected behaviour of the original disease. Comparison of the new specimen with material from the original diagnosis is important. Relapse in extranodal sites such as the GU tract may indicate transformation to a high grade lymphoma. Overall, diffuse large B-cell lymphoma (DLBCL) is the predominant diagnosis. CT is the mainstay of monitoring treatment response. CT-PET has a role for assessment of residual masses.

Learning Objectives:

1. To recognise the varied imaging features of genitourinary tract lymphoma.
2. To understand the differential diagnostic criteria from other diseases.
3. To learn to select appropriate imaging modalities in diagnosis, staging and assessment of response to therapy.

08:30 - 10:00

Room D1

KISS (Keep It Simple and Straightforward): Musculoskeletal MRI

CC 316

The shoulder

Moderator:

A. Oktay; Izmir/TR

A-082 08:30

A. How I do it

J. Kramer; Linz/AT (kramer@ctmri.at)

The first step prior to the examination of an optimal evaluation of the shoulder by MR imaging consists of a sufficient recommendation with some information of the patients history and clinical complaints. Not rarely the radiologist himself has to

ask the patient for those information. At the time of MR imaging plain films and/or results of an ultrasound exam of the shoulder, if possible, should be available. However, only such prerequisites allow to run a tailored examination protocol and to support the orthopaedic colleague with the needed answers for further adequate therapy. The patient has to be placed in the magnet in a pleasant situation to avoid artefacts due to patients movement, which usually cause motion artefacts. It is very important to explain to patients to keep quiet during the whole examination, because artefacts may need repetitions of sequences, and lead so to prolongation of total examination time. Furthermore, they make diagnosis more difficult and eventually more or less inaccurate. Lastly, sequence repetitions decrease patient throughput and therefore cost effectiveness. Imaging in three orientations (axial, paracoronal-parallel to the supraspinatus tendon, and parasagittal - parallel to the glenoid cavity) using T1W (PDW) and/or T2W sequences have to be performed. In case of specific questions regarding lesions of the labrum intraarticular administration of contrast agent (MR arthrography) should be considered, which is sometimes (different from country to country) possible after discussion with referring orthopaedic surgeon only.

Learning Objectives:

1. To understand the influences of patient positioning, scan parameters and magnet/coil technology on image quality.
2. To learn how to optimise scan protocols to maximise patient throughput without compromising diagnostic quality.
3. To recognise how and when to modify scan protocols to answer specific clinical questions.

A-083 08:55

B. Normal variants and pitfalls

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

MR arthrography is superior to other imaging techniques in the evaluation of the glenohumeral joint. Knowledge of normal anatomy on MR arthrography is essential to identify pathology. Three glenohumeral ligaments (GHL) have been described, the superior GHL, the middle GHL and the inferior GHL complex, formed by an anterior band, a posterior band and an axillary recess of the joint. The number of ligaments is variable in any person and their size varies considerably. The SGHL is present in 90-97% of shoulder studies and is variable origin. The MGHL is present in 73-92%. The IGHL is present in almost 100% of shoulder studies. The MGHL is the least constant in size and it can be absent in up to 27% of individuals. A well-recognised variant is the Buford complex, which represents a cordlike thickening of the MGHL, with absence of the anterior superior portion of the labrum. This variant is seen in up to 6.5% of patients. Other normal variants that can be diagnostic pitfalls include the anterosuperior sublabral foramen and hyaline cartilage under the labrum.

Learning Objectives:

1. To become familiar with the normal anatomy.
2. To be able to identify normal variants.
3. To appreciate the range of pitfalls that may simulate pathology.

A-084 09:20

C. Identifying and reporting abnormal findings

S. Waldt; Munich/DE (Waldt@roe.med.tum.de)

MR imaging (MRI) and MR arthrography are the primary diagnostic imaging modalities applied to patients with degenerative, traumatic and sports-related shoulder lesions. In this categorical course the characteristic MR imaging and MR arthrographic features of articular pathologies of the shoulder, in particular, instability-associated injuries, rotator cuff tears and biceps tendon lesions are discussed. Beside lesion detection the radiological analysis comprises the understanding of the underlying pathomechanism and recognition of possible interrelations between different type of lesions (for example, secondary impingement and associated lesions of the posterosuperior labrum). The use of classification systems for specific lesions is introduced in order to improve the radiological report. A reasonable structure for written reports is discussed comprising a brief and clear description of pathological findings with subsequent interpretation and categorisation of findings with a view of therapeutic decision making.

Learning Objectives:

1. To review imaging appearances of instability lesions, rotator cuff tears and pathology of the biceps tendon.
2. To understand the use of terminology and classification systems to describe and categorise these common abnormalities.
3. To recognise underlying pathomechanisms and understand therapeutic consequences.

08:30 - 10:00

Room D2

Special Focus Session

SF 3d

Head and neck oncology: the three musketeers (CT, MR, PET)

Moderator:

A. Borges; Lisbon/PT

A-085 08:30

Chairman's introduction

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

An increasing number of functional and metabolic imaging options reflecting relevant aspects of tumour biology have rapidly been incorporated into clinical trials and, progressively, into clinical practice. While tumour staging according to the TNM system still rules most decisions regarding treatment choice in head and neck cancer, biological information from the tumour and its microenvironment has proven to have important predictive and prognostic value heading for a tailored and individualised patient's management. CT, MR and PET are the mainstay imaging modalities to access tumour extent, both of the primary tumour, lymphatic and distant metastases and for early depiction of recurrence during patient's follow-up. Hypoxia and angiogenesis, the major driving forces for tumour aggressiveness, long linked to chemo and irradiation treatment failure, can now be imaged both by PET (18 F-MISO or 60Cu ATSM) or MRI (BOLD and PWI, respectively). This information is being used to define biological tumour volumes, to tailor conformational and intensity modulated radiation treatments and to select patients for specific treatments such as radiosensitizers, hypoxia selective cytotoxic and antiangiogenic drugs. Overexpression/amplification of EGFR (epidermal growth factor receptor) are common genetic abnormalities in SCC linked to increased cell proliferation and worse prognosis. Imaging techniques reflecting cell proliferation/density (18 F-FLT -desoxyfluorothymidine- and diffusion-weighted MRI) can be used to select patients for treatment with EGFR inhibitors. This special focus session will review the use of these imaging modalities both prior, during and after treatment of head and neck cancer focusing on their specific advantages and accuracies in these different settings.

Session Objectives:

1. To become familiar with the premises behind the choice of CT, MR and PET in different anatomic areas of the head and neck.
2. To understand the added value of each technique in the diagnosis, follow-up and prognostic prediction of head and neck cancer.
3. To be able to tailor an imaging protocol taking into account risk-benefit and cost-effectiveness.
4. To become familiar with the clinical application of hybrid imaging and new PET tracers.

A-086 08:35

State-of-the-art CT/MR/PET as baseline modalities

S. Bisdas; Tübingen/DE (sotiros.bisdas@med.uni-tuebingen.de)

Contrast-enhanced CT and MRI are routinely used in order to determine the precise localisation, size and anatomic extent of the primary lesion. On the other hand, positron emission tomography (PET) is the most sensitive and specific technique for in vivo imaging of metabolic pathways and receptor-ligand interactions in the tissues. A common question is which of these techniques should be used in a particular patient. The most widely used technique is CT, as it has a number of important advantages over MRI, like wide availability, relative low cost and short examination time. However, CT also has a number of disadvantages compared to MRI: relative low soft tissue contrast resolution, severe image quality degradation by dental fillings or other metallic foreign objects, and radiation exposure. PET in combination with CT and/or MRI has a good sensitivity and specificity for the detection of primary tumour and for nodal staging as well as for detection in a single examination distant metastases, occult tumours, second synchronous tumours, and for radiotherapy planning. By combining PET with CT and MRI studies, either sequentially or synchronous performed, the diagnostic accuracy is significantly higher.

Learning Objectives:

1. To understand the advantages and shortcomings of each modality.
2. To learn the state-of-the-art CT/MR/PET protocols for routine imaging work-up in head and neck.
3. To be able to select the appropriate modality for staging of head and neck cancer according to the needs of the clinician and treatment planning.

A-087 08:58

State-of-the-art CT/MR/PET in the treated neck

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

Tissue changes in the treated neck by surgery and/or radiotherapy (RT) make the detection of residual or recurrent tumour more difficult. Clinical evaluation of the neck is also hampered by these changes. Therefore, any (non-invasive) method helping in the detection of recurrence is welcome. In order to evaluate the treated neck, radiologists should be familiar with expected post-RT findings. Histological changes post-RT will be discussed in combination with imaging examples. This knowledge will enable radiologists to recognise non-expected findings post-RT. Non-expected post-RT findings can be caused either by tumour recurrence, or by complications of treatment (e.g. chondro-radionecrosis). Imaging examples will be shown. Especially after surgery, including various types of neck dissection, lymphatic drainage patterns of the head and neck are altered. It is important that radiologists are aware of these changes. Imaging examples will be shown. CT and/or MR-findings in the treated neck may be inconclusive. In these cases, there may be an additional role for metabolic (PET) imaging. At present, the position of metabolic imaging in the imaging protocol for the treated neck is unclear. Information from the recent literature will be discussed. Also, examples from daily practice will be shown, with emphasis on the importance of base-line imaging after treatment and the timing of such base-line scans. This knowledge will help in understanding the current indications and limitations of post-treatment metabolic (PET) imaging of the head and neck.

Learning Objectives:

1. To become familiar with expected post-radiation CT/MR findings.
2. To become familiar with patterns of lymphatic spread after surgery.
3. To understand the indications and limitations of post-treatment metabolic (PET) imaging of the head and neck.

A-088 09:21

New techniques and protocols: perfusion, diffusion, spectroscopy and new PET tracers

V. Vandecasteele; Leuven/BE (vincent.vandecasteele@uz.kuleuven.ac.be)

Computed tomography (CT), magnetic resonance imaging (MRI), and [¹⁸F]fluorodeoxyglucose positron emission tomography (FDG-PET) are the main imaging modalities in head and neck cancer. However, the dependency on morphological and size-related criteria of anatomical imaging and the limited spatial resolution and FDG-avidity of inflammation of metabolic imaging may reduce diagnostic accuracy. New PET-tracers, including 11C-methionine, 18-fluorothymidine (FLT) and 18 F-misonidazole (FMISO) that target more specific tumour binding sites compared to FDG, are developed in order to improve specificity in tumour detection or treatment follow-up or to visualise specific prognostic tumour characteristics. While FMISO-PET may hold important prognostic information pre-treatment by depicting tumour hypoxia associated with treatment resistance, 11C-methionine and FLT may be used for more specific tumour depiction and early response assessment. Functional MRI sequences are developed aiming to improve lesion characterisation, nodal staging and treatment follow-up. Most frequently used techniques are diffusion-weighted MRI (DWI), dynamic-contrast-enhanced MRI (DCE-MRI) and MRI-spectroscopy (MRS). Although MRS may have value in nodal staging and treatment assessment, currently its main disadvantage is the limited spatial resolution. DWI measures differences in water mobility between different tissue microstructures quantified by the apparent diffusion coefficient, while DCE-MRI measures tissue perfusion using permeability measurements or semi-quantitative perfusion parameters. DWI is researched and gradually clinically implemented for locoregional staging, differentiation of tumour recurrence from post-treatment complication and early treatment follow-up. DCE-MRI mainly shows additional value for early assessment of treatment response, but also as a prognostic imaging modality as pre-treatment tumour perfusion may correlate with hypoxic status of the tumour.

Learning Objectives:

1. To understand the physiological basis and rationale for use of the different and new functional imaging modalities and tracers in head and neck cancer.
2. To have an overview of the currently possible clinical applications and compare the advantages and disadvantages of the different modalities for pre and post-treatment imaging.
3. To have an overview of potential future applications for treatment prediction and early treatment follow-up.
4. To recognise the potentially synergistic value between functional MRI techniques and nuclear imaging techniques.

Panel discussion:

The three musketeers were actually FOUR 09:44

CT, MR and PET: how to choose between modalities in head and neck cancer patients. An increasing number of imaging modalities reflecting functional and metabolic aspects of tumours have rapidly been incorporated into clinical practice. These modalities provide additional information on tumour vascularisation/ angiogenesis (CT and MR perfusion); on tumour metabolism, hypoxia and proliferation (PET using different radioactively labelled substances) and on tumour architecture and cellular density (DWI). Hybrid imaging, PET-CT and, in the near future PET-MR, can provide morphologic, metabolic and functional information in a one-stop-shop examination. The choice of the best modality (ies) to answer specific questions in the diagnosis, follow-up and in the prediction of response to treatment and prognosis will be addressed.

08:30 - 10:00

Room E1

Genitourinary

RC 307

Gynaecologic emergency and its mimics

Moderator:

K. Kinkel; Chêne-Bougeries/CH

A-089 08:30

A. Imaging of emergencies in pregnancy

G. Masselli; Rome/IT (gabrielemasselli@libero.it)

Acute abdominal and pelvic pain in pregnant women may be the manifestation of various gynaecological and non-gynaecological conditions. The correct diagnosis of the causes of acute pain during pregnancy is critical to minimise maternal-foetal morbidity and mortality. Although ultrasound (US) is the primary imaging investigation in the diagnostic evaluation of the pregnant patient, the role of magnetic resonance (MR) imaging in the evaluation of foetal and maternal diseases in pregnant patients continues to expand. MR imaging offers different potential advantages in comparison to US for evaluating acute abdominal and pelvic pain; these include multiplanar imaging capabilities, a higher soft tissue contrast and the ability to detect and distinguish blood from other fluid collections. When US is equivocal or nondiagnostic, MR imaging is a valuable complement to determine the exact aetiology of acute abdominal pain. The intrinsic safety and the accuracy of MRI in diagnosing abdominal and pelvic disease make it an excellent choice for triage of pregnant patients with acute abdominal and pelvic pain. MR imaging provides important information that influences patient management, and it is important for the radiologist to recognise the MR imaging appearance of the common causes of acute abdominal and pelvic pain during pregnancy. This lecture will discuss the use of MR imaging for maternal diseases that cause acute abdominal and pelvic pain during pregnancy. Moreover, this lecture will discuss the different MR imaging techniques to use, and will show how to detect and to differentiate the gynaecologic and non-gynaecologic causes of pain during pregnancy.

Learning Objectives:

1. To learn the most common causes of gynaecologic pain in pregnancy.
2. To understand how to diagnose non-gynaecologic causes of pain in pregnancy.

A-090 09:00

B. Emergencies of gynaecologic origin

A.G. Rockall; London/UK (andrea.rockall@bartsandthelondon.nhs.uk)

In this lecture, the role of imaging in the evaluation of gynaecologic emergencies will be presented. A combined approach using both clinical findings and imaging features is necessary. Accurate evaluation is important as failure to make a diagnosis may lead to serious consequences. Presenting symptoms, such as pelvic pain or vaginal bleeding or discharge, may overlap with pregnancy-related emergencies and with non-gynaecologic abdominal emergencies. The range of conditions to be considered include ovarian cyst emergencies (cyst rupture, haemorrhage or torsion), infective conditions (Bartholins' or vulval abscess, pelvic inflammatory disease or tubo-ovarian abscess) and acute bleeding (from inflammation, neoplasm, or trauma). Pain may be related to the menstrual cycle, as in endometriosis or ruptured corpus luteum, or may be unrelated, such as in fibroid or ovarian torsion or pelvic inflammatory disease. The imaging features of these acute abnormalities will be reviewed and discussed in the context of the differential diagnoses.

Learning Objectives:

1. To understand the causes of common gynaecologic emergencies.
2. To understand the imaging diagnosis of common gynaecologic emergencies.

A-091 09:30

C. Emergencies of non-gynaecologic origin

D. Akata; Ankara/TR (dakata@hacettepe.edu.tr)

During routine clinical practice, radiologist must often evaluate a wide range of cases with acute abdominal and pelvic pain. Ultrasound (US) is the primary imaging modality of choice to evaluate pelvic pain in the female patient. Computed tomography (CT) is mostly performed if ultrasound findings are equivocal or if the abnormality extends beyond pelvis. Conditions such as appendicitis, diverticulitis, pyelonephritis and renal calculi may develop in women of childbearing age with clinical features that mimic obstetric and gynaecologic emergencies. Pelvic pain is a diagnostic problem especially in pregnant woman. Ultrasound scanning has certain limitations secondary to increasing gestational age. CT is not appropriate due to radiation dose. In those situations, it has been proven that magnetic resonance (MR) imaging is a valuable adjunct to delineate the pathology. In non-pregnant woman the radiological evaluation is less difficult. Still, a multimodality approach may be needed in certain cases. In this lecture, radiological features of non-gynaecologic emergencies such as acute appendicitis, diverticulitis, renal calculi and pyelonephritis will be discussed.

Learning Objectives:

1. To understand the causes and imaging diagnosis of common non-gynaecologic emergencies.
2. To recognise how these may mimic gynaecologic disease.
3. To understand the use of a multimodality approach to solve the problem.

08:30 - 10:00

Room E2

Foundation Course: Paediatric Radiology

E³ 320b

Genitourinary problems: common daily practice

Moderator:

V. Donoghue; Dublin/IE

A-092 08:30

A. Imaging strategy in urinary infections

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

The purpose is to discuss the role of imaging and the potential of different methods applicable in childhood UTI - with a focus on US. The imaging task in UTI has changed, and new questions arise for radiology. In addition, growing economical demands pressurise radiology to restrict imaging to those conditions where an evident benefit has been demonstrated. This efficacy-oriented approach is difficult in children due to the lack of evidence-based data. Thus, controversies exist on if, when and how to investigate childhood UTI, trying to minimise procedures and reduce burden on children and health budgets without missing important conditions that may pose a threat to the kidney. Furthermore, modern imaging with new methods, applications and potential (e.g. contrast-enhanced voiding urosonography = ce-VUS) may influence the imaging algorithm. Therefore, the clinical demand and the value of established as well as new imaging for treatment have to be understood and balanced. Most of the proposed imaging algorithms heavily rely on modern US including Doppler options, recommend scintigraphy for the assessment of renal function and scarring, and define the indications for MCU (or ce-VUS) from these findings, additionally considering patient's age, gender and presentation, with respect to the individual clinical context. Imaging in childhood UTI has changed, some well-established methods and rules persist. Basically, detection of renal involvement is the centre point of acute imaging, with extended exploration, e.g. by MCU or MRI, in those who have complications, scars/upper UTI, and other risk factors such as malformations.

Learning Objectives:

1. To learn about the role, the importance and the information obtained from ultrasonography.
2. To learn about the technique and indications of voiding cystourethrography, as well as the role and potential of nuclear medicine examinations.
3. To learn about an imaging algorithm for the imaging approach based on existing ESUR & ESPR recommendations.

A-093 09:00

B. Urinary tract dilatation: what should be done, to whom and when?

F.E. Avni; Brussels/BE (Freddy.Avni@erasme.ulb.ac.be)

The in utero and post-natal follow-up of fetuses with urinary tract dilatation has provided lots of information about the proper management of urinary tract malformations. Nowadays, affected neonates are evaluated following standardised charts

(among others, thanks to the ESUR-ESPR working group). At birth, a confirmatory ultrasound is performed in order to evaluate the type and degree of the malformation. Urinary tract dilatation are separated into mild, moderate and marked. Mild and moderate dilatation will be followed by US. Voiding cystogram and functional studies will be performed only if the dilatation is significant or persists. The prognosis is usually good. Patients with marked dilatation would be managed more "aggressively". Their work-up would be initiated as soon as diagnosed in order to diagnose cases that need therapeutic manoeuvre. For them voiding cystogram, anatomical and functional studies cannot be skipped and are important for the prognosis. Long-term follow-up are needed to prevent further damage.

Learning Objectives:

1. To learn which infants with antenatal diagnosis of urinary tract dilatation require imaging and when.
2. To become familiar with the most important differential diagnosis.
3. To learn about the imaging strategies in these infants.

A-094 09:30

C. Renal and pararenal masses: basic rules

P. Tomà; Rome/IT (paolo.toma@opbg.net)

The differential diagnosis of renal and pararenal masses firstly depends on the age of the child. Wilms tumour (nephroblastoma) is the most common abdominal tumour in 1-8 years old (80% of cases in children less than 5 years old - peak age 3.6 years). Renal non-Wilms tumours represent a significant proportion of renal tumours in children, especially in children aged less than 6 months or greater than 12 years. Neuroblastoma most commonly arises from the adrenal gland but can arise anywhere along sympathetic chain; it is the most common tumour in children under 2 years of age (90% of cases in children less than 5 years - mean age < 2 years). Adrenal adenomas and carcinomas also occur in childhood. US is the initial imaging modality to investigate an abdominal mass in children. CT or MRI is used to confirm the US findings and not uncommonly add new, valuable information. Concerning Wilms tumour there is a very diverse approach to treatment according to geographical location. This variation in therapeutic attitude has consequences for the choice of imaging modality at diagnosis. Neuroblastoma staging includes also 123I-MIBG, and laboratory investigations (bilateral bone marrow aspirates with histochemical tests and urine catecholamine level measurements). We focus on the points under discussion: revision to the staging of neuroblastoma, the problems inherent in distinguishing nephrogenic rests from Wilms tumour and the approach regarding small lung nodules in children with Wilms tumour.

Learning Objectives:

1. To understand the imaging findings of paediatric renal and pararenal masses.
2. To learn how and when to use sonography, CT and MRI in investigation and differential diagnosis.
3. To learn about the role of imaging in staging renal and pararenal malignancies.

08:30 - 10:00

Room F1

Functional Imaging of Tumours: How to do it

MC 322

Functional and ultra structural MR

Moderator:

L. Martí-Bonmati; Valencia/ES

A-095 08:30

A. Diffusion imaging and whole body MRI

A. Luciani, C. Lin, F. Pigneur, C. Haioun, E. Itti, A. Rahmouni; Creteil/FR

It is now well accepted that treatment strategies and patients prognosis rely in large part on initial tumour staging. Early response assessment in cancer patients further enables adapted treatment selection treatment response on imaging. Recent instrumentation MR developments, including routine high field imaging, phased array coils and parallel imaging bring whole body MR imaging to clinical practice. Moreover, both optimised morphologic imaging and functional data previously obtained on specific dedicated examinations can be provided on a whole body scale. The aim of this lecture will be to review technical requirements of whole body MR imaging, with special focus on dynamic contrast-enhanced MRI (DCE-MRI), diffusion weighted imaging on a whole body scale (WB-DWI), and MRI using continuous rolling platform. The combination of phased array coils, enabling parallel acquisitions, the selection of dynamic contrast enhanced sequences, and

the choice of b-factors on WB-MRI will all be analysed. Emerging applications of WB-MRI and of WB-DWI will be exposed, especially regarding onco-haematological malignancies. WB-MRI can allow combination of morphologic and functional data on a whole body scale. Optimisation of MR instrumentation, standardisation of MR protocols and future studies on specific diseases are under way.

Learning Objectives:

1. To understand the technical specificities of whole body DWI.
2. To know how to apply whole body DWI in the detection and functional assessment of tumours, including haematological malignancies.
3. To learn about the developments of whole body DWI for tumour staging and response assessment.

A-096 09:00

B. Quality and quality control in DCE-MRI and DCE-CT

V.J. Goh; Northwood/UK (gohmcglone@hotmail.com)

Dynamic contrast enhanced MRI and CT provide valuable information of the anti-vascular effect of anti-angiogenic and vascular disruptive agents. The quality of DCE-MRI or DCE-CT data is influenced by patient, acquisition and post-processing factors. For example, patient habitus, scanner type, acquisition parameters, contrast agent and administration profile, signal to noise, input function, kinetic model, and processing software affect the accuracy of quantification. Multisite acquisition and processing provide challenges to multicentre implementation of DCE techniques within and outside the context of clinical trials: standardised acquisition and processing on the same scanner and software platform, while ideal may not be possible. Quality control is essential to maintain accuracy and consistency of standards across all sites. A consensus-based, practical approach to quality control of DCE-MRI and CT in early phase clinical trials will be presented.

Learning Objectives:

1. To understand the differences obtained with different imaging techniques.
2. To understand the differences obtained with different processing software.
3. To know the limitations of multi-site acquisition or processing.

A-097 09:30

C. Synthesis: functional imaging for tumour management

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

The major functional imaging tools for tumour management are obtained with dynamic contrast-enhanced imaging, diffusion-weighted MR imaging, and MR elastography. These acquisitions allow understanding of tumour angiogenesis and perfusion, and tumour architecture. Dynamic contrast material-enhanced imaging allows assessment of perfusion parameters. Diffusion-weighted MR imaging provides information that reflects tissue cellularity and the integrity of cellular membranes. MR elastography evaluates the mechanical properties of tissue such as stiffness and viscosity. To date, tumour detection is mainly based on morphologic features. However, changes in perfusion parameters have been shown as early parameters of liver metastases detection in patient with colorectal carcinoma or breast carcinoma. Tumour characterisation is usually based on morphologic features. Yet, perfusion parameters have been shown to correlate with microvascular density and tumour differentiation helping tumour characterisation. Furthermore, apparent coefficient diffusion (diffusion-weighted MR imaging) and stiffness and viscosity (MR elastography) are significantly different in benign and malignant tumours. Despite these differences, these last parameters usually do not allow definitive subtyping. Functional imaging starts playing a major role in non-surgical treatment follow-up especially with targeted cancer therapy. Changes in perfusion parameters, apparent coefficient diffusion, and stiffness and viscosity are observed in responders. Interestingly, these changes appear promptly after treatment initiation. These functional variables are not included in RECIST 1.1 but might be part of response criteria in the next future. Many examples of functional imaging for tumour management will be provided.

Learning Objectives:

1. To understand the potential of functional imaging in tumour detection.
2. To understand the potential of functional imaging in tumour characterisation.
3. To learn about the future use of functional imaging in treatment planning and follow-up.

08:30 - 10:00

Room F2

Special Focus Session

SF 3a

The BI-RADS 3 controversy

Moderator:

M.G. Wallis; Cambridge/UK

A-098 08:30

Chairman's introduction

M.G. Wallis; Cambridge/UK (matthewwallis492@btinternet.com)

Starting in the late 1980s an American College of Radiologists task force developed the concept of guidelines to standardise mammography reporting: breast imaging reporting and data system (BI-RADS). There is evidence that over time there have been improvements in consistency of use, sensitivity, specificity and positive predictive value. However, BI-RADS 3 'probably benign; short interval follow-up recommended; less than 2% risk of malignancy' has always been the most difficult and controversial, with the highest levels of discordance between classification and recommendation, wide variation in both intra- and inter-observer agreement and a 2007 literature review demonstrating PPV for malignancy of between 0 and 8%. Management of breast disease has moved on a great deal since the 1990s. In the main driven by increasing specialisation associated with population screening programmes. Nowadays a specialist breast radiologist works with a wide variety of needle options at his hip to such an extent that the breast Multi-Disciplinary Team increasingly feels that failure to obtain a non-operative diagnosis of discrete lesions is unacceptable. In this setting, and mindful of the medico legal consequences of 'delayed diagnosis', is there still room to allow a patient to leave the one stop clinic without a definitive diagnosis? As the leaders of the diagnostic team we also have to take account of the emotional and psycho-social consequences for our patients as well as the financial costs to patient and the healthcare economy.

Session Objectives:

1. To consolidate knowledge of BI-RADS classification with respect to grade 3.
2. To appreciate the potential variability in interpretation of BI-RADS 3.
3. To appreciate the management options and their implications for both patient and organisation.

A-099 08:35

Defining lesions to follow-up

P. Skaane; Oslo/NO (per.skaane@ulleval.no)

Breast imaging reporting and data system (BI-RADS) was developed for standardising reporting and include mammography, ultrasound, and MRI. BI-RADS category 3 "probably benign finding - short-interval follow-up suggested" should have less than 2% risk of malignancy. Category 4 has been subgrouped into 4A, 4B, and 4C, and this influence the classification of BI-RADS 3. Mammographic BI-RADS 3: three nonpalpable findings in this category include clusters of punctate microcalcifications, well-circumscribed and noncalcified solitary masses, and benign-appearing asymmetric density. Digital mammography will increase detection of amorphous microcalcifications and the number of BI-RADS 3 (or 4A) lesions. Intramammary lymph nodes and calcified fibroadenomas are BI-RADS 2 lesions. Ultrasonographic BI-RADS 3: a most important BI-RADS 3 lesion is a solid oval mass ("tumour") with gently lobulations, circumscribed margins, and parallel orientation. Using strict criteria, the negative predictive value is approaching 99%. Two other lesions are nonpalpable "complicated cyst" and clustered microcysts. The "complex" cyst, i.e., a mass with cystic and solid components, should be classified as BI-RADS 4. MRI BI-RADS 3: there is lack of evidence which MRI findings should be categorised BI-RADS 3. Nonmass-like enhancement (NMLE) and enhancement kinetics are unique to MRI. Lesions less than 5 mm ("foci") need no assessment. A challenge is MRI-detected tumours < 10 mm as morphologic analysis is of limited value. Benign kinetic curves may justify short-term follow-up. In high-risk women, MRI-guided vacuum-assisted biopsy should be considered. In conclusion, BI-RADS 3 is justified in diagnostic settings but should be avoided or kept at a minimum in screening.

Learning Objectives:

1. To understand the mammography features of BI-RADS 3 classification.
2. To understand the ultrasound features of BI-RADS 3 classification.
3. To understand the MRI features of BI-RADS 3 classification.

A-100 08:58

Decreasing the number of BI-RADS 3 in clinical settings

L.J. Pina Insausti; Pamplona/ES (ljpina@unav.es)

It is important to minimise the number of lesions classified as BI-RADS 3. In a clinical setting we can support our diagnoses using more additional imaging techniques than in a screening setting. The ways to decrease the BI-RADS 3 lesions are as follows. 1. Careful review of previous imaging studies: if the lesion had a benign appearance and was seen on previous studies, it should be classified as BI-RADS 2. 2. Palpation: the physical examination may be crucial to classify a lesion. 3. History of breast cancer and other clinical conditions: BI-RADS category 3 should be avoided as much as possible for BRCA carriers, patients having a recently diagnosed breast cancer or if pregnancy is planned. 4. Radiologist's experience: unexperienced radiologists tend to use more of this category. 5. Complementary studies: spot compressions and magnifications views can show suspicious signs that were not detected on conventional views, upgrading to BI-RADS 4 or 5. US can classify a mass as a cyst (category 2). Sonoelastography can also play a role. Very high spatial resolution breast MRI can be useful to evaluate the margins of the lesion more accurately, upgrading the lesion to category 4 or 5. 6. Size of the lesion: an important requirement to choose follow-up for a probably benign lesion is to ensure that, in case of being a malignant lesion, it will be an early diagnosis. Finally, the patient's age is important: the typical appearance of a benign lesion in a young low-risk woman (< 30) can make unnecessary periodic follow-up.

Learning Objectives:

1. To appreciate the reasons for inconsistency of cancer incidence between published studies.
2. To understand the difficulties of using some of the specific descriptors and their current limitations.
3. To become familiar with the way to integrate imaging modalities to reduce uncertainty.
4. To recognise the influence of clinical data in the management of a BI-RADS 3 lesion.

A-101 09:21

Management of BI-RADS 3 lesions

F. Sardanelli; Milan/IT (f.sardanelli@grupposandonato.it)

The principle of BI-RADS 3 imaging finding should be that of "quasi-benign" type, i.e. with a very low associated risk of malignancy (< 2%), opening the possibility of a short-term imaging follow-up as an alternative to imaging-guided needle biopsy. However, a number of issues should be regarded as relevant to radiologists and patients. 1. BI-RADS 3 cancer prevalence is highly variable due to (1.1) different prevalence in the study population (symptomatic/asymptomatic, clinical/screening setting; high-risk [BRCA1, BRCA2, family history, etc.], intermediate risk [dense breasts; previous breast cancer or high-risk lesions], relatively low risk) and/or (1.2) radiologists' differences in classification. 2. When needle biopsy is optioned, vacuum-assisted biopsy under stereotactical guidance for mammographic only findings (typically, microcalcifications) and core-biopsy for sonographic findings should be used; fine needle aspiration cytology should be avoided due to the high probability of benign lesions which need larger tissue samples. 3. When short-term follow-up (typically, 6 months) is optioned, the same technique on which the BI-RADS 3 lesions was initially detected should be used. 4. In the screening setting, short-term follow-up option is commonly not considered and the reader is forced to give a dichotomic reading (recall/not recall). 5. The choice between the two options should be clearly discussed with the patient, including the psychological cost of waiting six months to get a conclusive report, and a really informed consent should be obtained. 6. Till now, there is insufficient evidence for using tomosynthesis or MRI for evaluating mammographic or sonographic BI-RADS 3 findings.

Learning Objectives:

1. To learn about the management options of a BI-RADS 3 lesion.
2. To appreciate the costs to the patient of different management options.
3. To appreciate the costs to the organisation of different management options.

Panel discussion:

BI-RADS 3: biopsy or watch? 09:44

The premise behind the BI-RADS 3 classification is to identify a group of low risk lesions that can be safely placed on follow-up rather than biopsy. In practice this can be very difficult and is anachronistic to the principles of the European population screening programmes where the radiology objective is to diagnose or discharge. The panel will discuss these dilemmas.

08:30 - 10:00

Room G/H

New Horizons Session

NH 3

Quantum leaps in MRI: teslas, pulses, tracers

Moderator:

O. Clément; Paris/FR

A-102 08:30

Chairman's introduction

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

What will be the routine MR machine in 10 years? Which field strength? Which coils? Which gradient design? Which contrast agents? Which combination will allow a gain in sensitivity to allow molecular imaging? Can hybrid imaging be a solution? The goal of this session is to review the technical developments in field strength, pulse, RF coils and contrast agents, and to discuss the necessary choices for future MR scans.

Session Objectives:

1. To review the different perspectives of progress in MRI.
2. To understand that the progress is both instrumental and chemical with new probes.
3. To envisage a scenario where MRI will offer molecular imaging capacities.

A-103 08:35

What will be the standard machine and field of the future?

L. Darrasse; Orsay/FR (luc.darrasse@u-psud.fr)

Improving the sensitivity has still been an essential issue in MRI, because the signal from nuclear spins relies on extremely weak magnetic interactions dominated by thermal fluctuation. To push the signal-to-noise ratio upward, the basic routes have been (i) to increase the field strength, (ii) to improve the signal detection with radiofrequency coils and (iii) to enhance the signal dynamically with contrast agents or alternative preparation techniques. The first route is the most obvious one, driven by the trends in analytical MR spectroscopy and small-animal MRI. Going up to or even above 7 T represents a considerable challenge, both technically and in view to renew the MR equipment market. However, this way is limited by safety issues, radiofrequency penetration concerns and susceptibility artefacts. Alternatively, improving the radiofrequency system relies on a complex electrodynamics background, where tissue conductivity and different sources of noise have to be considered. During the last half-period of MRI development, radiofrequency coil arrays have appeared as a powerful mean to improve the signal-to-noise and to accelerate the spatial encoding process, even able to overcome some pitfalls with high-field MRI. Finally, the topics of an optimal field strength has always been highly controversial because the contrast mechanisms, on which the diagnostic information is mainly founded, are essentially field-dependent. Basically, the contrast mechanisms tend to be dominated, respectively, by macromolecular cross-relaxation at low field, and by susceptibility-weighted diffusion at high field. An emerging question is then to address different pathologies or organs with either general-purpose or dedicated MRI systems.

Learning Objectives:

1. To learn about the possibilities of gaining a jump in signal.
2. To understand the respective strategies of field increase and coil improvements.
3. To consider the probable system in 2020.

A-104 08:58

Will new technologies allow a jump in sensitivity?

J. Hennig; Freiburg/DE (Juergen.Hennig@uniklinik-freiburg.de)

Imaging technologies have made breathtaking progress for several decades and in all aspects of medical imaging - MR, CT, US and PET. Amongst the current developments in MRI there are several areas which hold promise to redefine the boundaries of sensitivity. Ultrahighfield MRI with field strengths of 7 T and more starts to reveal insights into tissue microstructure so far inaccessible to MR (or any other technique). This is still under intense technological development with some key issues to resolve notably safety issues related to the high radiofrequency power. The unique contrast and resolution does hold promise for highly relevant applications such as neurodegenerative disease, small vessel disease, MS and others - although definite clinical studies for a 'killer application' are still lacking. ¹³C-Hyperpolarisation of metabolites such as pyruvate, succinate, bicarbonate, etc. lead to an increase in detection sensitivity by factors of 10-100,000. Finally, the

development of targeted probes is progressing extremely rapidly and for all imaging modalities. Most of this work is aimed at preclinical research, but the tremendous impact of the new insight in translational research promises to be of high impact for clinical application. Will these technologies allow a jump in sensitivity? Yes and no. Image quality, contrast and sensitivity will grow significantly. The biggest impact will, however, lie in the combination of the new possibilities with other data - imaging as well as non-imaging. A true change in paradigm will only be achieved if the current parcelled knowledge about various aspects of the disease is unified into a comprehensive picture.

Learning Objectives:

1. To review the recent developments in RF-coils and gradients.
2. To learn about the new measurements technologies.
3. To envision how these new tools will allow a huge gain in sensitivity.

A-105 09:21

Will new MR contrast probes compete with PET?

S. Aime; Turin/IT (silvio.aime@unito.it)

Purpose: Molecular imaging is a new science that will have a tremendous impact in the development of innovative diagnostic tools. In the first stage of its enrolment, it has relied massively on PET/SPECT and optical imaging technologies because of the superior sensitivity of their probes. In the long-term, MRI/MRS approaches may recover a central role, provided that further sensitivity improvements will be attained.

Methods and Materials: High sensitivity MRI probes have been designed and tested for molecular imaging applications. In the case of paramagnetic based systems they rely on improved design of the coordination cage as well as on the encapsulation/incorporation in proper nanocarriers. For multiple detection studies, CEST as well Hyperpolarized C-13 containing molecules have been considered.

Results: As molecular imaging is the evolution of biologists' in vitro work that has revolutionized the way living cells and intact tissues were investigated, MRI multiplex-visualization of biological processes appears to be a key task for the forthcoming years for an efficient translation of such outstanding achievements. The search for frequency-encoding MRI contrast agents represented by CEST and Hyperpolarized C-13 containing molecules have opened the interesting perspective of detecting more than one agent in the same anatomical region. This task is largely precluded to nuclear probes. Moreover merging MRI and nanotechnology allows the attainment of high sensitivity systems also with the classical relaxation agents.

Conclusion: Recent achievements in amplification procedures allow to tackle the intrinsic insensitivity of MRI probes to make them more competitive in the arena of molecular imaging applications.

Learning Objectives:

1. To review the recent developments in MR contrast agents.
2. To understand the principle of CEST agents.
3. To understand the role of the new contrast probes in molecular imaging.

Panel discussion:

What is ready for our next machine? 09:44

MRI has experienced tremendous developments in the last 20 years to become an indispensable clinical tool. The success story still goes on with major developments in the design of new hardware and specific contrast probes, resulting in a potentially huge gain in sensitivity and potentially competing with other imaging modalities like PET. Will all these technologies develop at the same pace? Will contrast probes be ready when the machine can use them? Will the tendency for higher fields continue?

08:30 - 10:00

Room I/K

Cardiac

RC 303

Systematic approach to congenital heart disease

(CHD)

Moderator:

A.P. Parkar; Bergen/NO

A-106 08:30

A. Vascular rings and other congenital vascular things

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

The cardiac tube appears around the third week of embryonic development and develops into a structure with several segments (truncus arteriosus, bulbus cordis, ventricle, atrium, and sinus venosus). The truncus arteriosus divides into the aorta and pulmonary trunk. Six paired aortic arches develop that terminate in dorsal aor-

tas. There is regression of portions of these arches, but several remnants normally persist. Any failure in this process can result in congenital anomalies of the aorta or pulmonary vessels. These anomalies can be categorised into aortopulmonary anomalies, systemic arterial anomalies, and pulmonary artery anomalies. The aortopulmonary anomalies comprise truncus arteriosus, hemitruncus arteriosus, aorticopulmonary window, patent ductus arteriosus, and transposition of the great arteries. The systemic arterial anomalies include the anomalies of the aortic arch, of which the most common is a left aortic arch with aberrant right subclavian artery. Double aortic arch is the most common cause of a vascular ring and is characterised by left and right aortic arches arising from the ascending aorta and encircling the trachea and oesophagus. A right aortic arch can have three "subtypes": aberrant left subclavian artery, mirror image branching, or isolated subclavian artery. The first type is the most common one and is the second most common cause of vascular ring. Aortic coarctation, pseudocoarctation and interruption of the aortic arch are other systemic arterial anomalies. The most important pulmonary artery anomalies are idiopathic dilatation of the pulmonary trunk, absence or proximal interruption of a pulmonary artery, pulmonary arterial stenosis, and pulmonary sling.

Learning Objectives:

1. To understand the embryology of the aortic arch.
2. To review the imaging findings and clinical significance of vascular rings in the chest.
3. To learn how to diagnose the most common congenital anomalies of the pulmonary arteries.

A-107 09:00

B. MRI: getting more specific

A.M. Taylor; London/UK (a.taylor@ich.ucl.ac.uk)

Cardiovascular magnetic resonance (CMR) imaging has become integrated into the assessment pathways for congenital heart disease in both paediatric and adult patients. CMR provides a powerful tool, giving anatomical and haemodynamic information that echocardiography and catheterisation alone do not provide. Extra-cardiac anatomy, including the great arteries, systemic and pulmonary veins, can be delineated with high spatial resolution. Vascular and valvular flow can be assessed, shunts can be quantified, and myocardial function can be measured accurately and with high reproducibility, regardless of ventricular morphology. Finally, CMR surpasses both catheterisation and echocardiography in providing high resolution, isotropic, three-dimensional (3D) datasets. This allows for reconstruction of data in any anatomical imaging plane, giving complete visualisation of complex congenital cardiac anomalies, without the use of ionising radiation. In the congenital heart disease, CMR can be justified for any patient in whom clinical or echocardiographic data are insufficient for monitoring, decision-making or surgical planning. Due to the complexity of both the anatomy and physiology of congenital heart disease, it is essential to have a systematic approach for CMR when assessing these patients.

Learning Objectives:

1. To understand the advantages of MRI in CHD.
2. To learn how to use dedicated MRI techniques (e.g. flow measurements) in CHD.
3. To learn which MR parameters have a prognostic value in CHD.

A-108 09:30

C. MDCT: the expanding role

A. Küttner; Frankfurt a. Main/DE (Kuettnr@radiologen-frankfurt.de)

With the development of novel CT scanners, especially the Dual Source CT, novel strategies of examining congenital heart disease became possible. Especially newborns and infants younger 3 years of age are difficult to examine, since compliance cannot be expected. Also young children are especially susceptible to ionizing radiation and should be exposed as little as possible. In a first step the course will illustrate the underlying technical principle how to examine children in < 1 sec with sub mSv exposure. Also the course will teach how to avoid sedation in children of any age. In a second step the course will show how to apply contrast media in children of all ages and what strategy to use. In a third step the course will show how to appropriately choose scanning parameters for the CT scan since the size and weight varies considerable in children as there are small to date newborns with < 2 kg body weight up to adolescents with a body weight > 60 kg. Since little comprehensive data is available how to examine with an optimal compromise between sufficient image quality and unnecessary radiation overexposure the data of the Erlangen study will be presented and discussed. In a fourth part typical indications for the exam are shown and how to interpret the exam. Also limits for the exams are shown. In a final step a comparison with MRI is shown which method is used for which pathology.

Learning Objectives:

1. To learn how to examine CHD with MDCT.
2. To compare the advantages and limitations of MDCT in comparison to MRI.
3. To understand the role of CT in differentiating various types of CHD.
4. To learn how to control radiation dose.

08:30 - 10:00

Room L/M

Special Focus Session

SF 3c

Tumour response to treatment: RECIST, desist or insist?

Moderator:

R.H. Reznek; London/UK

A-109 08:30

Chairman's introduction

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

The use of imaging to monitor response to treatment has become central in the care of patients with cancer. It is crucial therefore that radiologists involved in the management of patients with cancer understand the place of imaging within the clinical context of the management of patients with cancer; that they are aware of the criteria of the accepted current criteria for assessing response and are familiar not only with new developments in imaging that act as a surrogate end-point for evaluating the success of treatment but are also aware of how imaging is used to predict the likely response early in the patient's pathway. This session will concentrate on all these aspects on the use of cancer imaging in monitoring response to treatment in patients with cancer.

Session Objectives:

1. To understand the clinical importance of monitoring the response to treatment in patients with cancer.
2. To appreciate the need for standard response criteria and how they have been derived.
3. To become familiar with the range of morphological and functional imaging criteria available to monitor response.

A-110 08:35

Monitoring response to treatment in patients with cancer: why and how.

The oncologist's view

P. Johnson; Southampton/UK (johnsonp@soton.ac.uk)

We are in the era of targeted cancer therapy, whether by small molecules derived from knowledge of the molecular pathogenesis of tumours, or from biological therapies emerging from our understanding of immunology and cell biology. These approaches convey new challenges for the monitoring of response. Small molecule therapeutics often stabilise tumours for significant periods without producing clear reduction of masses, and for these the assessment of surrogate endpoints takes on increasing importance. The measurement of pharmacodynamics is central to early phase trials in which confirmation of on-target effects is required to determine the biologically effective dose, and in many cases this is best done by functional imaging. Biological therapeutics such as monoclonal antibodies and cellular immunotherapy also need novel approaches for the determination of their actions in vivo, particularly as they are frequently tested in the setting of low level disease. Randomised trials are underway to assess the contribution of functional imaging, in particular CT-PET as a means to guide therapy. The emerging data suggest that there are broad variations in accuracy, both according to the disease in question and the context in which studies are performed, even before factors such as imaging quality control and standardised reporting are included. For the future, standardisation of techniques and common quality control will play a vital part in advancing our understanding in this rapidly evolving field.

Learning Objectives:

1. To learn how new anticancer treatments are being developed and applied in the clinic.
2. To understand how surrogate endpoints are assuming an increasing importance in this process.
3. To appreciate how imaging can contribute to this and how important it is to have a reproducible system.

A-111 09:00

Principles in the use of conventional/anatomic imaging for response assessment

L. Schwartz; New York, NY/US (lschwartz@columbia.edu)

The standard way to assess a patient's response to chemotherapy is to use computed tomography (CT) to measure tumour size using uni-dimensional (RECIST) or bi-dimensional (WHO) criteria. This methodology has changed little in the past 30 years despite the emergence of new therapies and advances in imaging technology. Measuring the changes in the size of tumours in one or two dimensions does not always capture the effects of novel therapies on primary tumours and metastases. Radiographic changes in the size of tumours treated, for instance, with epidermal growth factor receptor tyrosine kinase inhibitors such as gefitinib or erlotinib or inhibitors of angiogenesis such as bevacizumab do not necessarily occur at the same magnitude or speed as observed in those individuals treated with standard cytotoxic therapies. With these newer agents, tumours respond by undergoing cystic change, central necrosis, and density changes that may not be captured by conventional measurements of the largest lesion diameter.

Learning Objectives:

1. To understand and appreciate the use of conventional/anatomic imaging for response assessment in clinical practice as well as in clinical trials.
2. To understand general and disease-specific challenges associated with response assessment at imaging.
3. To recognise potential improvement in imaging and image post-processing for response assessment.

A-112 09:25

PET in monitoring response

W. Weber; Freiburg/DE

PET imaging and specifically PET/CT with the glucose analogue fluorodeoxyglucose (FDG) has been evaluated in a significant number of studies to monitor tumour response in patients undergoing chemotherapy, radiotherapy or targeted therapies. The clinical value of for differentiation of residual or recurrent viable tumour and therapy-induced fibrosis or scar tissue has been established for malignant lymphomas and various solid tumours. Furthermore, there are now several reports suggesting that quantitative assessment of therapy-induced changes in tumour FDG-uptake may allow prediction of tumour response to chemotherapy and targeted drugs very early in the course of therapy. In non-responding patients treatment may be adjusted according to the individual phenotype of the tumour tissue. Current studies investigate whether FDG-PET can be used to "personalise" treatment and to reduce the side effects and costs of ineffective therapy. In addition to FDG, several other imaging probes are in clinical studies to monitor tumour response to therapy. These include among others [¹⁸F]fluorothymidine (FLT) for imaging of cellular proliferation, [¹⁸F]fluoromisonidazole for assessment of tumour hypoxia and radio-labelled RGD-peptides for angiogenesis imaging. Preclinical and early clinical trials with these imaging probes are encouraging, but need to be confirmed in larger clinical trials.

Learning Objectives:

1. To understand how image acquisition and reconstruction influence visual and quantitative analysis of PET studies.
2. To describe current criteria for assessing tumour response in lymphoma and solid tumours and recognise the limitations of these criteria.
3. To understand how differences between scanner models can influence response assessment by PET.

Panel discussion:

Why does the radiologist need to understand the importance of monitoring response and how it is done? 09:45

Monitoring the response to treatment has become a critical part of the management of patients with cancer. The markedly improved diagnostic performance of cross-sectional imaging in delineating the extent of malignancy has meant that imaging has become increasingly important as a surrogate end-point. These two factors have resulted in an increasing need for a standardisation of the criteria of response both in therapeutic trials and in clinical practice. It is vital that all radiologists imaging patients with cancer are familiar with the limitations, pitfalls and strengths of these changing criteria and also are aware of the possibility of using imaging to evaluate the changing molecular make-up of the cancer.

08:30 - 10:00

Room P

Contrast Media

RC 306

Contrast media: always as safe as we wish?

Moderator:

S.K. Morcos; Sheffield/UK

A-113 08:30

Chairman's introduction

S.K. Morcos; Sheffield/UK (sameh.morcos@sth.nhs.uk)

Extracellular water soluble contrast media (CM) are either iodine (I) or gadolinium (Gd) based. They have similar pharmacokinetics and excreted mainly by the kidneys with biological half life around 90 minutes. They do not cross intact blood brain barrier, minimal cell penetration and are not metabolised inside the body. Iodinated CM are classified into high-osmolar, low-osmolar and iso-osmolar contrast agents. Osmolality, ionicity and viscosity are important physicochemical factors which influence the safety of these agents. Gd-CM are either linear or macrocyclic and available as ionic or non-ionic preparations. The stability of the Gd-CA is an important safety feature of these agents particularly in patients with reduced renal function. The macrocyclic agents have high kinetic stability whereas the non-ionic linear preparations have low kinetic and thermodynamic stability. Contrast media adverse effects can be divided into acute and delayed reactions. Acute reactions are allergic like and usually develop within one hour of CM administration. Delayed reactions develop after an hour and within a week of CM administration. Acute reduction in renal function referred to as contrast-induced nephropathy (CIN) may develop after contrast administration in patients with pre-existing risk factors. Patients with advanced reduction in renal function may develop the complication of nephrogenic systemic fibrosis (NSF) after administration of low stability Gd-CM. In this session contrast-induced nephropathy and nephrogenic systemic fibrosis will be discussed. Measures to reduce the incidence these adverse effects will also be presented.

Session Objectives:

1. To understand optimised and integrated approaches for management of currently available contrast agents.
2. To review the advantages and disadvantages of different contrast media.
3. To learn about the safety of patients and professionals.

A-114 08:35

A. Iodinated CM: whether CIN is a SIN, and how to avoid it

R.W.F. Geenen; Alkmaar/NL (r.w.f.geenen@mca.nl)

The pathophysiology of CIN is complex and not well understood. Basically, a misbalance between vasodilatation and vasoconstriction takes place inside the kidney after intra-arterial or intravenous CM administration. Furthermore, increased oxygen demand of tubular cells due to increased reabsorption of sodium and water is a second mechanism, leading to transient medullar ischaemia. Identifying the patient at risk is the first step in prevention. Knowledge of the patient's medical record and a recent basic kidney function are mandatory. High-risk patients should receive prevention. Two major topics in CIN prevention are the questions whether iso-osmolar CM cause significantly less CIN than low-osmolar CM and whether hydration schedules with NaHCO₃ give significantly less CIN than hydration schedules with NaCl 0.9%.

Learning Objectives:

1. To understand the physiology of iodinated contrast media.
2. To understand CIN mechanisms.
3. To learn about pertinent safety issues.

A-115 08:58

B. MR contrast agents: rumble in the jungle

G. Heinz-Peer; Vienna/AT (gertraud.heinz@meduniwien.ac.at)

Currently up to 50% of all MRI examinations worldwide are performed using contrast agents, either an extracellular agent or an organ-specific agent. The extracellular MRI contrast agents are chelates that contain the paramagnetic ion gadolinium which strongly affects the relaxation properties of water protons, leading to changes in tissue contrast. Gd-DTPA was the first extracellular agent to be introduced in clinical practice. Since the introduction of Gd-DTPA in 1988, various gadolinium chelates with different chemical properties became available for clinical use. For many years, it was believed that gadolinium-based contrast agents (GBCA)

were nearly a 100% safe which led to a liberal and off label use of these agents. Nephrogenic systemic fibrosis (NSF) was first identified in 1997, but reported in the peer-reviewed literature in 2000. The disease typically affects patients with end-stage renal disease, including those on regular dialysis treatment. First publications reporting an association between GBCA and NSF appeared in 2006. According to Medwatch, 589 people developed GBCA-associated NSF between 1997 and 2007. Most of these cases were associated with the administration of linear chelate GBCA. The proposed trigger for NSF is transmetallation of the gadolinium chelate whereby free gadolinium is released from the chelate in exchange for endogenous metals such as zinc, copper, and calcium with subsequent binding to human tissue. The exact pathogenesis is unclear, but it is likely that cofactors may be involved.

Learning Objectives:

1. To understand the spectrum and mechanisms of MR contrast agents.
2. To understand the pathophysiology behind NSF.
3. To learn about clinical safety issues to consider beyond NSF.

A-116 09:21

C. PET tracers: established tracers and those on the horizon

F.C. Gärtner, M. Schwaiger; *Munich/DE*

There is a large number of PET radio-pharmaceuticals in research, but only a limited number have reached clinical application. The success of clinical PET depends primary on the use of ^{18}F deoxyglucose (FDG), which was introduced as brain tracer in the late 1970s. Since tumour tissue displays high glucose uptake, FDG became an important diagnostic and prognostic biomarker in cancer. Beyond FDG, tracers of various biologic processes in tumours are currently evaluated. The most promising are FLT, FET, ^{18}F Choline. ^{18}F -labelled compounds are preferred because of the 2 hrs physical half-life, which allows distribution to sites without cyclotron. Experimental compounds address angiogenesis, hypoxia, apoptosis and extra-cellular matrix. With the introduction of ^{68}Ga -generators, ^{68}Ga -labelled receptor ligands are being used for detection of neuro-endocrine tumours. In cardiology, PET tracers are available for perfusion, metabolism and innervations. Gene-reporter imaging has been used to monitor cell-based therapies in neurology. One of the most promising applications of molecular imaging principles is the targeting of amyloid deposition in the patients with Alzheimer's disease. It is hoped that early diagnosis of the neurodegeneration may lead to better therapies. The advent of hybrid-imaging will be associated with the need for multimodal contrast agents exploiting the imaging characteristics of the involved instrumentation for more differentiated visualisation of structure, physiology, and biology.

Learning Objectives:

1. To understand the working mechanism and radiation of current clinical tracers.
2. To become familiar with the potential clinical indications and applications.
3. To learn about potential new tracers.

Panel discussion:

What specific precautions are mandatory in order to guarantee contrast media safety to patients and healthcare professionals? 09:44

Current contrast agents are safer than previous products. However there are still safety aspects to consider, including patient's kidney function, thyroid metabolism, allergy, radiation exposure, or specific medical history, and there is no such thing as total or complete safety. While these simple precautions may appear obsolete in the era of sophisticated technical approaches, these issues are still quite complex and crucial in maintaining a high safety level. The discussion will give guidelines and tips for achieving a high level of safety when using contrast agents.

08:30 - 10:00

Room Q

Special Focus Session

SF 3b

The ABC of EVAR

Moderator:

M. Szczerbo-Trojanowska; *Lublin/PL*

A-117 08:30

Chairman's introduction

M. Szczerbo-Trojanowska; *Lublin/PL* (ewamak@MRI.am.lublin.pl)

Treatment of aortic aneurysms have been revolutionised two decades ago by the introduction of endovascular methods. They became a favoured alternative to open surgical repair nowadays. The number of patients with aortic aneurysms treated with

stent-grafts is steadily increasing. Therefore, knowledge of this treatment option is fundamental to provide basis for procedure planning and a meaningful radiological reporting. Imaging plays a crucial role in the assessment of patients with aortic aneurysms. Eligibility for endovascular treatment depends very much on detailed anatomical knowledge of the aorta, its branches and vascular access through the iliac arteries. We will review the role of imaging modalities: US, CT, MR for detection and evaluation of anatomy of thoracic and abdominal aneurysms. The strength and weakness of each modality will be reviewed and inclusion criteria for endovascular aortic aneurysm repair will be presented. The precise sizing of the stentgraft obtained from the images is certainly one of the most critical points of the endovascular procedure and a condition of its success. Although it is a minimally invasive treatment it is associated with complications. There is a strong need for general radiologists to know about the most prevalent normal and abnormal findings of the post-treatment aorta. The session will end with discussion addressing the central role of imaging in pre- and post-treatment evaluation of the patients with aortic aneurysms.

Session Objectives:

1. To learn about the leading role of interventional radiology in management of patients with aortic aneurysms.
2. To understand the importance of pre and post-procedural imaging.
3. To understand the role of the radiologist in the management and follow-up process.

A-118 08:35

Endovascular treatment of thoracic aortic aneurysms

J.-P. Beregi; *Lille/FR* (jean-paul.beregi@chru-lille.fr)

Indications for and experience with placement of endovascular stent grafts in the thoracic aorta are still evolving. Recent advances in imaging technologies have drastically boosted the role of pre-procedural imaging. The accepted diagnostic gold standard, digital subtraction angiography, is now being challenged by the state-of-the-art computed tomography angiography (CTA), magnetic resonance angiography (MRA) and trans-oesophageal echocardiography (TEE). Among these, technological advancements of multidetector computed tomography (MDCT) have propelled it to being the default modality used, optimising the balance between spatial and temporal resolutions and invasiveness. MDCT angiography allows the comprehensive evaluation of thoracic lesions in terms of morphological features and extent, presence of thrombus, relationship with adjacent structures and branches as well as signs of impending or acute rupture, and is routinely used in these settings. In this presentation, we review the current state-of-the-art radiological imaging for thoracic endovascular aneurysm repair (TEVAR), especially focusing on the role of MDCT angiography. After analysing the technical aspects for optimised imaging protocols for thoracic aortic diseases, we will discuss pre-procedural determinants of candidacy, and how to formulate interventional plans based on cross-sectional imaging.

Learning Objectives:

1. To learn about etiology, clinical presentation and indications for treatment.
2. To understand which imaging information is required for management of thoracic aortic aneurysms.
3. To learn about the outcomes and drawbacks of stentgrafting.

A-119 08:58

Endovascular treatment of abdominal aortic aneurysms

R. Morgan; *London/UK* (robert.morgan@stgeorges.nhs.uk)

The purpose is to present the essential principles of endovascular repair of abdominal aortic aneurysms (EVAR). Abdominal aortic aneurysms (AAA) larger than 5.5 cm should be treated. Inclusion criteria for EVAR include satisfactory aneurysm neck morphology and suitable access vessels. Preprocedural imaging involves CTA from the diaphragm to the femoral arteries. Several devices may be used to cover a wide range of anatomy. EVAR procedures are generally performed as combined procedures by teams of vascular surgeons and interventional radiologists. Patients are followed up indefinitely by CTA (or ultrasound) and plain radiography. The periprocedural mortality is three times lower compared with surgery. Late mortality rates are similar between surgery and EVAR. Quality of life issues favour EVAR in the short and medium term. Early published series reported high complication and reintervention rates for EVAR, although these have reduced with increased experience and improved device technology. **Conclusion:** EVAR has become a favoured alternative to open surgical repair of AAA in many European centers. Further refinements to the technique and devices are ongoing.

Learning Objectives:

1. To learn about etiology, clinical presentation and indications for treatment.
2. To understand which imaging information is required for management of AAA.
3. To learn about the outcomes and drawbacks of stentgrafting.

A-120 09:21

The role of imaging in follow-up

K.A. Hausegger; Klagenfurt/AT (klaus.hausegger@lkh-klu.at)

The goal of surveillance after EVAR is to prevent late rupture of aneurysm. High pressure ELs (type I and type III EL) are risk factors for late rupture therefore have to be treated. Type-II, IV and type V (endotension) ELs are low pressure ELs with a low rupture risk. Thus, it is essential not only to detect ELs but also to classify ELs correctly. Until recently stent graft surveillance has been performed with contrast enhanced multislice CT (MSCT), typically 1, 3, 6 and 12 months after EVAR and thereafter in yearly intervals. However, although MSCT proved to be a very effective in FU cumulative radiation exposure, repetitive contrast medium load and increasing work load have to be seen critically. Therefore, alternative surveillance protocols especially including ultrasound have been evaluated. Several studies have shown that a risk-adjusted follow-up regime might be most efficient. Patients with low risk of aneurysm-related mortality after EVAR have a normal 1- and 6-month MSCT scan and sack shrinkage at 12 months. In these patients regular contrast enhanced US in yearly intervals have been proven to be safe for further FU. A one yearly non-enhanced low-dose CT or a plain film may be recommended to detect distortion or migration of the stent-graft. Patients with a persistent type II EL after one year need to be followed more closely and imaging modality is chosen depending on the character of the EL. In most cases EL classification can be made correctly by MSCT or US; however, sometimes DSA may be needed.

Learning Objectives:

1. To learn about the follow-up imaging strategy.
2. To compare the advantages and limitations of US and CT.
3. To understand the role of MRI.

Panel discussion:

The key role of imaging in endovascular aortic aneurysm repair 09:44

Many patients with aortic aneurysms are currently treated endovascularly. Therefore the number of patients imaged pre and post-procedurally is increasing. Radiologists evaluating aortic aneurysms with different modalities should know the key imaging features to look for in pre-treatment as well as follow-up examinations.

10:30 - 12:00

Room A

ESR meets France

EM 1

From neurosciences to clinical practice

Presiding:

Y. Menu; Paris/FR

J.-P. Pruvo; Lille/FR

A-121 10:30

Introduction

J.-P. Pruvo; Lille/FR (jppruvo@chru-lille.fr)

Neuroimaging is one of the fields of radiology with the most exciting recent advances. Moreover, these advances show dramatically important clinical applications. Some are useful for the specialised neuroradiologist, but most are critical for the general radiologist as well. In this session, we will try to address some of the most relevant issues: white matter disorders are common diseases. Expertise of the radiologist is important in detecting the disease, and in the evaluation of the activity after treatment. With this respect, standardisation of criteria is desirable for appropriate medical decisions. Functional Imaging is a fascinating insight into the human brain. It opens new horizons and has found many applications in the evaluation of psychiatric diseases, and in the planning before treatment of brain lesions, among other potential applications. Although it is obvious that we ignore much more than we know, this field is already one of the most exciting topics in neuroradiology. Although these methods are still in the field of specialists, everybody should be aware of the possibilities of functional imaging of the brain and its recent developments. Stroke is by excellence a clinically relevant problem. Because it is an emergency situation, time really matters, and we have more than one imaging tool to explore these patients, it is mandatory to provide strong recommendations and guidelines for the radiologist, in accordance with the clinical situation and with the treatment options. At the end of this session, the attendees will be aware of important advances in the domain of neuroradiology, and will take home very important landmarks for their own clinical practice.

Session Objectives:

1. To learn how cutting edge research can translate into clinical application in the field of neuroradiology.
2. To understand imaging strategy in common diseases like demyelinating diseases and stroke.
3. To evaluate whether functional imaging of the brain can lead to potential application for clinical practice in the near future.

A-122 10:35

White is white: a simple guide to demyelinating diseases

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

Magnetic resonance imaging (MRI) is the best tool to explore white matter disorders (WMD), including the most common demyelinating disease: multiple sclerosis (MS). The formation of demyelinating lesions is related to an "inflammatory attack". New techniques as diffusion tensor imaging (DTI), perfusion weighted imaging and USPIO enhancing can explore earlier and more specifically lesions formation. Acute demyelinating lesions may resolve (remyelination) or persist as "chronic black holes". Chronic demyelinating lesions lead to axonal injury and Wallerian degeneration. A diffuse neurodegenerative process leading to cerebral atrophy is actually a major landmark in MS. Conventional MRI sequences allows visualisation of white matter lesions (seen as hyper T2/FLAIR lesions, low signal T1 lesions and possible gadolinium contrast enhancement), presently the basis of MS diagnosis. MS follow-up is usually clinic but imaging could provide prognosis and therapeutic parameters ("surrogate markers") even if disease progression and axonal loss are independent from "lesion load". MR spectroscopy, DTI or magnetization transfer imaging (MTI) provide measurement of diffuse tissue damage in clinical research, and may correlate to disease progression, as well as brain volume measurement. After exclusion of alternative diagnosis (MRI "red flags" as other WMD), MRI lesions dissemination in space and time criteria are the main points in MS diagnosis. The widely used revised McDonald criteria may be replaced by more simple and efficient MAGNIMS criteria. Such criteria could allow starting "modifying disease treatments" as soon as the first "clinical isolated syndrome".

Learning Objectives:

1. To understand the MRI-targeted biological landmarks in demyelinating diseases.
2. To know how to classify the appropriate techniques for diagnosis, prognosis, therapeutic evaluation and for clinical research.
3. To understand the input of MRI in the diagnosis of multiple sclerosis.

Interlude (1) 10:55

A-123 11:00

Functional imaging: useful tool for the radiologist or crystal ball for the psychiatrist?

A. Krainik; Grenoble/FR (akrainik@chu-grenoble.fr)

Since blood oxygenation level-dependent (BOLD) signal changes have been observed using MRI and modulated using neuronal stimuli, functional MRI (fMRI) has quickly become the most popular non-invasive functional neuroimaging technique in clinical practice and cognitive neuroscience. Indeed, high-field MR scanners and BOLD-sensitive sequences are now widely accessible in both clinical and research settings. BOLD signal that relies on deoxyhaemoglobin concentration is detectable without injection of external contrast media. The colourful activation maps combined with three-dimensional brain anatomy may have also made this imaging method as much attractive as controversial. Numerous applications of fMRI have been suggested in medicine. After a 15-year long history in clinical practice and thousands of scientific papers even in prestigious journals, the role of fMRI remains mostly dedicated to map eloquent cortex before a neurosurgical procedure. In fact, BOLD fMRI is challenging because the relationship between the neuronal response to a stimulus and the activation blobs relies on neurovascular coupling, haemodynamic response, MR signal detection, and complex time-series analyses. Besides an obvious and partially elucidated complexity, and several concerns on the interpretation of experimental paradigms in cognitive neuroscience, fMRI is based on a robust physiological and physical framework. BOLD signal is reproducible across subjects and MR scanners. fMRI requires a rigorous methodology to acquire and analyse data, an advanced knowledge in sulcogyral and functional neuroanatomy to estimate spatial displacement and reorganisation in patient with focal lesion, and a solid experience in BOLD imaging to distinguish artefacts and potential confounds from appropriate results.

Learning Objectives:

1. To know the key points of quality in fMRI.
2. To know the main pitfalls in fMRI interpretation.
3. To learn more about advances in fMRI of brain perfusion.

Interlude (2) 11:20

also
EPOS

Friday

A-124 11:25

Stroke around the clock: will the challenger (CT perfusion) beat the champion (diffusion MRI)?

X. Leclerc; Lille/FR (xleclerc@chru-lille.fr)

In patients admitted for a suspected stroke, time management is the most important criterion for therapeutic decisions. Less than four hours and a half, all patients admitted in emergency for an acute neurological deficit without impairment of consciousness (NIH < 25) and presented with a brain ischaemia of less than one third of the territory of the middle cerebral artery should receive IV thrombolysis. Brain imaging must exclude bleeding and quantify the extent of ischaemic damages. Between 4.5 and 6 hours after onset of symptoms, intravenous thrombolysis and/or intraarterial mechanical or chemical thrombolysis may be indicated in selected cases. The assessment of ischaemic penumbra and vessel permeability is particularly important for the therapeutic decision. This may be evaluated either by MRI or CT. MRI is the technique of choice that should be used whenever possible because of the absence of irradiation and iodine-related side effects, the optimal anatomical coverage, the detection of lacunar infarct and its sensitivity for evaluating ischaemic brain damages of the posterior fossa. Imaging protocol should include FLAIR (fluid attenuated inversion recovery), T2*, diffusion/perfusion and MR angiographic sequences. In case of unstable patient or if MRI is not available, a non-contrast CT scan must be performed and completed by perfusion CT and CT angiography. The main advantages of this technique are the short time of data acquisition and the absolute quantification of perfusion due to the linear relation between attenuation and concentration.

Learning Objectives:

1. To understand the medical challenges in patients with stroke, and why and when imaging should be performed to decide on a specific treatment.
2. To understand the appropriate protocols for CT and MRI in patients with stroke and to recognise the main results.
3. To learn about the respective possibilities and limits of CT and MRI, their complementarities or concurrence, and to learn whether imaging strategy can be tuned to machine availability.

Panel discussion 11:45

10:30 - 12:00

Room E2

Foundation Course: Paediatric Radiology

E³ 420

Common digestive problems in children: the radiologist as a key player

Moderator:

A. Paterson; Belfast/UK

A-125 10:30

A. Abdominal and pelvic pain: a practical approach

S.G.F. Robben; Maastricht/NL (s.robben@mumc.nl)

Many paediatric abdominal emergencies present with abdominal or pelvic pain. Any delay in diagnosis and treatment may result in death or severe morbidity. These diseases are highly age-dependent. Newborn infants may have congenital diseases as Hirschsprung's disease or meconium ileus or may develop necrotising enterocolitis, incarcerated inguinal herniation and midgut volvulus. Infants and preschool children have intussusceptions, urinary tract infections and (rare) haemolytic uremic syndrome. Children and adolescents have appendicitis, genito-urinary infections, ovarian torsion and Henoch Schonlein purpura. Considering radiation dose in children and the excess value of ultrasonography (US) in small individuals, US plays an important role as initial diagnostic modality in paediatric patients with abdominal pain. Sensitivity and specificity for US in diagnosing intussusception, midgut volvulus, urinary tract abnormalities and appendicitis is over 90%. Conventional abdominal radiographs or fluoroscopy is valuable in Hirschsprung's disease, meconium ileus, malrotation and necrotising enterocolitis. I consider CT as an additional technique when the initial techniques (US and conventional radiography) are inconclusive. MRI is seldom indicated in paediatric patients with abdominal emergencies because of motion artefacts in anxious children and sometimes limited MR capacity. Delay in diagnosis of the above-mentioned diseases may be devastating, ranging from life-long disability to death. Therefore, it is important to consider these diagnoses and to initiate prompt adequate diagnostic work-up.

Learning Objectives:

1. To learn about the common causes of abdominal pain in children.
2. To understand the importance of ultrasonography and to learn when CT or MRI might be required.
3. To learn about issues relating to radiation dose in the paediatric abdominal and pelvic CT.

A-126 11:00

B. Jaundice in children: common causes and imaging strategy

D. Pariente; Le Kremlin-Bicêtre/FR (daniele.pariente@bct.aphp.fr)

Jaundice is rare in children but imaging has a major role to establish the cause which differs according to age. In the neonatal period the leading cause is biliary atresia (BA) which consists of the obliteration of the extrahepatic bile duct (BD) without dilatation of intrahepatic BD and requires urgent surgical treatment to reduce the need for liver transplantation. BA must be considered when there are persistent white acholic stools and firm hepatomegaly. US shows the absence of dilated BD and in a few cases a cyst at the porta hepatis or findings of the splenic malformation syndrome, but often it is not conclusive. MRCP has not yet proved to be reliable for the diagnosis of BA. Other neonatal cholestases include medical intrahepatic causes which can be identified by biological tests or histological findings and rare causes of extrahepatic obstruction with dilated BD such as lithiasis, choledochal cyst or spontaneous perforation of BD. In childhood, US easily identifies all causes of extrahepatic obstruction by showing dilated BD; the main causes include choledochal cyst (the most frequent congenital malformation, defined by an abnormally long common bilio-pancreatic channel), cholelithiasis, tumoural compression, sclerosing cholangitis, portal vein obstruction, postsurgical or post-traumatic stenosis... In all these cases, in our experience, MRCP has become the modality of choice and has replaced invasive procedures which are nowadays reserved for treatment. MDCT may be useful in rare instances, for example, to differentiate calculi and aerobilia after surgery. Imaging protocols and illustrative cases will be presented.

Learning Objectives:

1. To learn the common causes of jaundice in the various paediatric age groups.
2. To learn about the imaging strategies.
3. To become aware of complications following therapy and their investigation.

A-127 11:30

C. Neonatal bowel obstruction: the role of the radiologist

S. Ryan; Dublin/IE (stephanie.ryan@cuh.ie)

Neonatal bowel obstruction generally presents within hours of birth. The diagnosis of bowel obstruction is clinical but imaging is vital to determine the cause. The plain radiograph will distinguish upper from lower intestinal obstruction. The radiograph alone is diagnostic in duodenal atresia and jejunal atresia and the baby may be taken directly to surgery. If the radiograph shows multiple dilated loops of bowel, more than 4 loops, then the obstruction is distal ileal or colonic. The radiograph may give some clues as to the possible cause, such as a large fluid level in the dilated loop proximal to an atresia. Contrast enema, usually with low osmolar water soluble contrast, is used in most cases, however, to determine the cause of lower intestinal obstruction because the management of this is different for different causes of obstruction. Meconium ileus and ileal atresia are the commonest ileal causes of obstruction and Hirschsprung's disease and meconium plug syndrome are the commonest colonic causes of obstruction. Colonic atresia is rare and imperforate anus is a clinical diagnosis. Radiologically guided reduction is used to treat meconium ileus. Intestinal obstruction in the older neonate may be due to volvulus, pyloric stenosis, duodenal stenosis or omphalomesenteric band. In the baby born prematurely, obstruction may be caused by stricture secondary to necrotising enterocolitis. Radiographs and contrast studies are also used to evaluate these conditions.

Learning Objectives:

1. To learn about the most common causes of neonatal obstruction.
2. To understand the role of plain radiography in establishing the diagnosis.
3. To know when upper and lower GI contrast studies are indicated and the contrast medium used.

12:15 - 12:45

Room A

Plenary Session

HL 1

Josef Lissner - Honorary Lecture

Presiding:
Y. Menu ; Paris/FR

A-128 12:15

The chest radiograph: a perfect design

J. Cáceres; Barcelona/ES (josecac@gmail.com)

Over the past years, diagnostic imaging has witnessed a veritable explosion in the modalities available for studying patients. When applied to the study of the thorax, they contribute to earlier detection of abnormalities and greater diagnostic accuracy. Yet, the conventional radiographic examination of the chest continues to be the most commonly performed imaging study and, when properly interpreted, continues to demonstrate a wealth of information. For a correct interpretation of the chest radiograph, several premises should be met by the radiologist: a proper knowledge of the anatomy and semiology of the thorax, stressing the need for a lateral projection, understand the importance of reviewing previous studies and try to avoid unnecessary cross-sectional studies.

Learning Objectives:

1. To understand how to re-evaluate the role of the chest radiograph in diagnostic imaging.
2. To review basic principles of interpretation.
3. To understand the importance of the lateral projection and of previous studies.

14:00 - 15:30

Room E2

Foundation Course: Paediatric Radiology

E³ 520

Thoracic diseases: common, important and potentially devastating

Moderator:
C.E. de Lange; Oslo/NO

A-129 14:00

A. Investigating a child with a "cough": a pragmatic approach

C.M. Owens, S. Cacaci; London/UK (owensc@gosh.nhs.uk)

This lecture will address the radiological approach to imaging children of all age groups presenting with cough. This is a common symptom with very diverse causes, from acute viral infection to complex vascular and intrinsic congenital tracheal anomalies and can be the presenting symptom of acute (rapidly fatal if not managed adequately) and chronic effects of foreign body aspiration. The various causes of cough vary with age and whether cough is acute, sub-acute or chronic. This has effects on radiological investigations deployed, and thence on subsequent clinical management. We will present a pragmatic approach to radiological investigations in this diverse set of patients, using simple algorithms and illustrate the more important (and often rarer) causes of cough with discussion around deployment of examinations that are fit for purpose using ALARA principles. Guidance on imaging algorithms and CT technique will be given to children with this important presenting symptom of myriad diverse pathological processes. The attendee will learn the value and optimal use of imaging with tips on optimising CT technique as fit for purpose.

Learning Objectives:

1. To learn about the differential diagnoses in the very young child and in older children.
2. To learn which imaging modalities best help to determine the final diagnosis in the various age groups.
3. To understand radiation protection requirements in chest CT examinations.

A-130 14:30

B. Unresolving pneumonia: when and how to image, and clinical consequences

K. Foster; Birmingham/UK (katharine.foster@bch.nhs.uk)

Pneumonia is a common cause of attendance to hospital. Chest infections in children are usually viral and self limiting, but sometimes chest infections can be prolonged or repeated. There are many underlying causes for this, for example, congenital anatomical causes, underlying patient susceptibility, inhaled foreign bodies and unusual organisms. One of the more common causes seen in hospital is when pneumonia has become complicated by empyema. Very rarely other conditions such as Kawasaki's disease or tumours can masquerade as pneumonia. This session will review these conditions together with the benefits and limitations of plain radiography. It will also consider times when other imaging modalities such as CT and ultrasound can help to guide diagnosis and treatment.

Learning Objectives:

1. To learn about the role of plain radiography.
2. To learn about the value of ultrasonography and to outline the instances when CT is helpful.
3. To be aware of the complications and how the radiologist can contribute to management.

A-131 15:00

C. Common cardiac disorders in children: the basic role of imaging

C.J. Kellenberger; Zurich/CH (christian.kellenberger@kispi.uzh.ch)

In children, congenital heart disease (CHD) is more frequent than acquired heart disease. Diagnosis and subsequent management of patients with CHD relies heavily on different and often multiple complementary imaging modalities. Serial assessment of the morphology and function of the heart and thoracic vessels is needed at various stages of care. Although chest radiography is frequently used for monitoring the cardiorespiratory status and complications that may arise during clinical care or intervention, it rarely provides a complete diagnosis. Echocardiography, as first line imaging modality, often provides all information required for diagnosis and follow-up, especially in small children with good acoustic windows. Contrast-enhanced computed tomography (CT) and magnetic resonance (MR) imaging are valuable for detailed three-dimensional evaluation of the extracardiac vasculature and cardiac anatomy. In addition to being radiation free, MR has the advantage to provide both morphologic and functional information with the use of different techniques including ECG gated gradient-echo cine imaging, gadolinium-enhanced angiography and velocity-encoded phase-contrast imaging. A comprehensive MR evaluation including quantitative measurements of ventricular volumes and function as well as blood flow in vessels and across valves can give important information on long-term sequelae of the underlying cardiac defect, the significance of residual lesions, and potential complications of surgery. It is also valuable for planning and timing of future interventions. Today, CT and MR have become the next line of investigation when echocardiography does not provide sufficient information, while catheter angiography is reserved for the assessment of coronary arteries, measurements of pulmonary vascular resistance and interventional procedures.

Learning Objectives:

1. To learn whether plain radiography still plays a role in diagnosis.
2. To become familiar with the technique of cardiac CT and when best to use it.
3. To learn when MRI should be used and the sequences required.

14:00 - 15:00

Room Z

The Beauty of Basic Knowledge: Interpretation of the Chest

Radiograph

MC 21B

Lobar collapse

A-132 14:00

Lobar collapse

J. Cáceres; Barcelona/ES (josecac@gmail.com)

It is important to recognise lobar collapse in the chest radiograph, because it is often caused by bronchogenic carcinoma. A hilar mass and lobar collapse are findings strongly suggestive of a primary tumour. The most common signs of loss of volume of a lobe are increased opacity of the affected lung, displacement of fissures, displacement of the hilum and elevation of diaphragm. Imaging findings vary depending of the affected lobe.

Learning Objectives:

1. To learn the signs that identify lobar collapse.
2. To learn specific signs applied to different lobes.
3. To understand the significance of lobar collapse in the adult.

16:00 - 17:30

Room A

New Horizons Session

NH 6

Not just Hounsfield numbers: CT aimed at the fifth dimension?

Moderator:

J.M. Boone; Sacramento, CA/US

A-133 16:00

Chairman's introduction

J.M. Boone; Sacramento, CA/US (jmboone@ucdavis.edu)

Computed tomography (CT) systems have provided three-dimensional (x, y, z) data since their clinical introduction in the 1970s. This session will address the extension of CT imaging into the fourth and fifth dimensions. The rapid acquisition capabilities of modern CT scanners open the door to the fourth dimension - time - where a time-course CT scan can provide clinical information about blood flow, perfusion and other physiological measures regarding organ function. The door to the fifth dimension - energy - is opened by dual energy image acquisition techniques, which are made possible by dual source CT scanners or rapidly switching x-ray source CT scanners. Dual energy CT images can be manipulated to provide quantitative information with regard to the elemental composition of tissues, which, in turn, can be used to differentiate between bone and iodine contrast, with many other applications possible as well. Modern CT scanners now provide multidimensional data sets characterised as $I(x, y, z, t, E)$, and the additional information provided by these five-dimensional data sets provide genuinely useful clinical information which add to the diagnostic potential of computed tomography.

Session Objectives:

1. To learn about CT capabilities beyond just imaging.
2. To better understand dual energy CT capabilities.
3. To better understand the potential of CT perfusion.

A-134 16:05

Basic principles of dual energy CT

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

X-ray computed tomography (CT) usually measures the attenuation of the patient or object cross-section in question at a fixed chosen voltage value; the result is presented as the linear attenuation coefficient μ expressed in Hounsfield units (HU). Dual energy CT (DECT) acquires data at two different mean energies and evaluates the differences in attenuation. Dual energy CT imaging has been a topic since the 1970s. The acquisition modes have changed over the years from two separate scans at different voltages to single scans with rapid kV-switching, and dual source CT operating with different voltages and pre-filtrations. These concepts will be explained in detail including future options of energy-discriminating detectors. The basic physics principles remain the same for all acquisition schemes. The two independent measurements allow separating two tissue characteristics contributing to attenuation. For example, low and high effective atomic number material densities can be determined in the so-called basis material decomposition. Arbitrary combinations such as monoenergetic or electron density and effective atomic number images can then be provided. These will be illustrated and explained by examples such as differentiation between plaque and contrast agent or virtual unenhanced abdominal organ imaging. DECT meanwhile offers quite a number of accepted clinical applications which will be covered in a separate talk.

Learning Objectives:

1. To learn the basic principles of dual energy imaging.
2. To learn the acquisition modes of dual energy imaging in CT.
3. To better understand the dose consequences of dual energy CT.

A-135 16:28

Clinical examples of dual energy CT

L.S. Guimarães; Viseu/PT (luis.s.guimaraes@gmail.com)

Dual energy (DE) computed tomography (CT) allows the discrimination of different materials, which has several clinical applications. The ability to differentiate calcium from uric acid renal stones allows the identification of patients that will benefit from drugs that alkalise urine. A musculoskeletal application of the same technique is in tophaceous gout, where the crystals can be differentiated from bone. Post-processing of CT angiography images can be facilitated using DE techniques to identify and remove the calcium signal. Such an approach removes both bones and calcified plaques. "Virtual non-contrast" images can be obtained by identifying and removing the iodine-containing voxels of contrast-enhanced CT images, simulating non-contrast images and potentially eliminating the need for some non-contrast acquisitions, but it should be realised that small misclassifications could result in missing tiny caliceal tip stones, for example. DECT also allows the utilisation of low energies without the prejudice of unacceptable noise. Since iodine signal is significantly higher at low energies, disease conspicuity can be improved. This is particularly beneficial in the liver (for hepatocellular carcinoma identification), in the pancreas (for visualisation of hypo- and hypervascular lesions), and in enterography (to increase the identification of hyperenhancement). The approach for displaying the enhanced iodine signal may be one of blending information from the two energies (into a single grey-scale image), or via an iodine-only view. Further validation of dual energy techniques and their limitations is needed to understand the patient populations in which such techniques can be utilised and where conclusions based on dual energy data can be trusted.

Learning Objectives:

1. To learn about the clinical applications of dual energy CT imaging.
2. To learn about the value of clinical applications in diagnosis.
3. To better understand the clinical situations where dual energy CT should be used.

A-136 16:51

CT contrast perfusion

K.A. Miles¹, V.J. Goh²; ¹Brighton/UK, ²Northwood/UK (gohmclg@hotmail.com)

CT perfusion imaging is a quantitative technique that employs rapid sequences of CT images after bolus administration of intravenous contrast material to measure a range of physiological processes related to the microvasculature of tissues. CT perfusion parameters can provide surrogates for tissue hypoxia as well as the physiological processes such as vasodilatation that represent vascular responses to hypoxia. Although the basic techniques for DCE-CT have been available for decades, more recently a range of technological advances have contributed to the greater applicability of perfusion CT in the clinical environment including wider CT detectors, shorter gantry rotation times, 'table-toggling', radiation dose reduction and software corrections for image mis-registration due to respiratory or other patient motion. Consensus guidelines are now available for the acquisition and processing of CT perfusion studies for the brain and body. To date, the main applications of CT perfusion imaging in stroke have been the confirmation of stroke diagnosis and extent, identification of penumbra and selection of patients for thrombolysis. The main applications in oncology have been in lesion characterisation, risk-stratification and assessment of treatment response.

Learning Objectives:

1. To learn about how CT contrast perfusion is performed technically.
2. To better understand the clinical data the perfusion provides.
3. To have a good understanding of the most important applications of CT perfusion.

Panel discussion:

Will CT surprise us again? 17:14

What clinical situations benefit from dual energy or contrast perfusion imaging? Can contrast perfusion imaging benefit from dual energy techniques? What are the three most important clinical applications of DE and CT perfusion imaging?

16:00 - 17:30

Room B

Interactive Teaching Session

E³ 620a

Cancer of the uterus and cervix: what the radiologist must report

A-137 16:00

Cancer of the uterus and cervix: what the radiologist must report

B. Hamm¹, H. Hricak²; ¹Berlin/DE, ²New York, NY/US (bernd.hamm@charite.de)

MR imaging is the method of choice for staging uterine malignancies. The main criterion for local staging of endometrial cancer is the depth of myometrial invasion. Diagnostic accuracy can be improved by performing a dynamic contrast-enhanced study in addition to T2-weighted imaging. Staging of cervical cancer is based on high-spatial-resolution axial and sagittal T2-weighted imaging, on which invasion of the parametrium can be assessed with a high degree of accuracy. Especially for cervical cancer, MR imaging can replace numerous other diagnostic tests and allow more accurate pre-treatment staging while reducing costs. In addition, MR imaging is used in planning radiotherapy and in post-radiotherapy follow-up. Lymph node staging on MR lymphography remains unreliable and may potentially be improved by the addition of diffusion-weighted imaging.

Learning Objectives:

1. To become familiar with imaging features in staging cervical and uterine cancer.
2. To understand the impact of imaging on modern patient treatment.
3. To understand the imaging findings on follow-up.

16:00 - 17:30

Room C

ESR meets Gastroenterologists

EM 2

Optical and virtual colonography: friends or enemies?

Presiding:

R. Hultcrantz; Stockholm/SE
Y. Menu; Paris/FR

A-138 16:00

Chairmen's introduction

R. Hultcrantz¹, Y. Menu²; ¹Stockholm/SE, ²Paris/FR (Rolf.Hultcrantz@ki.se)

Colonoscopy is a very useful and important method to examine the colon. In recent years virtual colonoscopy has become a popular alternative to optical colonoscopy. Disorder of the colon includes colorectal cancer, which is one of the most common cancers worldwide and presents a threat to life since the mortality is almost 50%. Colorectal cancer screening has been shown to be an efficient method to find early forms of colorectal cancer and also to reduce mortality in this disease. In this session we will discuss the various methods used to examine the colon, how useful they are and the economy behind using them.

Session Objectives:

1. To understand the respective roles of OC and VC in colorectal diseases.
2. To become familiar with technical innovations and new diagnostic opportunities offered by OC.
3. To understand the clinical value of VC.

A-139 16:05

Facts from the statistician (true for once?): incidence, prevalence, rationale for screening, standard results of optical colonoscopy

U. Haug; Heidelberg/DE (u.haug@Dktz-Heidelberg.de)

Facts from the epidemiologist: Incidence, prevalence, rationale for screening, standard results of optical colonoscopy. Colorectal cancer (CRC) is the third most common cancer in the world, with about 1 million new cases and more than 500,000 deaths per year. Incidence of CRC strongly increases by age and is higher in men than in women. The lifetime risk differs between countries and is about 7% in the United States. Because most cases of CRC develop from removable precancerous

lesions (adenomas) and curable early-stage cancer, screening for CRC has high potential for reducing incidence and mortality of the disease. Nevertheless, the benefit of population-based CRC screening needs to be weighed against potential risks, psychological distress and required resources since only a minority of the population develops the disease and may thus benefit from screening. Several industrialised countries offer faecal occult blood testing as a primary screening tool, with positive test results being followed up by colonoscopy. Some countries, such as the United States and Germany, also offer colonoscopy as a primary screening tool. While the results of randomised controlled trials regarding screening colonoscopy are still outstanding, there is evidence from observational studies that support its effectiveness in population-based CRC screening. Recent evidence suggests that colonoscopy, when performed in the community setting, is more effective in protecting from neoplasms in the left colon and rectum than in the right colon. Decision-analytic models support the (cost)-effectiveness of screening colonoscopy but results vary, among others, according to compliance, (country-specific) cost estimates and screening schedules.

Learning Objectives:

1. To learn about the incidence and prevalence of colorectal cancer and its precursors in the target population of screening.
2. To understand the rationale for colorectal cancer screening.
3. To become familiar with estimated (cost) effectiveness of colorectal cancer screening when using optical colonoscopy as a primary screening tool.

A-140 16:23

Facts from the statistician (true for once?): how accurate is CT colonography

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

The issue of diagnostic accuracy of CTC for CRC and polyps has been debated for a long time, because of the conflicting results published in the literature. Those results led researchers to design three important studies: two large, multicenter trials testing the performance of CTC in comparison with CC in asymptomatic individuals (ACRIN and IMPACT) and one randomised, double-arm trial (SIGGAR) conducted on symptomatic patients with the aim to detect CRC. Both the ACRIN and IMPACT reported per-patient sensitivity of 90% for polyps > 10 mm and 78-84% for polyps larger than 6 mm; per-patient specificity was extremely high, over 85%, independent of lesion size. The major drawback of the ACRIN was represented by the poor positive predictive value (PPV) (23% for polyps ≥10 mm); a definitely better PPV was documented in the IMPACT trial (62% for lesions larger than 6 mm) as well as in studies obtained in high-experienced centers. However, the negative predictive value in both the ACRIN and the IMPACT was rather high, approaching 100%; this is extremely important in order to reassure negative patients about the significance of the examination. Excellent results were also obtained in the Munich Colorectal Cancer Prevention Trial, a single-center study where around 300 asymptomatic subjects underwent low-dose CTC in comparison with other screening tests (CC, sigmoidoscopy and FOBT). Despite the good results there are still some open issues: the significance of diminutive (< 6 mm) polyps, the management of intermediate (6-9 mm) lesions and the detection rate for non-polypoid, flat lesions.

Learning Objectives:

1. To learn data from meta-analysis on VC accuracy.
2. To become familiar with the results of recent multi-centre trials.
3. To understand the performances of VC on the identification of small polyps and non-polypoid lesions.

A-141 16:41

When optical beats virtual

J.F. Riemann; Ludwigshafen/DE (riemannj@garps.de)

Optical colonoscopy is the gold standard in detecting and removing precancerous lesions and early colon and rectal cancer. Sensitivity and specificity of the procedure are over 95% up to 100%. The new HD-TV colonoscopes with additional virtual chromoendoscopic techniques such as NBI, FICE or iSCAN significantly have improved the precise diagnosis prior to histology. These improvements not only enable the gastroenterologist to completely excise lesions with sophisticated new resection techniques (EMR, ESR) but also let him predict the final pathology according to internationally accepted classifications (i.e. Kudo's classification for polyps). Limitations of optical colonoscopy are due to "blind" regions of the colon (both flexures), poor bowel cleansing and inexperienced examiners. Withdrawal time and adenoma detection rates are further quality markers for a sufficient colonoscopy. The acceptance rate of the screening colonoscopy is limited due to several reasons one of the most important being the opportunistic way of the invitation. Interval cancers play an important role if one or more of the described quality parameters fail. Further technical improvements like broadening of the field

of view and the "Third Eye" colonoscope are under investigation. At the moment, however, the combination of both, exact diagnostic and sufficient therapeutic action at the same time, is the reason why optical beats virtual in this particular indication.

Learning Objectives:

1. To learn about the precise diagnostic and therapeutic options concerning early colorectal cancer and its precursor lesions.
2. To understand the technical progress of the newest generation of colonoscopes.
3. To become familiar with the few limitations of the procedure.
4. To consolidate knowledge of the most important diseases of the large bowel.

A-142 16:59

When virtual beats optical

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

Since its evolution CT colonography has been advocated as a safe well tolerated alternative to colonoscopy, particularly in the context of colorectal cancer screening. Notably perforation rates are lower than those of colonoscopy and cardiovascular effects are less. However, patient preference studies have produced mixed results and it is not clear if standard CTC will increase compliance with screening. Furthermore, issues over apparent inferior sensitivity for polyp detection compared to colonoscopy, need for prolonged radiologist education and radiation dose exposure have been cited as barriers to widespread implementation in a screening context. Technical developments in recent years are beginning to address these issues. Use of reduced laxative regimens supplemented with faecal tagging have shown good results with superior patient acceptability. Software developments have also speeded up dataset analysis -notably panoramic or "virtual pathology" 3D views reducing or eliminating hidden areas within the colon. Furthermore, computer-aided detection software is increasingly fit for purpose and good data show a positive effect on radiologist performance both in the research setting and day to day clinical practice. This presentation will review the data on patient preference and safety and highlight developments in those areas in which CTC holds advantages over conventional endoscopic techniques. Discussion will focus not only on colon cancer screening but also the on data supporting CTC in older symptomatic patients who are at higher risk of adverse events during colonoscopy.

Learning Objectives:

1. To review the patient safety of CT colonography and conventional colonoscopy.
2. To review advanced computer techniques for maximising visualisation of the colon during CT colonography including 3D visualisation methods and computer aided detection.
3. To review the data on CT performance with particular emphasis on patient-friendly reduced laxative regimens.
4. To consider patient preference data.

Panel discussion:

Integrated strategy? What about the outsiders (capsule, DNA, PET, ...) 17:17

16:00 - 17:30

Room D1

KISS (Keep It Simple and Straightforward): Musculoskeletal MRI

CC 616

The knee

Moderator:

J. Labuscagne; Bunbury, WA/AU

A-143 16:00

A. How I do it

A. Barile; L'Aquila/IT (antonio.barile@cc.univaq.it)

MRI of the knee has to be performed with patient in supine position with knee in semiflexion (15-20°). The use of a dedicated coil is mandatory. Standard exam include: (a) spin echo (SE) T1 or proton density (PD)-weighted sequence in sagittal plane to evaluate menisci and cruciate ligaments; (b) SE T1-weighted sequence in coronal plane to evaluate marrow and anatomy; (c) dual-echo T2/DP in axial plane to evaluate lateral and medial supporting structures, patella and the location of fluid collections; (d) a fat-suppressed sequence short tau inversion recovery (STIR) or fast spin echo (FSE) T2-weighted in a coronal plane to easily detect marrow oedema. For the evaluation of anterior cruciate ligament (ACL) a PD sequence with or without fat saturation could be performed in a sagittal-oblique plane parallel to the orientation of ACL. For the evaluation of the postero-lateral

stabilisation complex system a dual echo T2/DP sequence could be performed in a sagittal-oblique plane drawing an imaginary line which on an axial image used as reference plane, is done perpendicular to popliteous tendon. Gradient echo (GE) sequences are useful in cartilage and traumatic pathology. T2-weighted sequences underestimate cartilage thickness since cortex and cartilage have the same signal. PD sequences may have the similar signal for cartilage and adjacent joint fluid, obscuring defects; fat suppression solves this. If available, acquisitions performed in orthostatism could give further information in the assessment of meniscal and patello-femoral pathology.

Learning Objectives:

1. To understand the influences of patient positioning, scan parameters and magnet/coil technology on image quality.
2. To learn how to optimise scan protocols to maximise patient throughput without compromising diagnostic quality.
3. To recognise how and when to modify scan protocols to answer specific clinical questions.

A-144 16:25

B. Normal variants and pitfalls

S.J. Eustace; Dublin/IE (seustace@iol.ie)

This talk will review appearances of normal anatomic variants identified at MRI of the knee including discoid meniscus, transverse meniscal ligaments meniscal flocce, ossicles, and pseudotears. Subsequently the talk will focus on diagnostic pitfalls reflecting both imaging technique and variations in anatomy such as the effect of motion, imaging plane and anatomic variations in patella shape.

Learning Objectives:

1. To become familiar with the normal anatomy.
2. To be able to identify normal variants.
3. To appreciate the range of pitfalls that may simulate pathology.

A-145 16:50

C. Identifying and reporting abnormal findings

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

MRI of the knee is one of the most frequent performed investigations, thus indicating that common abnormalities need to be familiar to the general radiologist. A simple and straightforward method of enabling assessment of clinically relevant anatomical entities is based upon a (pre)structured radiology report. Use of speech recognition facilitates implementation of pre-structured reporting in a KISS manner. Since one now is enabled to structure the report, using digital tools, terminology used should be discussed between the reporting radiology department and the clinical partners. It is mandatory that the important message, the clinical relevance of the information that radiologists put in their report, is understood by the referring clinician in the same manner as it was meant to be. We should consider the background of our referring physician, and tailor our report, both in chosen terminology as well as detailed information. When working in a centre in which both specialised orthopaedic surgeons as well as general practitioners (GPs) or sports physicians are referring for MRI, each of the three needs a tailored report, especially considering advice for secondary referral: GPs and sports physicians will need different approach, compared to medical specialists. Also, the knowledge of terminology used should be considered. The presentation focuses on common encountered pathologies, considering common abnormalities. Emphasis is given to common abnormalities, and pitfalls that should be dealt with. Some sports specific entities are discussed. Implication of clinical correlation is stressed. The presentation will include case-based clinical illustrations.

Learning Objectives:

1. To review the imaging appearances of common abnormalities.
2. To understand the use of terminology to describe pathological findings.
3. To learn how to structure a radiological report to ensure clarity and brevity.

16:00 - 17:30

Room D2

Interventional Radiology

RC 609

RF ablation beyond the liver

Moderator:

A. Adam; London/UK

A-146 16:00

A. RF ablation in bone

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

The purpose of this refresher course is to demonstrate bone ablation. The main aim of thermal tumour ablation is to destroy the tumour using ionic movement to kill the malignant cells without damaging adjacent vital structures. Multiple sources of energy have been used to induce cell death. RF energy is an electromagnetic one. Radio waves emanate from the non-insulated distal portion of the electrode. Heat is produced by resistive forces (i.e., ionic agitation) surrounding the electrode as the radio waves attempt to find their ground. Other type of ablations (using different wave lengths) include microwave, electroporation, laser and radiofrequency ablation is still seeking its place among bone interventional techniques. This presentation is an overview, in an area of non-vascular interventions in the spine and the appendicular skeleton. It will explain the patient selection, indication and possible approaches to a bone lesion. Available material will be discussed, as well as possible combinations of them in order to yield maximum results, while reducing possible drawbacks.

Learning Objectives:

1. To learn about indications, patient selection and preprocedural imaging.
2. To understand the technique.
3. To review the results and complications.

A-147 16:30

B. RF ablation in the kidney

M.A. Farrell; Waterford/IE (michaela.farrell@hse.ie)

Over the last two decades, open nephron sparing surgery has become the preferred surgical alternative to nephrectomy for treatment of patients with a single, small (< 5 cm) localised renal mass and a normal contralateral kidney. Because 25-49% of newly diagnosed small renal masses are identified incidentally on cross-sectional imaging, often in elderly patients, less invasive surgical nephron sparing alternatives have been advocated, including laproscopic partial nephrectomy and laproscopic cryoablation, for select tumours in an effort to reduce surgical mortality and morbidity while preserving renal function. Percutaneous image-guided ablation offers potential advantages over surgical methods including the minimally invasive nature of the procedure, less mortality and morbidity than surgery, shorter hospital stay, and quicker recovery. Local tumour control rates of up to 95% have been reported for small tumours. Central tumours and tumours greater than 3 cm in diameter are more difficult to successfully treat with local tumour progression occurring 25% of central tumours. Tumours larger than 3 cm in diameter typically require overlapping ablations and incomplete treatment can result from residual tumour at the ablation interfaces. While in some reports, local tumour progression occurred in up to 20% of tumours larger than 3 cm, in contrast, others have shown that all exophytic tumours, despite their size, can successfully be treated using multiple overlapping ablations and complete treatment may require more than one ablation session. The most clinically relevant and potentially avoidable complication is ureteral injury with resultant obstruction of the intrarenal collecting system.

Learning Objectives:

1. To learn about indications and patient selection.
2. To become familiar with currently available therapeutic alternatives.
3. To review the results of RF ablation compared with other treatments.

A-148 17:00

C. RF ablation in the chest

I. Bargellini; Pisa/IT (irenebargellini@hotmail.com)

Percutaneous image-guided radiofrequency ablation (RFA) represents as a safe and effective minimally invasive procedure in selected patients with unresectable or medically inoperable lung malignancies. When adequately performed, in selected patients, the procedure is associated with over 95% immediate technical success rate and relatively low incidence of major (8-15%) and minor complications (20-40%). Pneumothorax represents the most frequent complication (up to 60%) but

requires chest tube drain in less than 10% of cases. Sustained complete tumour response has been reported in about 85-90% of the target lesions; lesion size represents the most important risk factor for tumour local recurrence. Data regarding long-term survival are now being published, reporting promising outcomes. According to the RAPTURE study, the 2-year cancer-specific survival was 73% in patients with NSCLC, 68% in patients with colorectal metastases, and 67% in patients with other metastases, with corresponding overall survival rates of 48%, 66% and 64%, respectively. The use of RFA in combination with systemic chemotherapy for lung metastasis is now under investigation. Initial results report about 30% 5-year survival rate in patients with colorectal metastasis. The association between RFA and radiotherapy should also be considered in selected patients.

Learning Objectives:

1. To learn about indications and patient selection.
2. To understand the technique and complications.
3. To review the results of RF ablation to date.

16:00 - 17:30

Room E1

Musculoskeletal

RC 610

Metabolic bone diseases

Moderator:

J. Freyschmidt; Bremen/DE

A-149 16:00

A. Metabolic bone disease for the practicing radiologist

M. Sundaram; Cleveland, OH/US (sundarm@ccf.org)

Osteoporosis, osteomalacia, hyperparathyroidism and Paget's disease have conventionally been considered the disease entities that comprise metabolic bone disease. The lecture will follow this convention and discuss the imaging characteristics that suggest osteoporosis in the elderly or anorexia nervosa in younger patients by the distribution of fractures and marrow changes as well as the role of bone mineral density evaluations in osteoporosis. Oncogenic osteomalacia will be discussed in the context of appropriate imaging for detecting the tumour and emphasise the basic biochemical abnormality that most radiologists should be familiar with that leads to the diagnosis. Radiologists most frequently encounter hyperparathyroidism in renal osteodystrophy with over a million patients worldwide kept alive by dialysis. Dialysis-induced imaging changes such as amyloid and the spectrum of findings from long-term dialysis will be shown and demonstrated. Paget's disease is on the decline. Its distinctive MRI signal characteristics in uncomplicated cases, in contrary to most bone lesions encountered in clinical practice, will be explained.

Learning Objectives:

1. To get an overview of the entities that are considered in the realm of metabolic bone disease.
2. To understand common, less common and rare findings.
3. To learn about some imaging findings that occur as a consequence of treatment.

A-150 16:30

B. Latest advance in osteoporosis

C.R. Krestan; Vienna/AT (christian.krestan@meduniwien.ac.at)

Osteoporosis is of great socioeconomic impact, as approximately 30% of all postmenopausal women have osteoporosis in developed countries. Ageing of populations worldwide will be responsible for a major increase of the incidence of osteoporosis in postmenopausal women. In 1994, the WHO Working Group defined osteoporosis according to measurements of bone mineral density (BMD) using dual energy x-ray absorptiometry (DXA) as a bone density T score at or below 2.5 standard deviations (T score) below normal peak values for young adults. The relative risk of a fracture is between 1.3 and 1.6 for each unit decline in spine or total hip T score. Due to limitations of the T-score concept a 10-year risk calculating tool has been developed by the WHO to determine intervention thresholds. Fragility fractures are, however, not only related to bone mineral density (BMD). Trabecular bone microarchitecture is a significant determinant of the bone's mechanical properties and is thus of major clinical relevance in predicting fracture risk. Trabecular bone structure analysis can be based on images from multidetector computed tomography, high-resolution peripheral computed tomography, high-resolution MRI and projection radiography. Advantages and disadvantages of the different methods depend on radiation, costs, availability and a reasonable time for in vivo scanning. Grading of vertebral fractures can be done using a visual

semiquantitative scoring method. Vertebral morphometry is based on radiographs or scans from DXA-machines calculating ratios of vertebral heights with normal values to identify vertebral fractures.

Learning Objectives:

1. To become familiar with what the radiologist ought to know about the WHO definition of osteoporosis and vertebral fracture risk.
2. To understand the standard techniques and newer diagnostic techniques that provide insights into the structure of trabecular bone.
3. To analyse the pros and cons of these techniques.
4. To describe methods of grading and quantitative morphometric assessment.

A-151 17:00

C. Rickets, osteomalacia, hyperparathyroidism and renal osteodystrophy

J.E. Adams; Manchester/UK (judith.adams@manchester.ac.uk)

Diagnostic imaging features of rickets relate to defective osteoid mineralisation & include widened growth plates, splayed/poorly mineralised metaphyses (rachitic rosary) with bone softening (tri-radiate pelvis, deformity of long bones [bow legs, knock knees, varus/valgus deformity femoral neck]). In adults diagnostic feature is Looser's zone (linear radiolucency, perpendicular to cortex, sclerotic margins), which occur most commonly: medial femoral neck, pubic rami, lateral scapular borders & ribs. If cause of rickets/osteomalacia is vitamin D deficiency (nutritional, lack of sunlight, malabsorption, chronic liver/renal disease) or low calcium intake, low serum calcium stimulates secondary hyperparathyroidism (2HPT)(check for sub periosteal cortical erosions lateral margins middle phalanges 2nd & 3rd fingers). Other causes (hypophosphataemia, 'oncogenic', low alkaline phosphatase [hypophosphatasia] and severe acidosis) will not have 2HPT. Primary HPT (third most common endocrine disorder after thyroid disease & diabetes): 80% due to PTH adenoma, 15% to genetically-determined multiple endocrine abnormalities [MEA] syndromes & 5% PTH carcinoma. Imaging features include bone cysts [brown 'tumours'], chondrocalcinosis, nephrocalcinosis, renal calculi & superiosteal erosions. As diagnosis often made on raised serum calcium with asymptomatic/mild disease there may not be any diagnostic imaging features present. Chronic kidney disease (CKD) results in azotaemic osteodystrophy (AZO), a complex bone disorder. The active metabolite 1.25 (OH)₂ vitamin D is not formed in kidney so serum calcium falls; this stimulates 2HPT. Phosphate is retained & calcium x phosphate ratio raised, resulting in metastatic calcification in arteries & soft tissues, often related to bursae adjacent to large joints. There may be bone sclerosis ('rigger jersey spine') or osteopenia.

Learning Objectives:

1. To recognise the imaging features of rickets, osteomalacia, hyperparathyroidism and renal osteodystrophy.
2. To learn the various causes of vitamin D deficiency and other disorders that result in rickets and osteomalacia.
3. To appreciate the role of imaging in renal osteodystrophy.

16:00 - 17:30

Room E2

Foundation Course: Paediatric Radiology

E³ 620b

Common musculoskeletal disorders: how to avoid the traps!

Moderator:

A.C. Offiah; Sheffield/UK

A-152 16:00

A. Imaging a child with a limp

A. Sprigg; Sheffield/UK (alan.sprigg@sch.nhs.uk)

Limping is due to many causes. Clinical assessment determines imaging strategy. Sepsis and obscured trauma are easily missed, later presenting hip dislocation < 3years. Despite clinical diagnosis and neonatal US scanning some children present late with a limp (Trendelenburg gait). Do not be reassured by a 'normal' neonatal US report. Plain radiographs are the best modality. Arthrogram and CT assist surgical management of late presenting DDH. AVN - Perthes aged 3-11. Initial radiographs may be normal. Best diagnostic film - frog view both hips. Nuclear medicine or MR help detect early cases. Management aims to keep the femoral head covered by the acetabulum. Slipped capital femoral epiphysis age > 11 yrs. Clinical misdiagnosis is common - referred pain between hip and knee. Early signs of SCFE are subtle on a true AP view - a frog view is best. The greater the slip at

presentation, the worse the outcome in adulthood. AVN is a significant complication. CT/MR assists orthopaedic planning. Imaging strategy: plain radiographs. Small children localise pain poorly. Whole limb radiographs may be needed. US detects hip effusions but cannot differentiate pus from effusion. Nuclear medicine may need sedation for scanning phase. A full bladder may obscure the pelvis. MR is sensitive for soft tissue pathology and marrow disease included in the area imaged. Radiographs are needed before MR, which is insensitive for bone detail. Other causes: spinal problems - discitis, avulsions of muscle origins, trauma - toddler's fracture, diffuse bone disease, localised bone disease; blind areas: spine, pelvis/sacroiliac joints.

Learning Objectives:

1. To learn about the imaging approach to the child with suspected developmental hip dysplasia.
2. To become familiar with the differential diagnosis in the older child with a limp.
3. To learn which imaging modalities best help to arrive at a diagnosis.

A-153 16:30

B. Non-accidental injury: a radiologist's nightmare

P.K. Kleinman; Boston, MA/US (Paul.Kleinman@childrens.harvard.edu)

Skeletal injuries are the most common findings noted on imaging studies in cases of child abuse. In infants, certain lesions, such as the classic metaphyseal lesion and posteromedial rib fractures are sufficiently characteristic to point strongly to the diagnosis of inflicted trauma. Other fractures are less specific for abuse, but when correlated with other imaging findings and clinical information, their presence may add strong support for the diagnosis. Many of the most specific injuries produce subtle radiographic alterations, and meticulous technique, adhering to a strict imaging protocol, is vital in providing optimal detection of the fractures. In recent years, increasing attention has been given to those conditions that may simulate inflicted injury. A variety of normal variants, naturally occurring diseases and accidental injuries may be confused with the findings of child abuse. Other conditions, real or hypothetical, may be suggested by consultants in medico-legal proceedings. To be credible, a witness must be prepared to counter reckless and irresponsible testimony given by uninformed or biased medical „experts“. To ensure that investigators and finders of fact are provided with testimony that is clear, concise and accurate, the radiologist must be fully informed and prepared to address the radiologic alterations and their significance to a reasonable medical certainty.

Learning Objectives:

1. To learn in detail the investigation of a child with suspected non-accidental injury.
2. To learn about the typical skeletal injuries seen on plain radiography and the differential diagnosis.
3. To understand when further imaging is required and which imaging modality is best.

A-154 17:00

C. Bone and joint infection and inflammation: pearls and pitfalls

M. Alison, B. Tilea, R. Azoulay, G.-H. Sebag; Paris/FR

(guyl.sebag@rdb.ap-hop-paris.fr)

Acute osteomyelitis and septic arthritis are diagnostic and therapeutic emergency in children. Diagnosis remains challenging because of their variable expression (acute, subacute, chronic stages, causative agents and hosts). Imaging strategy relies on a multimodality approach including radiographs and ultrasonography as first line examinations with a complementary role for bone scintigraphy and MRI. MRI is especially useful for misleading challenging presentations (such as axial skeleton, pelvis and calcaneus osteomyelitis) and for detection of reversible osteochondral ischaemia requiring urgent surgical drainage. Juvenile idiopathic arthritis (JIA) is a heterogeneous group of chronic inflammatory disorders that are classified on their mode of onset (systemic, pauci and polyarticular diseases). It is a diagnosis of exclusion and imaging plays a major role in the differential diagnosis. Radiographic scoring systems of JIA are different from adult scoring systems with less emphasis on joint space narrowing. Doppler-ultrasonography and MRI play an increasing role in the assessment of disease activity and response to treatment.

Learning Objectives:

1. To learn about the imaging approach to a child with suspected osteomyelitis and septic arthritis and to outline the classical features.
2. To learn how best to investigate a child with suspected arthropathy and the specific findings.
3. To understand the differential diagnoses of bone and joint infections.

16:00 - 17:30

Room F1

Functional Imaging of Tumours: How to do it

MC 622

Dynamic contrast-enhanced (DCE) imaging

Moderator:

A. Ba-Ssalamah; Vienna/AT

A-155 16:00

A. DCE-CT

J. Votrubová¹, H. Mirka²; ¹Prague/CZ, ²Pilsen/CZ (jana.votrubova@homolka.cz)

Dynamic contrast enhanced computed tomography (DCE-CT) is a noninvasive method showing haemodynamic changes in living tissue in various oncologic and non-oncologic applications. Recently, it has gained an increased popularity for studying malignant tumour blood supply and formation of new vessels, also known as angiogenesis, that plays a critical role in the growth of cancer. Technical remarks: Repeated rapid CT scans are acquired at the same location to allow determination of time-attenuation curves (TAC). Several quantitative parameters are assessed: tumour blood flow (TBF) (ml/min/100 g), tumour blood volume (TBV) (ml/100 g), permeability surface product (PSP) (ml/min/100 g) and mean transit time (MTT) (s) are calculated using dedicated perfusion software. Indication: Perfusion CT may be used by the distinction of benign from malignant lesions when conventional methods are unreliable, may improve staging by demonstrating occult hepatic metastases, may guide biopsy to the tumour region most likely to be of highest grade. Several tumours with higher perfusion are more sensitive to the chemoradiotherapy than that with lower perfusion. Findings at DCE-CT images after chemoradiotherapy are a significant predictor of early tumour response and overall survival. Its applications have been stimulated by the development of anti-angiogenesis therapy for monitoring the effects of therapy and additionally may be used as a noninvasive tool in detection of hepatic toxicity of chemotherapy. In the future, new prognostic information could impact clinical management. Studying the response of cancers by measuring changes in their blood flow may provide useful information on oncologic patients for managing cancers in the future.

Learning Objectives:

1. To know the advantages of DCE-CT.
2. To learn how to extract the parameters on true cases.
3. To learn useful tricks for performing and processing good quality examinations.

A-156 16:30

B. DCE-MR

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

Before undertaking DCE-MRI examinations in the therapy assessment setting it is important to know the time of expected maximal antivasular effects, demonstrating recovery and additive effects if applicable. Identification of potential confounding variables that could alter DCE-MRI kinetics irrespective of treatment effects need to be identified. The choice of suitable lesions in important and robust data acquisition protocols that are able to deal effectively with physiological motions are needed. Consideration on the use of an appropriate input function is vital. Successful QA and QC steps should ensure that failed examination rates are minimal. Data analysis requires validated, fit for purpose software that incorporates data traceability. Kinetic parameters measures must be clinical meaningful and if possible closely linked to underlying physiological processes. Measurement error and causes of variability should be known.

Learning Objectives:

1. To know the advantages of DCE-MRI.
2. To learn how to extract the parameters on true cases.
3. To learn useful tricks for performing and processing good quality examinations.

A-157 17:00

C. DCE-US

L. Solbiati; Busto Arsizio/IT (lusolbia@tin.it)

Neoangiogenesis is a key stage in the development of malignant tumours and their invasive potential is strongly linked to their vascularisation. Modern chemotherapy is largely based on anti-angiogenic substances: new target drugs and treatment protocols are continuously introduced in clinical practice, often with severe problems related to modalities of use, costs and side effects. Consequently, there is a

great need for early, accurate and reliable imaging indicators of tumour response to anti-angiogenic drugs which is ultimately defined by overall survival rate, but is mostly based on changes in number and size of measurable tumour "targets", i.e. blood vessels. Thanks to its characteristics of high temporal and spatial resolution in limited fields and lack of ionising radiation and side effects (i.e. easy repeatability), contrast-enhanced US (CEUS) is currently the simplest and also most reliable imaging modality for detection, analysis and quantification of intratumoural macro- and micro-vascularity (up to 40 µm in diameter). Even minimal changes can be easily detected and quantified with CEUS during anti-angiogenic treatments: early disappearance (or severe reduction) of tumoural vascularisation is highly predictive of complete (or significant) response even before tumour volume decreases. Initial clinical studies were conducted on hypervascular hepatic metastases (e.g. metastases from GISTs), but recently also hypovascular hepatic metastases and primary cancers of different organs are being assessed. For the quantitative analysis of tumour vascularity changes several parameters (peak intensity, time-to-peak intensity, area under the curve, etc.) are currently being investigated and specific perfusion software connected to working stations are being developed and clinically tested.

Learning Objectives:

1. To know the advantages of DCE-US.
2. To learn how to extract the parameters on true cases.
3. To learn useful tricks for performing and processing good quality examinations.

16:00 - 17:30

Room F2

Breast

RC 602

Breast MRI today

Moderator:

W.A. Kaiser; Jena/DE

A-158 16:00

Chairman's introduction

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

The clinical application of MR-mammography (MRM) in the last 26 years has shown that this imaging tool has had significant diagnostic advantages in the field of breast diagnosis, e.g. the proof of small breast cancers, the differentiation between scar and recurrent tumours, the detection of multifocality/multicentricity, the search for primary tumours, the delineation of implants, etc. The clinical use of MR-mammography is steadily increasing. However, many still describe a "high sensitivity but a low specificity", which is wrong. Achieving a high quality is not an easy task; a lot of teachers have to be learned and considered. This refresher course is focussing on high quality concerning technical and diagnostic aspects, especially focussing the question of improving specificity.

A-159 16:05

A. How to set up a high quality breast MRI unit

C.S. Balleyguier, S. Canale, E. Zareski, F. Bidault, B. Boulet, S. Delalogue, G. Aboud, B. Boyer, C. Dromain; Villejuif/FR (balleyguier@igr.fr)

Breast MRI has become a key examination in the strategy of breast imaging. The input of breast MRI is its great sensitivity to detect breast malignant tumours, nevertheless false positives are still common. Quality of acquisition parameters is mandatory to obtain high quality images and to avoid artifacts. The key points are as follows: 1. Indications for the examinations should be precisely defined i.e. staging of known cancer, screening of high risk patients, etc. Training of the officers who organize appointments is of utmost importance. 2. Appropriate patient positioning. Many pitfalls are related to inappropriate basic technique; training for technicians is mandatory. 3. Reliable protocol includes examination of both breasts with T1w and T2w sequences with and or without fat suppression, dynamic acquisition after contrast injection should provide as the best compromise between spatial and temporal resolution. The role of new sequences such diffusion-weighted imaging sequences has to be defined. 4. Standardisation of image interpretation should be homogenously shared within the imaging team. Reports should be established according to the BI-RADS principles. The role of CAD should be precisely defined as an adjunct and not as a substitute to expert reading. 5. Quality control includes the combination of technical checking: double reading and cooperation with clinicians in order to provide an adequate number of radiologic and pathologic correlation. Because breast MRI is a continuous process, all the key points should be concurrently optimized. Any failure would jeopardize the whole procedure.

Learning Objectives:

1. To review the techniques and interpretation criteria.
2. To discuss the use of contrast agents and CAD in breast MRI.
3. To know the advantages and limitations of 3T MRI for breast imaging.

A-160 16:28

B. Evidence-based controversies

F. Sardanelli; Milan/IT (f.sardanelli@grupposandonato.it)

An evidence-based consensus on indications to breast MRI was recently reached by an interdisciplinary working group promoted by the European Society of Breast Cancer Specialists (EUSOMA). There was a general agreement on MRI for screening high-risk women, evaluating the response to adjuvant chemotherapy, evaluating suspected implant rupture, searching for occult primary cancer, evaluating suspected recurrence when conventional imaging is inconclusive. A limited consensus was obtained for the use of preoperative MRI in women with invasive lobular cancer, at high risk, with mammography/ultrasonography discrepancy in tumour size, and in patients candidate to partial breast irradiation. The debate on preoperative MRI has been fuelled by the publication of the results of the COMICE study, a large randomised study which showed a non-significant impact of MRI on re-excision rate (19% in both arms). Thus, we have now a large evidence for a superior MRI ability for ipsilateral and contralateral staging and for impact on surgical treatment on about 15-20% of patients (with potential overdiagnosis and overtreatment), without a demonstration of a positive impact on patient outcome. In this context, recommendations for preoperative MRI include: clear patient information; high-quality studies; mandatory verification/localisation of MRI additional findings with impact on patient treatment using targeted sonography or MR-guidance; treatment delay no longer than 1 month; decision on changes of treatment planning by a multidisciplinary team; attention paid to methods for translating MRI 3D information on disease extent to the operating theatre.

Learning Objectives:

1. To become familiar with current controversies in clinical applications of breast MRI.
2. To review literature on the role of MRI in breast cancer staging and screening in high risk patients.
3. To evaluate the potential impact of overdiagnosis in breast MRI.

A-161 16:51

C. How to improve the specificity of breast MRI

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

Breast MRI has shown diagnostic sensitivities of 94-99% for invasive breast cancer; however, specificities have been reported significantly lower with values between 37% and 86%. The specificity of breast MRI is in a routine clinical setting based on the evaluation of morphologic features and relative "slow" dynamic characteristics of enhancing lesions. The only moderate specificity that is achieved using these characteristics can result in a significant number of false positive findings during, for instance, screening or pre-operative imaging. These findings will often require short-term follow-up, target ultrasound with biopsy or even MRI-guided biopsy. Fast dynamic imaging, spectroscopy and diffusion weighted imaging (DWI) have been described to have potential for improving the specificity of breast MRI. The use of fast dynamic imaging sequences result in a more accurate evaluation of the initial enhancement of the lesion. In combination with pharmacokinetic modelling this can result in a more quantitative evaluation of enhancement. In proton-MR spectroscopy (MRS) the presence of a choline signal, a cell-membrane precursor, in breast lesions can be used to differentiate benign from malignant lesions. The specificity of MRS varies between 67 and 100% in literature (average 87%). DWI has also shown potential in differentiating between benign and malignant lesions, but, like with other techniques, varying specificity values are reported ranging between 46% and 93%. In this presentation the value of these techniques for improving the performance of breast MRI will be discussed.

Learning Objectives:

1. To become familiar with literature on MRI specificity.
2. To understand the value of ultrafast sequences.
3. To appreciate the value of spectroscopy and diffusion-weighted imaging.

Panel discussion:

Do we find too many cancers with MRI? 17:14

Preoperative staging of breast cancer has become one of the main indications of breast MRI. Studies have shown that MRI changes management in a significant percentage of patients, leading to a higher number of mastectomies. This has caused concern, especially in the surgical community. The debate is on the possibility and potential harms of overdiagnosis as well as cost effectiveness and patient selection issues in preoperative staging.

16:00 - 17:30

Room G/H

State of the Art Symposium

SA 6

Brain tumour: imaging and response

Moderator:

M. Stajgis; Poznan/PL

A-162 16:00

Chairman's introduction

M. Stajgis; Poznan/PL (stajgis@o2.pl)

Over the last years, novel therapies for patients with brain tumours are being implemented worldwide. One can observe a shift in imaging from merely anatomical details information towards providing tumour physiology data. Number of new MRI techniques have been developed and are currently used in advanced brain tumour imaging, monitoring and prediction of treatment response. Where and when to use them? In which order?

Session Objectives:

1. To become familiar with the role of different MR techniques in advanced brain tumour imaging.
2. To consolidate knowledge of monitoring and prediction of treatment response in patients with brain neoplasms.
3. To learn how to differentiate necrosis, pseudo-progression and true recurrent brain tumour with advanced MR imaging.

A-163 16:05

Advanced brain tumour imaging: complete imaging protocol

M. Law; Los Angeles, CA/US (meng.law@usc.edu)

Advanced imaging is now widely utilised in the research and clinical settings. In the clinical setting, qualitative, semi-quantitative and quantitative approaches such as review of colour-coded maps to ROI analysis and analysis of signal intensity curves are being applied in practice. We will also compare the relative advantages for T1 DCE MRI with T2* DSC MRI in the estimation of perfusion and permeability metrics in the clinic as well as some more automated histogram analysis methods. The role of advanced imaging in the characterisation of tumour biology and different pathologies will be reviewed. Differentiating between recurrent tumour and therapeutic necrosis is often a challenge. We will review the role of advanced imaging and also the effects of anti-angiogenic therapies on tumour microvasculature/microenvironment resulting in changes in diffusion, perfusion and MRS. Pseudophenomenon has made conventional imaging with gadolinium contrast agent almost obsolete necessitating mechanistic techniques to differentiate entities such as pseudoprogression which is seen more commonly as a result of therapy with temozolomide and radiation for high grade gliomas as well as pseudo-response and pseudo-pseudoprogression. Lastly to combine and apply these different imaging techniques in a multi-parametric algorithmic fashion in the clinical setting can be shown to increase our diagnostic specificity and confidence.

Learning Objectives:

1. To become familiar with different advanced MR techniques used in brain tumour imaging.
2. To learn the role of permeability, perfusion, diffusion imaging and MR spectroscopy in characterising brain tumour biology and differential diagnostics.
3. To become familiar with a complete imaging protocol, which can be implemented in a multi-parametric algorithm fashion in brain tumour diagnosis.

A-164 16:28

Monitoring and prediction of treatment response

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

High-grade gliomas have a poor survival rate despite improvements in surgery, radiation and chemotherapy. A contributing factor to the poor survival is the inability of currently available imaging techniques to accurately delineate the tumour which results that targeted focal treatment may not be effective. Conventional imaging is not able to give an early assessment of the effectiveness of radiation and/or chemotherapy. Early identification of patients with a poor treatment response or who suffer from tumour recurrence can be of great advantage: it provides the opportunity to adjust individual more rapidly, and sparing patients unnecessary morbidity, and

delay in initiation of other maybe more effective treatment. In recent years, different functional imaging approaches such as dynamic contrast-enhanced (DCE) and dynamic susceptibility-weighted contrast (DSC) MRI, diffusion-weighted imaging and spectroscopy have been complementary used for diagnosis and treatment response. In this lecture different advance MR and CT imaging methods as well as the traditional way of monitoring to assess treatment response will be discussed. In addition, a novel recently published promising technique will be described - the parametric response mapping (PRM), a novel voxel-wise analytical method of monitoring physiological and environmental changes in a tumour volume during treatment will be presented and compared to the traditional methods used. Finally, the aim of the lecture is to consolidate the present knowledge and novel ideas in brain tumour imaging for future monitoring of treatment response and the possibility and limitations for future individualisation of cancer therapy.

Learning Objectives:

1. To gain an understanding of the present traditional model for the treatment cycle for brain tumours and how they are monitored.
2. To learn about different imaging biomarkers for early assessment of brain tumour treatment response that might result in individualisation of cancer therapy.
3. To consolidate present knowledge and ideas in brain tumour imaging for future brain tumour therapy and monitoring of response.

A-165 16:51

Radiation necrosis and pseudo-progression vs recurrent tumour

M. Essig; Heidelberg/DE (m.essig@dkfz-heidelberg.de)

Pseudophenomenon has made conventional imaging with gadolinium contrast agent almost obsolete necessitating mechanistic techniques to differentiate entities such as pseudoprogression which is seen more commonly as a result of advanced multimodal therapeutic concepts. Advanced, non-enhanced and contrast enhanced MR imaging techniques include MR-spectroscopy, perfusion MR imaging, dynamic contrast enhanced MRI and diffusion tensor MR. In the presentation we will analyse the application of those techniques in brain tumour assessment with focus on the post-therapeutic brain to differentiate therapy induced from tumour-induced changes. The results of the available studies in literature, all with relatively limited patient numbers, indicate that the combination of functional MRI proved to be useful in the post-therapeutic workup of gliomas, lymphomas and metastatic disease. The typical patterns of tumour recurrence and the different therapy-induced effects will be presented. In perfusion (DSC-MRI) and dynamic contrast enhanced magnetic resonance imaging (DCE-MRI) the signal intensity measurements of the tumour reflect a composite of tumour perfusion, vessel permeability, and the extravascular-extracellular space. In contrast to conventional enhanced MRI, which simply presents a snapshot of enhancement at one time point, both techniques permits a fuller depiction of the wash-in and wash-out contrast kinetics within tumours, and this provides insight into the nature of the bulk tissue properties on its microvascular level. With the strong demand in drug development the identification of biomarkers that can assess tumour microvascular properties non-invasive dynamic MRI is the method of choice to assess tumour response and to identify atypical tumour response findings.

Learning Objectives:

1. To identify the different aspects of therapy-induced MRI findings.
2. To differentiate therapy-induced changes from tumour recurrence by the use of modern MRI techniques.
3. To identify technical aspects of functional MRI techniques in brain tumour imaging.

Panel discussion:

Try to understand the clinical question and you will know which imaging is appropriate 17:14

We are witnessing a change in brain tumour imaging from merely providing anatomical details toward the characterisation of tumour biology and physiology. A number of advanced MRI techniques serve as powerful tools in therapeutic decisions and prognosis. How and when should we use them? In which sequence? All of them? To answer these questions, the understanding of clinician questions and value of particular MRI studies is essential.

16:00 - 17:30

Room I/K

Chest

RC 604

Bedside chest imaging

Moderator:

H. Prosch; Vienna/AT

A-166 16:00

A. Bedside chest radiography: technical aspects and correct interpretation

E. Eisenhuber; Vienna/AT (eisenhuber@gmail.com)

Although bedside chest radiograph is one of the less elaborate imaging examinations in our diagnostic armamentarium, it remains the most frequent radiologic procedure performed in intensive care patients. Despite its limitations chest imaging is an important tool in the management of the critically ill patient. Though the advent of digital radiography has vastly contributed to improved image quality of the bedside radiographs, optimal positioning and technique remain a real challenge for the performing technologist. In addition, the interpretation of chest radiography in the critically ill patient poses a challenge for the radiologist, because findings are frequently unspecific and lung opacifications have similar appearances in a variety of different cardiopulmonary pathologies. Clinical information and an interdisciplinary approach are therefore crucial for optimal interpretation of these chest radiographs. The American College of Radiology has established expert recommendations for the use of bedside chest radiography. Current recommendations suggest that routine daily chest radiographs should be reserved for patients with acute cardiopulmonary problems and in patients receiving mechanical ventilation. Acquisition of a portable chest radiograph is recommended after insertion of endotracheal tubes, central venous catheters, pulmonary artery catheters, chest tubes, and nasogastric tubes. Therefore, knowledge of correct positioning of catheters, tubes, and monitoring devices and of various malpositions and associated complications is essential for the interpreting radiologist.

Learning Objectives:

1. To learn about the technical requirements of portable chest units.
2. To understand key imaging findings in different clinical settings.
3. To understand potential limitations of bedside chest radiography and how to avoid common pitfalls.

A-167 16:30

B. Bedside thoracic ultrasonography: how far can it go?

K. Vidmar Kocijancic; Ljubljana/SI (ksenija.vidmar@sb-izola.si)

Chest ultrasonography (CHUS) is a useful imaging tool in patients at intensive care units, because of its simplicity and reproducibility. However, there are some limitations such as low specificity of some crucial sonographic signs and limited searching area (soft tissues, pleural cavity and lung consolidations). The ICU patient can be examined in supine or sometimes in lateral or partly lateral position using intercostal spaces as an acoustic window. Supine analysis of the anterior chest wall rules out pneumothorax, while lateral approach detects clinically relevant pleural effusion and parenchymal consolidations. CHUS is a method of choice in detection as well as in characterisation and volume estimation of free and/or loculated pleural fluid. With CHUS we can explore and characterise lung consolidations from the moment they reach the visceral pleura. They can be in contact with pleural line or can be observed through an effusion. However, in case of subcutaneous emphysema and/or diffuse oedema of soft tissues the lung parenchyma can not be reliably assessed. Also, in the question of pulmonary embolisms in critically ill patient, CHUS could be contributive. Sometimes small pleural effusion can be visible with some peripheral lung tissue consolidations indicating minute pulmonary infarction. Typical pulmonary infarction is triangular tissue consolidation with air bronchogram and absence of Doppler blood flow signals within consolidated lungs but CECT for confirmation is mandatory. CHUS exploration of the diaphragm can reliably evaluate respiratory movements since pleural effusion even substantial does not affect the amplitude of diaphragmatic excursion.

Learning Objectives:

1. To understand the advantages and limitations of bedside thoracic ultrasonography.
2. To learn about the US findings of pleural and parenchymal diseases suitable for bedside ultrasonography.
3. To review current guidelines for estimation of pleural effusion volume.

A-168 17:00

C. Radiologic-guided bedside interventions of the thorax

F. Gleeson; Oxford/UK (fgleeson@mac.com)

This presentation will review the ultrasound appearances of pleural disease in ward and ITU-based patients, and will discuss the indications for pleural procedures and the complications associated with them. The use of colour Doppler to aid the diagnosis of effusions will be discussed, as will the identification of septations and the need for intrapleural fibrinolytic therapy. The advantages of guided versus blind drain insertion will be presented, and the benefits of large versus small bore drains will also be discussed.

Learning Objectives:

1. To review current clinical indications for ultrasound-guided intervention of the thorax.
2. To learn how to perform bedside intervention of the thorax.
3. To review potential complications of thoracic bedside interventions.

16:00 - 17:30

Room L/M

Special Focus Session

SF 6

Dynamic MR imaging of the pelvic floor: easy and useful

Moderator:

D. Weishaupt; Zurich/CH

A-169 16:00

Chairman's introduction

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

Pelvic floor function and structure is complex. Imaging has a key role in guiding the clinician in managing patients with incontinence, constipation, difficult rectal evacuation and pelvic organ prolapse. Dynamic imaging is of particular interest for assessment of the pelvic floor since this kind of imaging gives a near physiological data set of what is happening and gives us a better understanding of the multifactorial causes of pelvic floor dysfunction. Whereas conventional evacuation proctography was over years standard of reference for dynamic imaging of the pelvic floor, dynamic MR imaging of the pelvic floor is gaining increasing acceptance among radiologists and clinicians. However, dynamic MR imaging of the pelvic floor is (due to the architecture of most of the clinically MR magnets) usually performed in supine position which does exclude the axial load on the pelvic floor. The lack of a physiological patient positioning during dynamic pelvic floor MR imaging is still brought into discussion if dynamic MR imaging of the pelvic floor can replace conventional techniques or not.

Session Objectives:

1. To review the current status and technique of dynamic pelvic imaging.
2. To learn about indications and imaging findings of dynamic pelvic imaging.
3. To understand the role of dynamic pelvic imaging in the light of conventional techniques.

A-170 16:05

How I do it

C.S. Reiner; Zurich/CH (caecilia.reiner@usz.ch)

The pelvic floor is a complex anatomic and functional unit. In clinical routine a simple anatomic concept of the female pelvic floor has gained acceptance. Especially for treatment planning, the female pelvic floor may be separated into three functional compartments: the anterior compartment (bladder and urethra), the middle compartment (vagina, cervix, uterus, and adnexa), and the posterior compartment (anus and rectum). Intact structure of the pelvic floor is a basic prerequisite for a normal mechanism of defecation and continence. Over the last years, MR imaging has gained increasing acceptance as imaging modality for evaluation of the pelvic floor, which enables a global and integrated approach to the pelvic floor. Using static T2-weighted sequences the morphology of the pelvic floor can be visualised in great detail. A rapid half-Fourier T2-weighted, balanced steady state free precession (bSSFP), or gradient-recalled echo (GRE) sequence are used to obtain sagittal images while the patient is at rest, during pelvic squeeze, during pelvic strain and to document the evacuation process. On these images the radiologist identifies the pubococcygeal line (PCL) (which represents the level of the pelvic floor). In normal findings, the base of the anterior and the middle compartment are above the PCL at rest, and the pelvic floor elevates during contraction. During straining,

the pelvic floor muscles should relax and the pelvic floor descends normally less than 3 cm below the PCL. Based on the static and dynamic MR imaging sequences a vast array of morphologic and functional pelvic floor disorders can be depicted.

Learning Objectives:

1. To review the technique and imaging protocols of dynamic pelvic MRI.
2. To understand relevant anatomical structures and classification systems for defining normal and abnormal findings.
3. To review normal findings in asymptomatic volunteers.

A-171 16:28

Indications and spectrum of pathological findings

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

Functional abnormalities of the pelvic floor represent a significant health-care problem, as they affect approximately 15% of older multiparous women. Moreover, nearly 300.000 surgeries in United States are annually performed to correct those disorders. The success of medical and surgical therapies relies on the correct classification of dysfunction and identification of the pelvic compartments involved. Clinical classifications of pelvic floor abnormalities are primarily topographic, rather than functional. However, as the pelvic floor muscles tend to act as a unique functional entity, their dysfunction usually leads to dysfunction of more than one organ system (genitourinary or gastrointestinal), resulting in a wide spectrum of symptoms variably associated, including dysuria, urinary incontinence, uterine prolapse, anal or pelvic pain, obstructed defaecation, rectal prolapse or faecal incontinence. Because of the variability of symptoms and complexity of physio-pathological mechanisms, diagnosis of pelvic floor disorders is usually achieved by combining different diagnostic tools. Dynamic MRI of the pelvic floor has emerged as an alternative and effective modality for assessing and understanding of these disorders. It currently offers a complete morphological and functional evaluation of all three compartments at the same time. Constipation and pelvic organ prolapse are the most common indications for a dynamic MRI. The physio-pathological features of the main pelvic floor disorders and their MRI findings will be shown in detail. MR images and movies, with particular regard to posterior pelvic floor abnormalities, such as rectocele, rectal invagination and prolapse, enterocele, descending perineal syndrome and spastic pelvic floor syndrome, will be illustrated and discussed.

Learning Objectives:

1. To review the current indications of dynamic pelvic floor imaging.
2. To understand the spectrum of pathological findings.
3. To understand the clinical relevance of abnormal findings.

A-172 16:51

Dynamic imaging of the pelvic floor: MR imaging or conventional technique?

S. Halligan; London/UK (s.halligan@ucl.ac.uk)

The ability to perform and interpret dynamic pelvic floor imaging is essential for the modern gastrointestinal (and indeed urogynaecological) radiologist. The other speakers in this session will be reviewing indications, pathologic findings, clinical relevance, and MR technique. Although I will detail the MR and fluoroscopic techniques used at my institution, I will focus on the specific technical and diagnostic advantages and disadvantages of both dynamic pelvic MR and conventional fluoroscopic evacuation proctography (defecography). Many practitioners wishing to initiate this type of imaging will wish to know what modality to choose and existing practitioners using fluoroscopy will possibly be interested in migrating their practice to MR. I will illustrate what imaging findings are best imaged by each technique, continually referencing this to whether the finding is ultimately important to the referring clinician or not. Using examples from our own research programme and clinical practice, I will illustrate why we have migrated our practice exclusively to dynamic MR.

Learning Objectives:

1. To review the current role of MR imaging and conventional techniques in dynamic pelvic imaging.
2. To appreciate the advantages and limitations of both techniques.
3. To learn which technique is useful for which clinical situation.

Panel discussion:

Does dynamic pelvic MR imaging replace conventional defecography? 17:14

Although dynamic pelvic MR imaging is increasingly used for imaging pelvic floor disorders, the crucial question is whether the technique can completely replace conventional techniques. Although MR imaging provides excellent soft-tissue contrast which is a particular advantage when imaging the pelvis, it has to be acknowledged, that the examination is performed in supine position and not in physiological sitting position.

16:00 - 17:30

Room N/O

Molecular Imaging

RC 606

Clinical potential of molecular imaging: between dream and reality

Moderator:

G. Frija; Paris/FR

A-173 16:00

A. Molecular imaging from bench to bedside

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

With the introduction of targeted therapeutics and personalised therapy regimen there is increasing need to improve diagnosis of diseases in a way that insight into pathophysiological and molecular regulation is provided. In this context, molecular imaging can be of tremendous help in basic research, drug development and the clinics. Many interesting approaches of molecular imaging have been tried in small animal models. New methods and tools have been identified, which are easy enough to handle, acceptable in its costs and, most importantly, reliable enough to be translated to clinical practice. Unfortunately, as soon as they have entered the clinics they are often not classified as molecular imaging anymore. Among those are MR-spectroscopy, SPIO/USPIO enhanced liver and RES imaging but also contrast agents like Gd-EOB-DTPA and most applications for PET/SPECT. Other interesting applications such as targeted ultrasound imaging are already established tools in preclinical research and very close to first clinical use. Near infrared optical imaging is another example of a rapidly developing technology and first clinical devices and dyes (e.g. to detect arthritic lesions) are available now. It can be expected that with the availability of targeted and activatable probes the acceptance and the use of optical imaging methods will further rise. Most probably, this will initially happen in context with intraoperative diagnosis and endoscopy. In summary, it is the aim of this talk to give a realistic overview on the available molecular imaging tools and on their potential for preclinical research and patient use.

Learning Objectives:

1. To understand the principles of molecular imaging research.
2. To understand how probes are tailored towards clinical applications.
3. To appreciate the required steps for clinical development and approval.

A-174 16:30

B. Cardiovascular disease

L. Hofstra; Utrecht/NL (leonard.hofstra@gmail.com)

Cardiovascular diseases remain the number one cause of morbidity and mortality, both in the developed and developing countries, and in men and women alike. It is expected that these numbers will continue to increase in the coming decades due to escalating proportions of obesity and the aging population. Atherosclerosis is the major cause for cardiovascular disease. Since in about 50% of cases a stroke or acute myocardial infarction is the first symptom of atherosclerosis, it is of paramount importance to identify patient at high risk. A first step in the identification is the use of clinical risk profiling, such as the Framingham Risk score, which has an area under the curve (AUC) of about 0.8 using ROC analysis. However, clinical risk profiling alone is not sufficient to identify individual patients at imminent risk to develop a cardiovascular event in the near future. A next step in a more precise identification of the patient at risk is the development of serum biomarkers for atherosclerotic disease. However, so far serum biomarkers have failed to contribute substantially to improve the AUC in the prediction of cardiovascular events using ROC analysis. A major step forward in risk stratification is provided by the rapid development of cardiac computed tomography, which offers a rapid visual access to the coronary tree, at low radiation dose and in a patient friendly manner. However, for the identification of the vulnerable plaque we need to go beyond anatomical imaging, and use molecular imaging tools. In the lecture I will discuss the different targets for molecular imaging within the vulnerable plaque, such as inflammation, apoptosis and angiogenesis. Imaging of these substrates of plaque vulnerability may offer opportunities for a precise identification of the patient at risk, at the individual level.

Learning Objectives:

1. To understand potential mechanisms for cardiovascular disease.
2. To understand how these probes can be used in visualisation of cardiovascular disease.
3. To learn about the potential clinical value of these probes.

A-175 17:00

C. Oncology

M.G. Pomper; Baltimore, MD/US (mpomper@jhmi.edu)

Although most clinical diagnostic imaging studies employ anatomic techniques such as computed tomography (CT) and magnetic resonance (MR) imaging, much of radiology research currently focuses on adapting these conventional methods to physiologic imaging as well as on introducing new techniques and agents for studying processes at the cellular and molecular levels in vivo, i.e. molecular imaging. Molecular imaging promises to provide new methods for the detection of minimal changes in diseased tissue and support for personalised therapy. Although molecular imaging has been practiced for over 20 years in the context of nuclear medicine, other imaging modalities have only recently been applied to the noninvasive assessment of physiology and molecular events. Nevertheless, there has been sufficient experience with specifically targeted contrast agents and high-resolution techniques for MR imaging and other modalities that we must begin moving these new technologies from the laboratory to the clinic. Several projects relevant to oncology will be discussed with emphasis on how they were/will be moved from the bench to the clinic.

Learning Objectives:

1. To understand the rationale of probes for oncology.
2. To understand how these probes can be used in visualisation of neoplastic diseases.
3. To understand the potential clinical value of these probes.

16:00 - 17:30

Room P

Vascular

RC 615

Non-traumatic acute aortic dissection and malperfusion syndromes

Moderator:

A.-M. Belli; London/UK

A-176 16:00

Chairman's introduction

A.-M. Belli; London/UK (Anna.Belli@stgeorges.nhs.uk)

Aortic dissection is increasingly managed by endovascular means. It is important for all radiologists to understand the benefits and disadvantages of varying imaging modalities in the differential diagnosis and the fundamental anatomical requirements for assessing suitability for endovascular repair. The causes, detection, classification and complications of aortic dissection will be discussed followed by a panel discussion of imaging strategies which give the best information for diagnostic work-up, endograft planning and monitoring of patients during and after treatment.

A-177 16:05

A. Predisposing factors for developing non-traumatic acute aortic dissections

V. Bérczi; Budapest/HU (Berczi@hotmail.com)

Aortic dissection, a highly lethal disease, is defined as longitudinal cleavage of the aortic media by a dissecting column of blood. The mortality rate of untreated aortic dissection is 1-2% per hour for the first 24-48 hours, or 75% within the first 2 weeks, and 90% at 1 year. Predisposing factors include hypertension, inherited arteriopathies characterised by cystic medial necrosis, pre-existing aortic aneurysm, a bicuspid aortic valve, aortic coarctation, different vasculitides, the use of cocaine (due to its effect on aortic connective tissue and also by producing severe hypertension). Hereditary diseases include Marfan's syndrome (dedifferentiation of vascular smooth muscle cells, enhanced elastolysis of aortic wall components, defective fibrillin in the extracellular matrix), Ehlers-Danlos syndrome (hereditary connective tissue disorders leading to tissue fragility), annuloaortic ectasia and familial aortic dissection (elastolysis, deposits of mucopolysaccharid-like materials, cystic medial degeneration). Acquired conditions, such as hypertension, alter arterial wall composition in numerous ways, causing smooth muscle cell necrosis and fibrosis of elastic structures, leading to stiffness and vulnerability to pulsatile forces, thereby creating a substrate for aneurysms and dissections. Other acquired conditions include inflammation and autoimmune processes, causing nutrient deficiency and destroying the medial layers of the aortic wall. Pregnancy-related dissection is extremely rare. Beside discussion of the predisposing factors, a brief

description of variant anatomy (aortic spindle, ductus diverticulum) and structures causing diagnostic dilemma (pericardial recess, left inferior pulmonary vein, left superior intercostal vein and right atrial appendage) will be given.

Learning Objectives:

1. To learn how to determine the incidence and mortality.
2. To analyse the clinical and pathologic changes of aortic dissection.
3. To understand the natural history.

A-178 16:28

B. Acute aortic dissections: detection and classification

J. Lammer; Vienna/AT (johannes.lammer@akhwien.at)

The most commonly used classification is the Stanford classification: in type A dissections the ascending aorta is involved, in type B dissection the ascending aorta is not involved. The De Bakey classification subdivides the dissection in a type I dissection which involves the entire aorta, a type II dissection which involves the ascending aorta, and a type III dissection of the descending aorta only. In 2001, Erbel et al. published (European Heart Journal; 22: 1642-1681) a new classification. Class 1: classical aortic dissection with an intimal flap between true and false lumen. Class 2: intramural haematoma. Class 3: discrete dissection without haematoma, eccentric bulge at tear site. Class 4: penetrating aortic ulcer, Class 5: iatrogenic and traumatic dissection. Clinical symptoms: the typical patient with aortic dissection is male, in his 1960s with a history of hypertension who suffers with abrupt onset of a sharp, ripping chest pain. Malperfusion of organs: compression of the true lumen may cause malperfusion of the coronary and cerebral arteries, the spinal cord, all abdominal organs and the limbs. This malperfusion may change the symptoms. Imaging: contrast-enhanced CT is the imaging modality of choice. The report has to describe the classification, the entry site, the grade of true lumen compression, organ malperfusion, pericardial and pleura effusions, and false lumen ectasia. However, aortic valve insufficiency which can be a complication of type A dissections are demonstrated by echocardiography, transesophageal ultrasound or MRI.

Learning Objectives:

1. To learn how to diagnose aortic dissection.
2. To understand the pros and cons of different imaging modalities.
3. To learn the classification.

A-179 16:51

C. Acute aortic dissections: imaging of complications

M.H.K. Hoffmann, A.-C. Fischer; Ulm/DE (martin.hoffmann@uniklinik-ulm.de)

Complications occurring after acute aortic dissections should be separated into those related to the disease per se and those related to post-treatment conditions. Life-threatening complications related to the disease should be familiar as immediate consequences for treatment may ensue. Most of these are either located in the aortic root or related to mal-perfusion syndromes. The aortic root with very thin walled structures of the sinus of valsalva is located within the pericardial sac. The structure is prone to rupture and may produce life-threatening pericardial tamponade or present clinically as sudden onset of severe aortic regurgitation. All imaging modalities suitable for diagnostic workup in such conditions have to be rapidly accessible and performable. This precludes lengthy MR imaging procedures and renders ultrasound and CT as the mostly used modalities. The condition that has to be recognised as the most important inductor of malperfusion syndromes in the descending aorta is the progression of dissection into aortic branches and the true lumen collapse. Both conditions are easily discernible with CT imaging. Complications related to treatment should be sub-classified into those after pure surgical treatment and those related to endograft repair. The acute surgical complication with most deleterious effects is related to spinal cord ischaemia. The condition also applies to endograft repair. It is therefore beneficial for the radiologist involved either in pre-surgical imaging or interventional treatment to acquire thorough knowledge of the spinal cord blood supply. Endograft complications of interest encompass endoleak formations, stent migrations and endoluminal stent collapse.

Learning Objectives:

1. To learn the most common complications.
2. To learn the most appropriate imaging strategy for diagnosis.
3. To understand the clinical significance of the most common complications.

Panel discussion:

Which imaging modality is best for endovascular management? 17:14

The various imaging modalities for establishing the diagnosis of acute non-traumatic dissections will be discussed. The panellists will present recommendations for diagnostic work-up with special respect to differential diagnosis such as acute myocardial infarction and acute pulmonary embolism. Also, the problem of sizing the endograft and planning the procedure will be addressed. The panellists will discuss strategies for detection of complications and for monitoring patients following treatment.

16:00 - 17:30

Room Q

RTF - Radiology Trainees Forum

TF 1

Highlighted Lectures

Moderators:

D. Bulja; Sarajevo/BA
P.R. Kornaat; Leiden/NL

A-180 16:00

Musculoskeletal trauma in children

I. Boric; Zagreb/HR (igor.boric1@zg.t-com.hr)

The aim of the lecture is to familiarise the audience with the specific paediatric conditions in trauma radiology. It will be described the major pathophysiologic differences in childhood and the consecutive altered injury pattern. The standard radiological imaging protocol for various involved body regions and different trauma settings/varying queries will be described, with suggestion for standardised diagnostic algorithms in some typical settings. Special regard will be given to radiation protection and the potential of imaging modalities such as ultrasound, multi-detector CT as well as MRI in paediatric trauma patients. The roll of the lecture is to provide some basic guidelines for young radiologists and general radiologists who less often have to deal with paediatric patients.

Learning Objectives:

1. To become familiar with the major pathophysiologic differences in childhood trauma
2. To standardised diagnostic algorithm in some typical settings in field of pediatric trauma.

A-181 16:30

Basic principles in the interpretation of signal intensities on T1- and T2-weighted images

G. Wilms; Leuven/BE (Guido.Wilms@uz.kuleuven.ac.be)

The signal intensities of normal structures and pathological findings on conventional T1- and T2-weighted MR images depend on many factors. The amount of water, proton density, chemical structure and/or binding, presence or absence of flow (of blood or CSF), calcification, fat, blood degradation products, melanin, mucine and even air are all factors that influence the signal characteristics. T1- and T2-lengthening is the rule in most tumoural, vascular and infectious lesions and therefore is rather unspecific. T1- and T2-shortening can be due to the presence of fat (lipoma), melanin (melanoma and metastasis of melanoma), mucine (metastasis of sigmoid carcinoma), colloid material (colloid cyst, Rathke cleft cyst) and even calcification (falx!). T1-shortening with T2-lengthening can be due to cholesterine (cholesterol granuloma, craniopharyngioma), high protein content (tumoural cysts), and methaemoglobin (late haemorrhage, thrombus). T1-lengthening and T2-shortening is almost exclusively due to deoxyhaemoglobin. Acute haemorrhage and meningioma can be iso-intense on T1-weighted images, while some meningiomas and micrometastases can be iso-intense on T2-weighted images. Absence of signal can be due to high-velocity flowing blood (aneurysm, AVM, hypervascular tumours), high velocity flowing CSF (normal pressure hydrocephalus, cortical bone or extensive calcification, air and a large amount of iron (coils, clips). It is concluded that the simple use of a combination of T1- and T2-signal intensities on conventional MR images can be used to arrive at the diagnosis and differential diagnosis of brain lesions.

Learning Objectives:

1. To learn the types of the different signal intensities on conventional T1- and T2-weighted MR images.
2. To correlate the signal intensities with biochemical and pathological findings, with the implications of specific MR effects and artifacts.
3. To use the combination of T1- and T2-signal intensities to arrive at the diagnosis and differential diagnosis of brain lesions.

A-182 17:00

Plain film criteria: quality of the x-rays

H. Bosmans; Leuven/BE (hilde.bosmans@uz.kuleuven.ac.be)

The quality of radiographs is determined by many parameters from both technical and clinical origin. During the presentation, we will make an overview of the particular features of x-ray tubes and plain films that affect the quality of the radiological image. The training session will start from very simple x-ray tubes and film, and gradually introduce more sophisticated, state-of-the-art technology. We will briefly explain concepts such as focal spot, heel effect, beam quality, filters, grid, film sensitivity, automatic exposure control, etc. from a practical point of view. The European Commission and selected research groups have developed criteria to judge the quality of the images and we will show how they can be used to improve the daily practice. A more technical evaluation of quality is possible with images of test objects, some of which are very straightforward and interesting if problems have to be retrieved. X-ray quality should be at a high level every day. Therefore quality control procedures have a role. One example evaluates the stability of the imaging chain by means of acquisitions of homogeneous blocks of PMMA. We will illustrate typical findings with repercussions on the radiological practice, and show that the fight against artefacts is a never ending process. Both with film and digital detectors, radiologists should be aware that quality management and quality control procedures are needed. Quality has to be organized, and quality control procedures have to be automated and included in the routine practice.

Learning Objectives:

1. To become familiar with the basic principles of x-ray imaging, from the tube to the film.
2. To understand the technical quality of a radiograph and how technology and its proper use influence the radiological quality.
3. To illustrate the role of quality control procedures in the daily practice.

Postgraduate Educational Programme

Saturday, March 5

08:30 - 10:00

Room A

Special Focus Session

SF 7

My 'most beautiful' mistakes

Moderator:

M. Zins; Paris/FR

A-183 08:30

Chairman's introduction

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

Interpreting the results of imaging studies is more and more challenging and time consuming due to the large volume of data to evaluate, compare and post-process. Radiology errors are inevitable, affect all radiologists and may be defined as a mistake that has management implications for the patient. Errors can be broadly classified into technical errors, active errors (errors in perception, judgment or knowledge) and errors of communication. The majority of errors are false-negative interpretations and occur during interpretation of CT examinations. Good communication between the referring physician and the radiologist is essential. Unfortunately, only a small minority of radiologists keep a personal record of their errors. Patient safety should benefit from the repeat organisation of "error meetings" through the act of collective learning. Radiologists and radiology departments must continue to improve the process of recording and addressing errors.

Session Objectives:

1. To understand the potential pitfalls that may be encountered in interpreting imaging exams with emphasis on acute medicine and oncology.
2. To recognise the different types of errors: technical errors (latent or system related) or active errors (errors in perception, judgment or knowledge).
3. To learn about methods to facilitate identification of errors in order to minimise their occurrence.

A-184 08:35

Abdomen

A.H. Freeman; Cambridge/UK (a.h.freeman@talk21.com)

Making a mistake in radiology may result in catastrophic effects for the patient. It is therefore crucial that as radiologists we are honest with ourselves, prepared to review our mistakes and errors with an open mind, and thus pass this knowledge onto future generations of radiologists. Mistakes may come about through technical, observational and deductive errors and these will be reviewed utilising two separate cases.

Learning Objectives:

1. To understand the potential pitfalls that may be encountered in interpreting abdominal imaging exams.
2. To become familiar with technical errors in the realisation of abdominal imaging exams that contribute to misinterpretation.
3. To be aware of the spectrum of factors that contribute to active errors (detection, characterisation) in interpretation of abdominal imaging exams.

A-185 08:58

GU

L.E. Derchi; Genoa/IT (derchi@unige.it)

Radiologists do make mistakes, diagnostic errors can be the cause of severe consequences to patients or, luckily, in many cases, they can be corrected. Learning from mistakes is quite important since understanding why a mistake has been made help to avoid it in the future. During this lecture a series of mistakes made in the field of GU will be presented and causes which have lead to each of them will be analysed.

Learning Objectives:

1. To understand the potential pitfalls that may be encountered in interpreting GU imaging exams.
2. To become familiar with technical errors in the realisation of GU imaging exams that contribute to misinterpretation.
3. To be aware of the spectrum of factors that contribute to active errors (detection, characterisation) in interpretation of GU imaging exams.

A-186 09:21

Chest

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

There are diverse underlying causes for "diagnostic mistakes". Missed lesions due to inadequate technique, "satisfaction of search" or lack of perception have to be differentiated from interpretative mistakes of lesions that have well been seen but erroneously interpreted due to the lack of experience, misconception or overlap of findings that complicates the differential diagnosis. Each of these underlying reasons require a different approach to avoid them or reduce their risk of occurrence. The first type of mistake arises more often when interpreting chest radiographs and refers to the detection of mostly small focal parenchymal densities but also to the interpretation of mediastinal and hilar contours. By analysing typical cases, visual "tricks", helpful display techniques and strategies for systematic review and analysis will be outlined that are thought to be helpful in reducing the risk of "missing" a lesion. The second type of mistake mostly represents a problem of interpreting parenchymal abnormalities seen on CT. Since the lung has limited means to "react" against an injury, many radiologic findings are aspecific. Interpretation of pathology of parenchymal changes is based on pattern analysis, the knowledge of disease distribution and additional findings of pleura and mediastinum. In many cases, an interdisciplinary approach of radiologists and clinicians is essential for correct interpretation. Cases will be analysed to illustrate difficult differential diagnosis occurring in daily routine (e.g., infectious pneumonia versus organising pneumonia) and key features helping in going into the right interpretative direction will be outlined. Emphasis will lie on focal lung disease rather on the interpretation of diffuse interstitial lung diseases.

Learning Objectives:

1. To learn about visual tricks and strategies to overcome typical perception errors in chest radiography.
2. To become familiar with overlaps of morphologic findings of focal parenchymal lesions frequently occurring in daily routine when interpreting thoracic CT.
3. To recognise those additional findings that represent the "helpful clue" for correctly narrowing the differential diagnosis.

Panel discussion:

What have we learned from our mistakes? 09:44

Interpreting the results of imaging studies is more and more challenging and time consuming due to the large volume of data to evaluate, compare and post-process. Moreover, errors in the interpretation of imaging studies can have significant effects on patient care, particularly in acute medicine and oncology. So the question is how to be aware of the potential pitfalls that may be encountered in the realisation and the interpretation of imaging studies and how to avoid them or to learn from them.

08:30 - 10:00

Room B

Organs from A to Z: Pancreas

MC 719

Imaging inflammation and function

Moderator:

O. Akhan; Ankara/TR

A-187 08:30

A. Acute pancreatitis

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

Acute pancreatitis remains a potentially life threatening condition with an overall mortality rate of 5%. Its outcome is strongly related to a precise and timely diagnosis, a correct estimate of severity and subsequent appropriate treatment. Radiologic imaging, particularly CT, plays a key role in staging the severity and therefore helps guiding therapeutic decisions. Management of interstitial or edematous pancreatitis is supportive while severe or necrotising pancreatitis requires intense monitoring and specific therapies. The latter has a higher mortality and guarded prognosis, since it may lead to organ failure, infection, pseudocyst formation and extrapancreatic parenchymal and vascular complications. A number of severity indices have been established to determine the prognosis of acute pancreatitis, based both on clinical and imaging criteria. A CT-based severity index has become the main prognostic method to predict outcomes. This course reviews relevant imaging findings of various stages of acute pancreatitis and its complications by CT, including special conditions such as groove pancreatitis and autoimmune pancreatitis. Currently established and modified severity indices are reviewed to learn how to estimate prognosis and guide therapy.

Learning Objectives:

1. To review the clinical and imaging classification of acute pancreatitis and its implications for patient management.
2. To understand the role of cross-sectional techniques and how to provide prognostic information.
3. To understand the role of imaging in clinical decisions regarding complications.

A-188 08:55

B. Chronic pancreatitis

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

Chronic pancreatitis (CP) is an inflammatory disease of the pancreas, with irreversible morphologic changes and fibrotic replacement of the gland, which progressively result in loss of exocrine and endocrine function. CP is morphologically characterised by irregular sclerosis associated with destruction and permanent loss of the exocrine parenchyma which may be either focal, segmental or diffuse. The primary symptoms of CP are abdominal pain and maldigestion, which may be physically and socially debilitating, although it is acknowledged that chronic pancreatitis can occasionally be painless. A classification based on the causes of CP is useful in order to better define the therapeutic interventions. However, morphological changes of the pancreatic ducts are the main rule of thumb for the classification in order to better compare the results of the treatment. Imaging techniques have a role both on the diagnosis - especially in the early phases of the disease - and on the classification of CP, either for the grading of the disease, to explain the aetiology - even for rare forms - and to differentiate the focal mass from ductal adenocarcinoma. CT, MRI and ERCP have a specific role in the assessment of CP, due to the different capacity of the techniques to explore the pancreatic gland. However, thanks to heavily T2w sequences, MRI has a competitive role with ERCP, which actually has more an interventional role in case of obstructive CP. Finally, MRI thanks to secretin test and DWI sequences is able to give a non-invasive assessment of pancreatic exocrine function.

Learning Objectives:

1. To review the imaging findings and classification of chronic pancreatitis.
2. To understand the pros and cons of imaging techniques including ECRP.
3. To learn about the rare forms of CP such as auto-immune and groove pancreatitis.
4. To pick up clues on how to differentiate from adenocarcinoma.
5. To learn how to measure exocrine pancreatic function.

A-189 09:20

C. Management of complications of pancreatitis

C.D. Becker; Geneva/CH (Christoph.Becker@hcuge.ch)

Complications of pancreatitis may include fluid collections and pseudocysts, vascular complications such as arterial pseudoaneurysm or thrombosis of the portal venous system, and stenosis of common bile duct and pancreatic duct. Inflammatory fluid collections in the context of acute pancreatitis often resolve spontaneously. Drainage may become necessary in the presence of clinical complications such as abdominal pain, compression of adjacent organs by large pseudocysts, or if superinfection of a pseudocyst occurs. Depending on clinical, morphologic, or technical factors, drainage may be accomplished with image-guided external catheter placement, by endoscopic internal (transgastric) drainage or by internal surgical drainage. Arterial pseudoaneurysm carries the risk of acute intra- or extraperitoneal bleeding, and transarterial embolisation is usually indicated when pseudoaneurysm is detected. Strictures of the common bile duct secondary to chronic pancreatitis may require percutaneous or endoscopic retrograde intervention.

Learning Objectives:

1. To review interventional techniques that are used to manage fluid collections in the setting of pancreatitis.
2. To compare the results with those obtained by surgical and/or endoscopic approach.
3. To learn about algorithms used for clinical decision making, and for treatment evaluation and follow-up.
4. To understand major shortcomings and complications and how to avoid them.

Discussion 09:45

08:30 - 10:00

Room C

CLICK (Clinical Lessons for Imaging Core Knowledge): Common

Clinical Cases

CC 718

Dyspnea

Moderator:

M. Rémy-Jardin; Lille/FR

A-190 08:30

A. Clinical considerations

J. Neuwirth; Prague/CZ (neuwirthj@gmail.com)

Dyspnoea is defined as an awareness of difficulty in breathing. Individual sensation is described as "shortness of breath", "breathlessness" or tightness in the chest. Clinical and diagnostic approach differs according to severity and speed of onset. It can be chronic, acute or hyperacute = life threatening. Hyperacute dyspnoea can be caused by pulmonary embolism, tension pneumothorax, severe metabolic acidosis, florid pulmonary oedema, status asthmaticus, severe upper airway obstruction and ARDS. Dyspnoea is the most common complaint of patients with cardiopulmonary diseases and 60% of dyspnoea is caused by cardiac, pulmonary or mixed cardiopulmonary aetiology. Clinical differential diagnosis list is long. The pulmonary causes are airway mass including angio-oedema, epiglottitis, laryngeal obstruction, asthma, bronchitis, chest wall trauma, effusion, emphysema, metastatic disease, pneumonia, pneumothorax, pulmonary embolism, pulmonary hypertension and restrictive lung disease. The cardiovascular aetiology includes: arrhythmia, coronary artery disease, intracardiac shunt, left ventricular failure, myxoma, pericardial and valvular disease. Less frequent aetiology includes drug-induced, neuro-psychogenic or haematological diseases or by increase of abdominal pressure. Rare causes are: neuromuscular, CNS disorders, altitude, anaemia, metabolic problems, anaphylaxis and sepsis. The priority diagnoses include COPD, heart failure, pneumonia and pulmonary embolism. The imaging methods are most decisive and conclusive in the last two. The plain chest film is requested just after check-out of vital signs, consciousness, pulse dimetry, oxygen mask and arterial blood gas in life threatening dyspnoea. CT and CT angiography are more frequently used in acute setting as well.

Learning Objectives:

1. To learn more about the clinical conditions causing shortness of breath.
2. To be informed about the clinician's way of thinking in the process of differential diagnosis.
3. To become familiar with the potential role of imaging in the establishment of the final diagnosis and planning of therapy.

A-191 09:00

B. Imaging techniques and typical findings

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

Dyspnoea is a common symptom in patients presenting to the emergency room. In almost two-thirds of all cases, dyspnoea is caused by either a pulmonary or a cardiovascular disorder. Imaging in patients with dyspnoea depends mainly on the clinical presentation and the medical history of the patient. Chest radiographs are a cost-effective and rapid test for the evaluation of patients with dyspnoea, with a fair sensitivity and specificity. For this reason, chest radiographs are usually performed early in the diagnostic evaluation of patients with acute and chronic dyspnoea. Chest radiographs enable the diagnosis of frequent causes of dyspnoea of pulmonary origin, such as pneumonia, pneumothorax, pleural effusions, interstitial lung diseases, and emphysema. The diagnosis of cardiovascular disorders, such as pulmonary venous hypertension, cardiomyopathy, as well as valvular diseases, is also facilitated by chest radiographs. If chest radiographs, clinical studies, and laboratory tests, however, are non-diagnostic or equivocal, CT is indicated. CT offers high sensitivity and specificity for the evaluation of pulmonary embolism and for diseases of the pulmonary parenchyma and the airways. High-resolution CT represents the method of choice for the evaluation of suspected diffuse lung disease. Additional expiratory scans are useful for the evaluation of mosaic perfusion and air-trapping.

Learning Objectives:

1. To learn about the available imaging modalities to be used for the evaluation of dyspnea patients.
2. To become familiar with the technical imaging considerations and the proper diagnostic algorithm.
3. To know more about the typical imaging findings.

A-192 09:30

C. Interactive case discussion

J. Andreu; Barcelona/ES (jandreas@gmail.com)

The aetiology of dyspnoea is varied. It may be due to pulmonary or pleural disease, cardiac pathology or extrathoracic causes. Imaging is an useful adjunct in the diagnosis of majority of cases of dyspnoea. In this lecture we will present selected cases which will demonstrate the usefulness of different imaging modalities, emphasising when cross-sectional imaging is indicated.

Learning Objectives:

1. To review typical cases illustrating the role of imaging modalities in the differential diagnosis of dyspnea cases.
2. To motivate the audience by the use of voting pads to be involved in the diagnostic process.
3. To highlight the conclusion that may be drawn on the basis of the discussed cases.

08:30 - 10:00

Room D1

KISS (Keep It Simple and Straightforward): Musculoskeletal MRI

CC 716

The ankle and foot

Moderator:

M. Shahabpour; Brussels/BE

A-193 08:30

A. How I do it

M. Zanetti; Zurich/CH (marco.zanetti@balgrist.ch)

We use two various standard MR imaging protocols for the evaluation of foot and ankle abnormalities. For hindfoot abnormalities, MR imaging is performed with the foot in neutral position and the patient is supine. T1-weighted spin-echo images are obtained in the coronal plane and in the transverse oblique plane (45° between the coronal and transverse planes). T2-weighted fast spin-echo images are obtained in the coronal plane and in the transverse plane. A fast spin-echo short tau inversion recovery (STIR) sequence is obtained in the sagittal plane. The protocol is modified when patients are referred specifically for flexor tendon abnormalities. Such patients are prone positioned to avoid magic angle artefacts. Alternatively to the prone body position, the foot can be plantarflexed in supine body position. In our experience this position is less comfortable and results in more motion artefacts than the well tolerated prone body position. For forefoot abnormalities, MR imaging is performed in the prone body position with plantarflexed foot. The reason for prone patient positioning is the higher conspicuity of Morton's Neuroma in the prone position compared to the supine position. The protocol consists of a sagittal T1-weighted spin-echo sequence, a transverse (perpendicular to the metatarsals) T1-weighted spin-echo MR sequence, and a transverse T2-weighted turbo spin-echo sequence. A coronal short inversion time inversion recovery (STIR) images is used as a screening sequence for bony lesions. Contrast enhanced T1-weighted fat-suppressed spin-echo MR images are obtained for rheumatic diseases.

Learning Objectives:

1. To understand the influences of patient positioning, scan parameters and magnet/coil technology on image quality.
2. To learn how to optimise scan protocols to maximise patient throughput without compromising diagnostic quality.
3. To recognise how and when to modify scan protocols to answer specific clinical questions.

A-194 08:55

B. Normal variants and pitfalls

A.H. Karantanas; Iraklion/GR (akarantanas@gmail.com)

MR imaging is recognised as the modality of choice in the diagnosis of many diseases of the ankle and foot. In order to better depict pathology, detailed knowledge of the normal anatomy is important. The proper depiction of normal anatomy requires recognition of the anatomic variants. Osseous variants include a flat or convex retromalleolar fibular groove, hypertrophy of the peroneal tubercle and retrotrochlear eminence, presence of various accessory bones such as the os naviculare and os peroneum and variation of the calcaneal apophysis ossification. Variants of the subtalar joints include a missing anterior facet, fusion of the anterior and middle facets and articulation between talar head and cuboid bone. At the posterior talocalcaneal articulation, variations exist regarding the curvature of the medial side of the joint. Soft tissue vari-

ants include the presence of accessory muscles, a low-lying peroneus brevis muscle belly, pseudosubluxation of the peroneus brevis tendon, and a bifurcated or mildly crescentic peroneus brevis tendon. Accessory muscles in the ankle area include in the lateral aspect the peroneal tertius and peroneal quartus, in the medial aspect the flexor digitorum accessorius longus, and posteriorly the peroneocalcaneus internus, tibiocalcaneus internus and accessory soleus. As variations are commonly seen in asymptomatic ankles, matching with clinical symptoms is important. Pitfalls include pseudoloose bodies in the ankle joint, pseudolipomas, and artefacts such as the „magic angle“ effect, chemical shift, susceptibility, motion, „ghost“ and partial volume averaging. Knowledge of normal anatomy, pitfalls and variants, aids radiologists in making the precise diagnosis of various disorders.

Learning Objectives:

1. To become familiar with the normal anatomy.
2. To be able to identify normal variants.
3. To appreciate the range of pitfalls that may simulate pathology.

A-195 09:20

C. Identifying and reporting abnormal findings

A. Cotten; Lille/FR (anne.cotten@chru-lille.fr)

Ankle and foot disorders are common and can affect a wide variety of patients and many different anatomical structures. A precise and complete analysis of all these structures is therefore required, and an appropriate terminology of the pathological features has to be used in the report. This lecture will review the MR appearances of the most common disorders (traumas, microtraumas, infection, rheumatism, tumours, etc.) affecting the bones, joints and soft tissues of the ankle and foot.

Learning Objectives:

1. To review the imaging appearances of common abnormalities.
2. To understand the use of terminology to describe pathological findings.
3. To learn how to structure a radiological report to ensure clarity and brevity.

08:30 - 10:00

Room D2

Genitourinary

RC 707

CTU and MRU: urinary tract imaging

Moderator:

R. Manfredi; Verona/IT

A-196 08:30

A. CTU/MRU in acute obstruction

T. Meindl; Munich/DE (thomas.meindl@med.uni-muenchen.de)

A variety of pathological processes that involve the upper urinary tract (UUT) may cause acute urinary obstruction: impacted calculi, neoplasms, intra- and extraluminal ureter compression, coagulopathy, fibrosis and surgery. Clinically acute obstruction leads to significant flank pain and renal colic that urges the clinician to immediate diagnostic work-up and appropriate treatment. Radiological imaging procedures include ultrasonography, intravenous urography, computed tomography (CT) and magnetic resonance (MR) imaging. Among the cross-sectional examinations, multi-detector CT is the modality of choice for clarifying the underlying cause of acute obstruction. Unenhanced (low-dose) CT is the new imaging standard for detection of calculi. Contrast-enhanced CT allows diagnosis of virtually all pathologies leading to obstructive nephropathy. After intravenous contrast media application, several contrast-phases can be imaged including the excretory phase for depiction of the UUT. Since radiation dose is a major drawback, imaging protocols have to be optimised and must be tailored to the clinical question. Magnetic resonance urography reveals the possibility of imaging the urinary tract without the need for contrast media by means of heavily T2-weighted sequences. These static urograms provide information about the grade and site of obstruction, independent of the excretory function of the kidneys. After injection of gadolinium chelates, one or more urograms can be acquired during contrast media excretion. In the context of acute obstruction, MR urography is preferred in paediatric, young and pregnant patients. Patients with renal impairment are examined with T2-weighted sequences without the need for contrast media. Magnetic resonance urography is complementary to CT in challenging cases.

Learning Objectives:

1. To learn the technical tips for MRU and CTU in acute obstruction.
2. To understand the value of cross-sectional urography compared to IVP.
3. To review the appearance of major diseases like urinary stones, clots, etc.
4. To understand the drawbacks of each method and which one should be used first.

A-197 09:00

B. Chronic/intermittent obstruction

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

The recent technological advances of CTU and MRU have had an exceptional impact on the assessment of chronic/intermittent obstruction. Imaging studies should help answer the clinical questions raised concerning the presence, level, and cause of obstruction. In this session, the recommended techniques of CTU and MRU will be described and their relative merits and limitations reviewed. 3D CT images should be used as an adjunct to the transverse images, instead of a replacement, because volume-rendered images best depict the lumen and not the wall of the urinary tract. Thin-section reformatted CT images likely are as sensitive as transverse images in the detection of urinary tract abnormalities. MRU is being increasingly used because it provides excellent anatomic and functional imaging in a single setting. It has proved particularly valuable in pregnant women and children. The relative advantages of static-fluid MRU and excretory MRU will be discussed. The main aetiologies of chronic/intermittent obstruction will be illustrated, including intraluminal diseases (stones, clots, etc.), wall abnormalities (transitional cell carcinomas, tuberculosis, etc.) and extraluminal diseases (pelvic and retroperitoneal tumours, retroperitoneal fibrosis, GI tract diseases, etc.) UPJ syndrome is the most common site of urinary tract obstruction in children. Vessels crossing a ureteropelvic junction obstruction contribute to the degree of hydronephrosis in up to 46% of these patients. Demonstration of these vessels and their location anterior or posterior to the obstruction facilitates surgical planning. At the end of the lecture, attendees will become familiar with moderate or severe urinary obstruction and their various features and causes.

Learning Objectives:

1. To learn the technical tips for MRU and CTU in chronic obstruction.
2. To review the appearance of major diseases like PU junction, prostate masses, chronic inflammation and extrinsic compression.
3. To understand the advantages and disadvantages of each method.

A-198 09:30

C. Tumours: CTU/MRU

N.C. Cowan; *Oxford/UK (nigel.cowan@nds.ox.ac.uk)*

1. Technological advances in both computed tomography (CT) and magnetic resonance (MR) imaging have improved the diagnostic imaging of the urinary tract, surpassing ultrasound and the intravenous urogram. Multidetector computed tomography urography (CTU) is defined as CT examination of the kidneys, ureters and bladder with at least one imaging series acquired during the excretory phase of contrast enhancement. MR urography (MRU) can be performed using heavily T2-weighted sequences without contrast material or T1 spoiled gradient-recalled echo sequences during the excretory phase after administration of gadolinium-based contrast material. In adults, CTU or MRU is now the preferred examination. Technical aspects of image acquisition and processing will be explored and technical tips relating to protocol design given. 2. The typical and atypical appearances of upper urinary tract urothelial tumours and bladder cancers will be demonstrated. A method of fluoroscopic biopsy of upper tract tumours is described for validation of the imaging diagnosis. 3. Early and accurate diagnosis of urinary tract tumours helps optimise prognosis but conventional investigative pathways are complicated and lengthy, utilising multiple imaging tests and many diagnostic algorithms exist without rigorous evaluation. CTU 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. MRU is a promising technique that may be used for the initial evaluation of patients at high risk for developing upper-tract urothelial carcinoma when CTU or intravenous urography is contraindicated.

Learning Objectives:

1. To learn the technical tips for MRU and CTU in the detection of urothelial tumours.
2. To review the typical and atypical appearance of urothelial tumours.
3. To understand why CTU/MRU are complementary tools to other imaging methods.

08:30 - 10:00

Room E1

Musculoskeletal

RC 710

Bone marrow oedema and bone marrow oedema-like lesions

Moderator:

B. Vande Berg; *Brussels/BE*

A-199 08:30

Chairman's introduction

B. Vande Berg; *Brussels/BE (bruno.vandenberg@uclouvain.be)*

The term bone marrow oedema was introduced to describe ill-defined bone marrow hypointensity on T1W and hyperintensity on T2W and water sensitive sequences. Bone marrow edema can be found in many similar unrelated disorders, such as bone contusions, osteonecrosis, inflammatory or degenerative disease, being a non-specific MRI abnormality representing a diagnostic challenge for radiologist. Recently has been demonstrated that bone marrow oedema might be a prognosis marker for OA (osteoarthritis) and inflammatory disease, and could be used as a powerful predictive tool for treatment options. Therefore our role as radiologist is to try to increase specificity to help patient management and decrease progression. The aim of this refresher course is to describe MR imaging features of bone marrow edema in different important and frequent disorders: osteoarthritis, inflammatory diseases and trauma.

A-200 08:35

A. BME and osteoarthritis

F.W. Roemer; *Augsburg/DE (f.w.roemer@gmx.de)*

Subchondral bone marrow lesions (BMLs) are a hallmark of osteoarthritis (OA) on MRI. Radiologically, BMLs in OA are understood as non-cystic subchondral areas of ill-defined hyperintensity on T2w images and of hypointensity on T1w images, but only water-sensitive fat-suppressed sequences depict the lesions to their maximum extent. BMLs are observed regularly in conjunction with adjacent cartilage alterations. Higher grades of cartilage loss are associated with higher prevalence and greater volume of concomitant BMLs. As the disease progresses, an increase in BML volume is seen in the same region subchondrally in many patients, which is positively correlated with an increase in cartilage loss and radiographic joint space narrowing. Cysts are strongly associated with BMLs in the same subregion and develop within non-cystic BMLs. The published data on the natural history of BMLs are ambiguous but recent reports showed that the majority of subchondral BMLs may regress or resolve completely. Note that progression and regression of BMLs may be observed within the same knee simultaneously. Histologic correlation studies showed that the lesions consisted of a mixture of different tissue patterns with only little oedema. Specific changes in bone mineralisation and remodelling in areas of BMLs have been shown, and they appear sclerotic compared to unaffected regions from the same individual. Differential diagnoses of OA-related BMLs include traumatic bone contusions and fractures with or without disruption of the articular surface. Osteonecrosis, inflammation, idiopathic BMLs, red marrow and post-surgical alterations should also be considered.

Learning Objectives:

1. To learn about the basic physiopathology of OA and its relation with BME.
2. To analyse the distribution and natural history of BME in OA.
3. To understand the differential diagnosis and relevance of BME in staging OA and as a marker of prognosis.

A-201 08:58

B. BME and early inflammatory disease

A.J. Grainger; *Leeds/UK (andrew.grainger@leedsth.nhs.uk)*

Marrow oedema is identified as a feature of many forms of inflammatory and mechanical arthritis, but has been most studied in the inflammatory arthritides and particular in rheumatoid arthritis. It was first reported as a feature of RA as far back as 1986. Work has been undertaken both using human specimens and specimens from animal models which suggest that marrow oedema seen on MRI in RA corresponds to areas of inflammation been associated with invading pannus, lymphocytic aggregates and hypervascularity. There is also evidence that the marrow lesions seen on MRI in ankylosing spondylitis correspond to histopathological inflammatory change. Marrow oedema has been shown to be an important predictor

of future joint damage in patients with rheumatoid arthritis. In addition to predicting bone destruction for erosion, marrow oedema is independently predictive of joint space loss and therefore cartilage destruction. It also correlates well with other measures of disease activity. We have applied dynamic contrast enhancement techniques to show that treatment with anti-TNF therapy brings about a reduction in contrast uptake in areas of marrow oedema in patients with RA. In the seronegative arthritides marrow oedema in the spine in ankylosing spondylitis has been shown to be predictive of future changes and of response to treatment. Diffusion weighted imaging of marrow lesions in ankylosing spondylitis can also be used to show a treatment response, seen as a change in the apparent diffusion coefficient.

Learning Objectives:

1. To become familiar with the imaging pattern of seronegative and rheumatoid arthritis distribution.
2. To understand the relationship between BME and early diagnosis of inflammatory disease.
3. To analyse whether BME helps in patient management, diagnosis and follow-up.

A-202 09:21

C. BME and trauma

O. Hauger; Bordeaux/FR (olivier.hauger@chu-bordeaux.fr)

Bone marrow oedema, also referred as bone contusion or bone bruise, is frequently identified at magnetic resonance imaging after an injury to the musculoskeletal system. It may result from a direct blow to the bone, compressive forces from adjacent bones impacting one another, or from traction forces that occur during an avulsion injury. Its location reflects the mechanism of injury, which allows for a focused search for predictable patterns of associated internal derangements. It is seen in any joint but are particularly common in the knee reflecting mechanisms such as pivot shift, hyperextension, contrecoup or dashboard injuries, as well as lateral patellar dislocation. In a context of trauma, bone marrow oedema, identified at MR imaging as areas of poorly margined signal intensity alteration (best seen on fat-suppressed sequences) in the cancellous bone and marrow, represents areas of oedema and haemorrhage secondary to trabecular injury. It can be seen as soon as one hour after trauma and usually resolves in the following six to eight months, except in case of subsequent chondral lesion.

Learning Objectives:

1. To learn about BME physiopathology in trauma scenario, direct and indirect mechanism.
2. To recognise BME as a footprint that allows other soft tissue injuries to be ruled out.
3. To analyse whether BME can be a value tool for follow-up.

Panel discussion:

Can we still use the term BME or should we be more specific? 09:44

The term bone marrow oedema was introduced to describe ill-defined bone marrow hyperintensity on T2 weighted images. Since then many studies have demonstrated that it can be found in many similar unrelated disorders, such as bone contusions, osteonecrosis, inflammatory or degenerative disease, and that it is a non-specific MRI abnormality. It has been demonstrated that bone marrow oedema might be a prognosis marker for OA (osteoarthritis) and inflammatory disease, and could be used as a powerful predictive tool for treatment options. Therefore our role is to increase specificity to help patient management and decrease progression.

08:30 - 10:00

Room E2

Foundation Course: Paediatric Radiology

E³ 720

Paediatric neuroimaging: let's make it simple!

Moderator:

J.F. Schneider; Basle/CH

A-203 08:30

A. Neurosonography in the neonate: rules of thumb

G. Enriquez; Barcelona/ES (genriquez@vhebron.net)

Sonography is an essential tool for studying the neonatal brain. Brain scans are usually performed via the anterior fontanelle; however, a more complete assessment of the brain can be achieved using the posterior and mastoid fontanelles, high-resolution linear array transducers and colour or power Doppler. The most common lesions in premature infants are intraventricular/periventricular haemor-

rhage and periventricular echodensities. The posterior fontanelle approach improves the detection of grade II haemorrhage in 30% more cases than the anterior fontanelle, and the mastoid fontanelle approach is essential for diagnosing cerebellar haemorrhage. Ventricular dilatation is the main complication of intraventricular haemorrhage and resolves spontaneously in approximately 65% of cases. The main challenge with periventricular echodensities is to differentiate them from classical periventricular leukomalacia. When cysts appear during follow-up, the diagnosis is straightforward. MRI is considered to be more sensitive than US for evaluating white-matter damage. Congenital brain malformations including ventricular dilatation of diverse aetiologies, corpus callosum agenesis and posterior fossa malformations are usually diagnosed prenatally. MRI complements US for this purpose. Acquired abnormalities arise mainly from infections and hypoxic-ischaemic injury. Although MR is considered the gold standard, US still plays an important role in the study of hypoxic-ischaemic lesions when used to its full capacity. Depending on the duration and severity of the hypoxic insult, patterns different from those seen in premature infants may be observed.

Learning Objectives:

1. To learn about the technique of neonatal neurosonography and outline its limitations.
2. To become familiar with the common abnormalities seen in the premature infant.
3. To learn about the common congenital and acquired abnormalities in the term infant.

A-204 09:00

B. Common congenital cerebral abnormalities

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

Brain malformations are conditions where the brain has not formed properly during pregnancy. These problems in brain structure are almost often (with some exceptions) associated with neurological and developmental problems. Often, brain malformations are part of syndromic complexes that require a multidisciplinary approach. Malformations may be caused by inherited genetic defects, spontaneous mutations within the genes of the embryo, or effects on the embryo due to the mother's infection, trauma, or drug use. Classification schemes are currently shifting from a morphological to a genetic approach. The most frequent congenital brain abnormalities may be categorised into anomalies of the corpus callosum and telencephalic commissures, holoprosencephalies and related entities, malformations of the cerebral cortex, and malformations of the cerebellum. These congenital brain defects are diagnosed either from direct physical examination or from imaging studies including CT and MRI. Prenatal MRI offers a viable method to improve detection and characterisation of these entities in utero.

Learning Objectives:

1. To learn about the common supra- and infratentorial congenital abnormalities.
2. To learn when MRI is required and the appropriate imaging protocol.
3. To learn if and when CT is still useful in the investigation of congenital anomalies.

A-205 09:30

C. CNS infection and inflammation: signs you should not miss

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

Different neuroimaging patterns of CNS infection may be found in neonates and young children. In the neonatal period parenchymal calcifications with or without ventriculomegaly are suggestive of intrauterine infection. Cytomegalovirus causes additionally striatal vasculopathy and gyral abnormalities and herpes simplex encephalomalacia. Herpetic infection in older children involves the orbital surface of the frontal lobes, the temporal lobes and the insula and causes haemorrhagic lesions. Ischaemic or haemorrhagic infarcts may be suggestive of varicella zoster infection. Involvement of the pontine tegmentum, the anterior horns and the ventral roots of the spinal cord is observed after enterovirus infection. HIV infection may appear as basal ganglia and deep white matter atrophy, as diffuse brain atrophy or even as necrotising encephalopathy. Brain abscess may appear as mass lesion presenting peripheral enhancement and restricted diffusion. Diffuse meningeal enhancement may be suggestive of viral or bacterial meningitis, while basal cistern enhancement is suggestive of tuberculous meningitis. Acute disseminated encephalomyelitis is a parainfectious condition appearing with multiple peripheral ill-defined simultaneously enhancing white matter lesions. Involvement of the basal ganglia, the thalami and the cortex may also be seen. Spinal cord lesions appear as longitudinal swelling over more than three vertebral segments. Multiple sclerosis (MS) presents with multiple lesions perpendicular to the long axis of the lateral ventricles. Larger lesions with open ring enhancement are suggestive of tumefactive MS. Spinal cord

involvement is characterised by lesions well or ill-defined lesions extending over less than one vertebral segment.

Learning Objectives:

1. To recognise how best to image the child with suspected CNS infection or inflammation.
2. To understand the imaging findings and the main differential diagnoses.
3. To learn about the complications and their investigation.

08:30 - 10:00

Room F1

Abdominal and Gastrointestinal

RC 701

Tumour evaluation: beyond morphology

Moderator:

O. Lucidarme; Paris/FR

A-206 08:30

Chairman's introduction

O. Lucidarme; Paris/FR (olivier.lucidarme@psl.ap-hop-paris.fr)

Until now, in oncology, only the RECIST criteria based on anatomical measurement of the tumour size are used for drug trials or in clinical practice because this is a standardised way to assess the tumour response that allows the calculation of the progression-free survival (PFS) or the time to progression (Ttp) that are usually accepted as surrogate end point for overall survival. However, tumour follow-up evaluation using only morphology is usually delayed and with the emergence of new numerous and very expensive targeted therapies there is now a need to move beyond morphology to find new ways to assess tumour responses or progression not only for clinical trials but also in clinical practice to maintain or to change quickly a treatment. This is the aim of the functional imaging using ultrasound, CT, MRI or PET. The ultimate goal of these technique is to find biomarkers able to predict the likely course of disease, irrespective of treatment (prognostic biomarkers) or able to forecast the likely response to treatment (predictive biomarkers); before (baseline values of a parameter) or during the treatment (dynamic variation of the parameter during the follow-up). During this session the presenters will discuss the technical issues and the results obtained today using ultrasound with shear-waves or microbubbles, functional CT, dynamic contrast enhanced MRI, diffusion weighted MRI and PET-CT. The candidate biomarkers will be presented as well as the limits and the problems that are still to be overcome.

A-207 08:35

A. US and CEUS

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

For tumour evaluation, the main advantages of ultrasound (US) associate a high frame rate and a large range of data and parameters potentially extracted from the signal backscattered from tissues. Beyond morphology, elastography is a first modality, based on in vivo estimation of the mechanical properties of tissues. Data on displacement or strain of tissues and lesions can be obtained by manual external compression, but shear wave generation techniques allow for a quantitative and more precise estimation of their visco-elastic properties. In oncology, clinical evaluation included first breast. Contrast-enhanced US (CEUS) is obtained after intravenous administration of microbubbles which are pure blood pool contrast agents. CEUS is capable for detection, characterisation and follow-up of tumour lesions, based on enhancement profiles during bolus, destruction-replenishment, or contrast burst depletion imaging. Quantification of perfusion in normal tissues and lesions may be obtained by extracting various blood flow and blood volume-related parameters from time-intensity curves. Protocols have entered validation processes to improve reproducibility. As a predictive technique, CEUS is a promising tool for monitoring changes of haemodynamic parameters and evaluating the early response during chemotherapy or antiangiogenic treatment. It is helpful in the guidance and follow-up of lesions treated by radiofrequency or cryoablation. Recent advances of US and CEUS include 3D/4D real-time imaging with matrix technology, and the evaluation of targeted agents, to be released on site after bubble destruction by the US beam.

Learning Objectives:

1. To learn about enhancement characteristics of the liver and the various focal liver lesions.
2. To understand in which situations US and CEUS are expected to be appropriate.
3. To understand the role of US and CEUS in comparison to CT and MRI.

A-208 08:58

B. CT and MRI perfusion

F. Berger; Munich/DE (Frank.Berger@med.uni-muenchen.de)

At initiation, tumours in a pre-vascular phase are supplied by oxygen and nutrients that diffuse from pre-existing normal vessels. When the tumour reaches a critical size of approximately 1-4 mm diameter, the resultant ischaemia leads to secretion of angiogenic factors. These factors, such as vascular endothelial growth factor (VEGF), recruit and maintain tumour vessels. "New" vessels (neovasculature) exhibit increased blood volume and permeability compared with normal vessels. Various new specific therapies in oncology target tumour vasculature or tumour neo-angiogenesis. It is not uncommon that these targeted therapies have pronounced cytostatic and not predominantly cytotoxic effects. This limits the usefulness of size-based morphological tumour response assessments. Of newer magnetic resonance imaging (MRI) modalities, perfusion MRI has emerged as a valid marker of tumour-induced blood vessels and their function. MRI perfusion measures the vascularity within a tumour, as well as its component heterogeneous parts. Of parameters which can be measured to date, blood volume and permeability are commonly applied in patient studies. Blood volume measures the aggregate size of the vascular space, while the permeability function informs about the integrity of vessels and their 'leakiness' to contrast agents. We will describe the use of MR perfusion to monitor such new therapies and discuss its specific advantages and limitations in comparison to CT perfusion protocols. PET-based strategies for targeted treatment-monitoring in oncology will be briefly mentioned, with prospect on the significance of combined vascular and metabolic imaging for further optimising non-invasive response assessment in specific anticancer therapies.

Learning Objectives:

1. To learn about established morphological-based strategies for tumour response monitoring: RECIST and WHO criteria with their limitations in targeted treatment surveillance.
2. To learn about the latest antiangiogenic/antivascular treatment strategies in oncology.
3. To learn about perfusion imaging protocols, specific advantages and technical challenges when utilising CT or MRI.
4. To learn about the significance of CT or MR perfusion imaging in oncology, typical applications and future strategies for improvement of non-invasive treatment monitoring in oncology.

A-209 09:21

C. MR diffusion and PET/CT

C. Della Pina; Pisa/IT (mclotilde@virgilio.it)

After a brief review of physical and technical principles of diffusion-weighted MR imaging and PET-CT, the lecture describes the ability of these techniques in evaluating functional parameters in tumour tissue. Diffusion-weighted sequences have been used in an attempt to further increase the diagnostic capability of baseline and dynamic MR study by providing functional information. Diffusion-weighted MR imaging is based on the random microscopic movement of molecules that can be quantified by means of apparent diffusion coefficient (ADC). In the early post-treatment period after loco-regional therapies, tumours may not change in size. Recent studies demonstrated that water diffusion can be used to differentiate viable and cellular regions from necrotic area in the tumour, regardless morphologic or dimensional changes. Moreover, new classes of antitumour therapy have been developed that have an antiproliferative effect, inducing a delay in tumour shrinkage. Diffusion MR imaging can be promising in this clinical setting as a biomarker to predict early response to systemic chemotherapy. On the other hand, PET/CT, combining the functional and the structural imaging approach, was shown to be superior regarding conventional imaging modalities in the identification of intrahepatic and extrahepatic metastases. Less experience and less publications are available for PET-CT in monitoring tumour response after interventional therapies, but the ability of PET-CT to measure early metabolic changes could make this technique useful in the development of novel anticancer drugs.

Learning Objectives:

1. To become familiar with the physical and technical principles of DWI and PET/CT in tumours.
2. To recognise the qualitative and quantitative information of the different modalities.
3. To review imaging findings after percutaneous and intra-arterial treatments of liver malignancies.
4. To appreciate the clinical role of these techniques in monitoring tumour response.

Panel discussion:

How can you easily implement some functional imaging into your practice? 09:44

Through clinical cases the speakers will discuss or debate the best use of the available functional imaging techniques, pitfalls and limitations and how they can be optimally used in combination with correlative anatomic imaging modalities according to the clinical questions (staging, restaging, assessment of response and prediction of patient prognosis before and after neoadjuvant therapy).

08:30 - 10:00

Room F2

Professional Challenges Session

PC 7

Professional issues in interventional radiology: education, training and standards

Moderators:

J.I. Bilbao; Pamplona/ES

J.H. Peregrin; Prague/CZ

A-210 08:30

Chairmen's introduction

J.I. Bilbao¹, J.H. Peregrin²; ¹Pamplona/ES, ²Prague/CZ (jibilbao@unav.es)

Interventional radiology (IR) is the part of clinical radiology based on the percutaneous or endoluminal treatment of widespread conditions. The procedures performed by the interventional radiologists require a deep level of knowledge of clinical imaging and specific training in patient management and care. Technical skills are also needed because complex devices and materials are used in some procedures. Therefore, specific training programmes are required to address the training needs for the interventional radiologist. A multidisciplinary approach is required (based on team work) with defined levels in patient care. IR procedures have become the treatment of choice for many conditions as an alternative for some surgical procedures. Even for some conditions without a defined treatment are now being treated by IR. Thus, it is a discipline with a great deal of interaction with other clinical specialities that requires a clear definition. IR specialists have to receive recognition in the patient care process and their activity has to be known by the medical community. The recognition of IR as a subspecialty of clinical radiology by the UEMS will contribute to the development of specific training programmes in the European community and will promote training centres with certified specialists.

Session Objectives:

1. To know more about the specific training needed for interventional radiology (IR).
2. To learn about the interaction between IR and other specialities.
3. To understand the relevance of the recognition of IR as a UEMS division within the section of Radiology.

A-211 08:35

Education and training in IR

A.-M. Belli; London/UK (Anna.Belli@stgeorges.nhs.uk)

Interventional radiology (IR) procedures are complex and require specific training to ensure good results. In the UK, a curriculum for subspecialty training was established in 1998 specifying the required knowledge, training and core procedures expected of trainees. This curriculum has undergone several reforms since that time. However, training is not uniform throughout Europe and this stimulated the development of a Europe wide IR training document to ensure similar training in all countries as a way of ensuring good medical practice. Radiology training is based on 3 years of common radiology training and 2 years of subspecialty training with an option for further specialist training in the 6th year. Regular appraisals and assessments of trainees' performance should guide progress at local training institutions with the aim that competence is assessed formally at the end of training by a European Board examination. This qualification will be recognised throughout Europe and ensures that the required proficiency in IR procedures has been attained. Competence in the core skills for IR occurs during the 3 years of training. In the next 2 years, trainees undertake modular training depending on their areas of interest and ultimate goals. The majority of this training is practical, supervised training in interventional suites and theatres, with clinical exposure. Simulators play a role alongside the more traditional training methods and allow early training in a more forgiving environment away from the patient. Development and validation of such simulation models is progressing.

Learning Objectives:

1. To learn about the differences in training in IR and methods of training harmonisation in Europe.
2. To learn about a syllabus for European IR training.
3. To understand the optimum timing and methodology for delivering IR training.

A-212 08:58

Turf battles facing IR

J.A. Reekers; Amsterdam/NL (J.A.Reekers@amc.uva.nl)

Interventional radiology, being part of general radiology, has traditionally always been a medical specialty to support clinicians. It is about 15 years ago that IR procedures were gradually changing from an extension of a clinician's treatment, to become stand-alone treatments replacing traditional surgical techniques. Interventional radiologists moved more towards the clinical site, not only making the diagnosis but also controlling the indications for treatment. This became very clear at the turning of the century as one of the pillars of vascular surgery, being aneurysm surgery, became the new playing ground for interventional radiologists. A major turf battle was born. Next to this well known turf battle there are many others emerging at the horizon. Gynaecologist wanting to perform UFE, GE-doctors performing biliary interventions, cardiologist doing renal stenting, but also urologist, trauma physicians and many others are moving towards image-guided minimal invasive treatment. Is the consequence of all these battles that IR by interventional radiologists should/will disappear? Not at all, at least when we stop fighting these battles. Recognition of IR as an independent clinical medical speciality, with his own needs, training and certification, is the most important way forward. Being the best equipped, best trained, image-guided treatment specialist is essential. Making service and financial alliances with other more traditional medical specialities is also important. The old adagio, if you cannot beat them, join them, is still valid. But join them on equal terms from the strong position as well trained clinical interventionalist.

Learning Objectives:

1. To understand reasons for turf battles.
2. To learn how to resolve conflict with other specialities.
3. To learn about conflicts with diagnostic radiology.

A-213 09:21

Future directions in IR

M.J. Lee; Dublin/IE (mlee@rcsi.ie)

The dramatic growth of interventional radiology (IR) over the last 15 years and its increasing impact on patient care have made IR a vital component of modern healthcare. IR is in a strong place; however, there are vital areas that require nurturing. Clinical practice in interventional radiology is a must for IR to continue to grow and fulfil its potential. Outpatient clinics, day case and inpatient beds should all be part of IR work plans. Teaching is an important part of any clinical discipline and interventional radiologists need to ensure that IR plays a prominent role in the undergraduate and postgraduate curricula of medical schools. Research is also important and has been gathering momentum and critical mass over the last 10 years. In Europe, IR remains strong under the stewardship of CIRSE. CIRSE holds the largest IR meeting, with an attendance of over 5000 delegates, annually. Recently, IR has been recognised as a sub-speciality under the umbrella of diagnostic radiology at UEMS. This is an important milestone with great potential. In fact, CIRSE have recently run the first sub-certification examination (European Board of Interventional Radiology-EBIR) in Interventional Radiology in Europe in October 2010. Importantly, the examination was endorsed by ESR and by the IR Division of UEMS. I believe EBIR is an incredibly important examination which will supercede national boundaries and give IR a more secure footing in Europe. Interventional radiology is emerging into the light, I believe it has a bright future.

Learning Objectives:

1. To learn about ways to guide IR in a safe direction.
2. To learn about subcertification in IR.
3. To understand the importance of recognition by UEMS.
4. To understand the issue of working in multidisciplinary teams.

Panel discussion:

What does an interventional radiologist need to know? 09:44

Some years ago, interventional radiologists (IRs) could have been seen as skilled physicians interested in the performance of complex vascular procedures. This is not the case anymore and now IRs are (or should be) fully involved in the multidisciplinary management of patients. This new scenario needs specific training, recognition among other specialists and institutional boards as well as specific subcertification.

08:30 - 10:00

Room G/H

EFOMP Workshop

New technology in diagnostic radiology:

advances in breast imaging

EF 1

Advances in technology for breast imaging

Moderators:

S. Christofides; Nicosia/CY

A. Del Guerra; Pisa/IT

Welcome address 08:30

S. Christofides; Nicosia/CY

Y. Menu; Paris/FR

A-214 08:40

Breast tomosynthesis

P.R. Bakic; Philadelphia, PA/US (Predrag.Bakic@uphs.upenn.edu)

Digital breast tomosynthesis (DBT) is an imaging modality which allows for three dimensional visualisation of breast tissue based upon the tomographic reconstruction using a limited number of x-ray projections. Early clinical studies indicated higher specificity and sensitivity compared to mammography, thus suggesting DBT as a candidate for replace mammography for early cancer screening. There are still several open issues in DBT, as, e.g. visualisation of microcalcifications, breast density estimation, use of contrast-enhanced DBT, and optimisation of DBT acquisition and reconstruction. This lecture will review published results of DBT clinical trials and discuss the open questions related to the use of DBT in quantitative imaging. In addition, we will discuss the use of simulation in DBT optimisation and validation. Validation of DBT is a challenging task due to its technological complexity. Clinical trials represent the gold standard for validation. They are, however, long, costly, and involve repeated exposure of women to radiation. Pre-clinical DBT validation may be performed using simulation of breast anatomy and image acquisition. Such approach offers ground truth about simulated tissues and flexibility to vary anatomy and/or acquisition parameters. The use of simulation in DBT validation will be illustrated by the examples of DBT geometric accuracy estimation and optimisation of DBT reconstruction parameters.

Learning Objectives:

1. To become familiar with the current research topics in digital breast tomosynthesis.
2. To compare the performance of digital breast tomosynthesis with mammography in terms of early cancer screening.
3. To learn about the use of breast anthropomorphic computer phantoms and acquisition simulation in validation of digital breast tomosynthesis.

A-215 09:05

Breast CT

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

X-ray computed tomography (CT) has been proposed and evaluated recently as a potential alternative method for breast imaging. Efforts so far showed success with respect to contrast-enhanced dynamic imaging, but suffered from limited spatial resolution. Respective efforts and clinical results will be reviewed. The new concept presented here builds upon micro-CT scanning approaches and aims at providing both high spatial resolution at around 100 μm for micro-calcification imaging and advanced dynamic scan capabilities with continuous acquisition and scan times of about 10 seconds for differential diagnosis of lesions. To achieve this, spiral scan modes, slipring technology, high-resolution detectors and high-power micro-focus x-ray tubes are demanded. The concept has been evaluated and confirmed by simulations and basic experiments; feasibility studies are expected by the end of 2011.

Learning Objectives:

1. To review the state of the art in CT of the breast.
2. To inform about concepts for dedicated CT scanners of the breast.

A-216 09:30

X-ray colour in breast imaging

C. Ullberg; Danderyd/SE (christer.ullberg@xcounter.se)

Colour x-ray imaging can best be described as the x-ray analogy to optical colour imaging. In optical imaging the wavelength - the energy - of the light gives the different colours that we see. Emerging x-ray detector technologies enable energy

discrimination of individual x-ray quanta, i.e. the detectors can 'see' the colour of the x-rays. Different materials attenuate the energy spectrum in their own characteristic way. By comparing the measured spectra with the spectrum emitted from the x-ray tube the penetrated material can be characterised. Colour x-ray imaging can be used in breast imaging to detect, for example the uptake of an iodinated contrast agent to show the vasculature of a tumour while reducing the impact of the structures from the surrounding tissue. It can also be used to estimate the breast density and as a material decomposition technique to separate the digital mammogram into compositional images, showing different material types separately. Colour x-ray imaging can, for example be realised with pulse height discrimination in a photon counting detector, multiple exposures with different x-ray tube settings or filtering the x-ray beam before or after the object. The most simple form of colour x-ray is dual energy where two images are acquired at different x-ray energies.

Learning Objectives:

1. To learn the benefits of colour x-ray imaging.
2. To get an overview of available methods for colour x-ray imaging and their respective advantages and drawbacks.

08:30 - 10:00

Room I/K

Chest

RC 704

Non-small cell lung cancer

Moderator:

J. Vilar; Valencia/ES

A-217 08:30

A. Update in TNM classification

S. Diederich; Düsseldorf/DE (s.diederich@marien-hospital.de)

Lung cancer staging is based on imaging techniques in combination with tissue diagnosis and surgical exploration. The TNM staging system describes the local tumour extent (T1-T4), presence or absence of lymph node metastases (N0-N3) and distant metastases (M0/M1). Different combinations of T-, N- and M-factors translate into tumour stages (stages IA-IV). Therapeutic decisions and assessment of prognosis are based on these tumour stages. Recently, the TNM system has been modified: tumour size is now used more precisely for T staging: tumours ≤ 2 cm: T1a, $> 2-3$ cm: T1b, $> 3-5$ cm: T2a, $> 5-7$ cm: T2b, > 7 cm: T3. Satellite tumour nodules in the same lobe are now classified as T3 (previously T4) and in a different lobe of the ipsilateral lung as T4 (previously M1). Satellite nodules in the contralateral lung (previously M1) and pleural or pericardial metastases (previously T4) are now classified as M1a, whereas distant metastases outside the chest are classified as M1b (previously M1). Also, the TNM staging system should now be applied not only to non-small cell lung cancer (NSCLC) but also to small cell lung cancer (SCLC). During this refresher course the different T-, N- and M-stages will be presented including the recent changes and examples will be presented and discussed with the audience. Therapeutic strategies in different tumour stages will be described and key decisions highlighted. The accuracy of different imaging procedures and findings will be presented and the role of biopsy in specific clinical scenarios will be discussed.

Learning Objectives:

1. To understand the principles of TNM classification for lung cancer.
2. To understand the relationships between tumour stage, prognosis, and therapeutic strategies.
3. To become familiar with the recent changes of TNM classification for lung cancer.

A-218 09:00

B. PET/CT in lung cancer

N. Howarth; Chêne-Bougeries/CH (nigel.howarth@grangettes.ch)

Integrated PET/CT imaging has an established role in the management of cancer patients and is now recommended for all patients with curative non-small cell lung cancer. PET/CT provides information essential for staging and prognosis, for choice of management and monitoring of treatment and for the detection of recurrence. Recent technical developments in PET/CT permit rapid examinations with improved resolution. Compared with standard CT or stand-alone PET, the added value of fused imaging is uncontested. The clinical influence of preoperative PET/CT is currently undergoing extensive evaluation. Radiologists should benefit from an understanding of important aspects of molecular imaging to improve their contribution to patient management. With the increasing use of PET/CT in the

management of cancer patients, imaging pitfalls must be recognised to avoid both false-positive and false-negative interpretation. The principles and good practices of PET/CT will be explained. Normal distribution of FDG, pitfalls and normal variants will be presented. Specific examples will be discussed to demonstrate how the combined information of images of human anatomy upon which biological information within body structures is added improves delineation of disease, can guide surgical and radiation planning and biopsy. Advances in technology result in new training requirements for radiologists who should promote close collaboration with nuclear medicine specialists.

Learning Objectives:

1. To review clinical indications and limitations of PET/CT for lung cancer staging and management.
2. To learn about future developments of PET/CT in lung cancer staging.
3. To understand the need for a complete integration of the nuclear medicine specialist and the radiologist in PET/CT examinations.

A-219 09:30

C. Radiofrequency ablation of NSCLC: current status

F. Deschamps; Villejuif/FR (Frederic.Deschamps@igr.fr)

Percutaneous radiofrequency ablation (RFA) is a safe and effective treatment for patients with small non-small cell lung cancer (NSCLC). The low morbidity, including pneumothorax requiring chest tube drainage (10%), breathing impairment pain and hospital stay make it possible in patients who have comorbidities that make them not surgical candidate anymore or in single lung patients. A series of 75 primary NSCLC (75% stage IA and 25% stage IB) patients demonstrated a median survival of 29 months with a 1, 3, and 5 years overall survival of 78%, 36%, and 27%. Median survival for stage IA was 30 months and 25 months for stage IB. Better survival was reported for tumours 3 cm or smaller with a survival rate close to 50% at 5 years. This is probably because the maximal ablation diameter is slightly larger than 40 mm with the electrode needles available now. Compared with RFA, larger and more circular zones of thermal necrosis with faster growth of the ablation zone can be achieved with microwave ablation (MWA) in a swine lung model. Early trials have demonstrated promising results for MWA and gives hope for better rate of complete ablation for larger tumour. Follow-up imaging of the ablation volume on CT is essentially based on morphologic evaluation. This method of evaluation has some drawbacks, namely late discovery of incomplete treatment. PET-CT appears promising to provide early evaluation of treatment response. Sensitivity and specificity of PET has been reported superior to CT in early detection of incomplete ablation.

Learning Objectives:

1. To be able to define the best candidates for lung radiofrequency ablation.
2. To understand the results of radiofrequency ablation for primary tumours and lung metastases.
3. To review different imaging patterns of ablated lesions in the lung.

08:30 - 10:00

Room L/M

Radiographers

RC 714

Radiography as a profession and a science

Moderators:

N. Kinsman; Poole/UK

C. van Kuijk; Amsterdam/NL

A-220 08:30

A. Cultural competence in the practice of radiography: international implications

C. Cowling¹, L. Boyd², M.D. Ward³; ¹Rockhampton/AU, ²Toronto, ON/CA, ³St. Louis, MO/US

At its core, radiography is the acquisition of radiographic images to help diagnose and treat patients within clinical practice. There are, however, many factors which impact on the success of procedures and resultant quality of images. The operator-client relationship is often influenced by cultural values and norms which can vary considerably. Optimal images are dependent both on operator skill and client compliance which comes with a sense of trust critical to the fiduciary relationship. This can be difficult to achieve within the physical environment of a radiology department and can also be impeded by cultural expectations and cultural conflict. Western societies that stress individual rights tend to focus on health practices that are embedded in this worldview such as the requirement for informed consent and

maintenance of confidentiality of patient information. In contrast, more hierarchical cultures often defer to elders for decision-making whereas communal cultures may involve community leaders in a shared decision-making process. Gender and religious issues can also affect the provision of high-quality procedures with same gender care being a requirement within some cultural groups and gowning procedures that maintain cultural values frequently being an expectation. In addition, in many countries in the developing world, radiation still has mystique and fear associated with it, affecting participation in screening programs and recruitment to medical radiation technology educational programs. This presentation will present findings from a variety of countries and cultures that will help to contextualise these issues through a cross-cultural imaging lens.

Learning Objectives:

1. To understand the concept of culture in relation to healthcare delivery from a technologist's and patient's perspective.
2. To understand the impact of culture on patient health outcomes.
3. To understand the knowledge, skills and attitudes needed by a culturally competent health practitioner.
4. To consider the impact of global differences in ethical codes, scopes of practice, educational and professional practice expectations.

A-221 09:15

B. Basic technique for image interpretation

C. Patrick; Poole/UK (Cheryl.Patrick@poole.nhs.uk)

First line image interpretation is now commonly used in the United Kingdom. For many years radiographers have used a system commonly known as "Red Dot" in order to identify to the referring clinician that an abnormality has been recognised on a radiographic image. This has more recently evolved into radiographer comment where the radiographers' experience in recognising abnormalities can help referring clinicians. Junior doctors are often inexperienced at image interpretation, thus this system can assist in ensuring that a higher percentage of fractures and injuries are observed and the appropriate treatment obtained. This presentation will demonstrate the fundamentals of basic image interpretation of the cervical, thoracic and lumbar spine in a trauma situation. It will include basic anatomy, mechanism of injury, common fractures and soft tissue signs. Using these principles this will encourage radiographers to use the comment system, both developing the radiographer's role and helping to improve patient care.

Learning Objectives:

1. To be familiar with the principles of image interpretation.
2. To gain knowledge of common abnormalities and injuries of the C/T and L spine.
3. To appreciate the role of the radiographer in image interpretation.
4. To consolidate knowledge of normal and abnormal radiographic appearances of the spine.

08:30 - 10:00

Room N/O

Head and Neck

RC 708

Suprahyoid neck

Moderator:

D. Pereira Coutinho; Lisbon/PT

A-222 08:30

A. Anatomy-guided differential diagnoses

C.R. Habermann; Hamburg/DE (c.habermann@uke.uni-hamburg.de)

Two fasciae cross the suprahyoid neck: the superficial cervical fascia (SCF) and the deep cervical fascia (DCF). The latter can be divided into three parts and these layers define different fascial spaces or compartments. The descriptions of these compartments in the literature vary almost as much as those of the fasciae themselves. In addition, the names of the formed compartments vary within the literature. Despite these controversies, the knowledge of these compartments is inestimable for correct differential diagnosis of pathologies that arise in the suprahyoid neck. With the utilisation of cross-sectional imaging, it has been noticed that growth of some tumours appears restricted by fasciae and knowledge of the anatomy of these fasciae allows not only prediction of growth patterns. By allocation of a tumour to a certain compartment the number of differential diagnosis drop dramatically due to the fact that in different compartments different types of tissue occur. In addition, the exact localisation of infectious disease of the suprahyoid neck may predict further intracranial or mediastinal spread. Even though the number

of spaces in the literature varies from seven to fourteen, the use of seven spaces or compartments seems to be helpful for a sufficient diagnostic approach using cross-sectional imaging. Anatomic landmarks and the radiologic appearance in a non-pathologic suprahyoid neck and a pathologic involvement of the suprahyoid compartments will be reviewed extensively in a coherent manner.

Learning Objectives:

1. To identify CT and MR imaging landmarks of the neck spaces.
2. To recognise the CT and MR imaging findings of normal anatomical structures in each space.
3. To understand the use of neck spaces as a basis for the differential diagnosis of pathologic conditions in the neck.

A-223 09:00

B. Suprahyoid neck lesions in daily clinical practice

V. Chong; Singapore/SG (dnrcfhv@nus.edu.sg)

The anatomy of the suprahyoid neck is complex and the spectrum of diseases is wide. To improve studies of the neck, radiologists should become increasingly more familiar with the anatomy and expected pathology in the various spaces. This familiarity provides crucial information required for the selection of treatment options and therapeutic planning. In addition, radiologists should be aware of situations when diagnostic inaccuracies may lead to serious consequences and complications. For example, surgical approach to a deep lobe parotid tumour as though it is a parapharyngeal lesion will in all likelihood result in facial nerve injury. MRI artefacts such as complex flow-induced increase in signals may be mistaken as a lesion prompting an unnecessary operation. An awareness of such pitfalls helps to improve the quality of imaging studies. This presentation highlights some pertinent anatomical knowledge that may help to improve the diagnostic accuracy of neck studies and at the same time explain the existence of pitfalls that may ruin imaging studies.

Learning Objectives:

1. To learn the anatomic basis of imaging abnormalities.
2. To understand the pathological basis of image interpretation.
3. To learn the potential pitfalls of radiological diagnosis.

A-224 09:30

C. Tips and tricks for suprahyoid neck lesions

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. Also, expanding lesions will 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 most frequent pathologies in the suprahyoid neck.
2. To review the proper imaging technique.
3. To learn how to differentiate between benign and malignant lesions.
4. To learn about a template for the 'perfect' report.

08:30 - 10:00

Room P

Vascular

RC 715

Vascular imaging: diabetes and vascular occlusive disease

Moderator:

M. Sapoval; Paris/FR

A-225 08:30

A. Metabolic syndrome, diabetes and vascular disease: what do we need to know?

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

The metabolic syndrome refers to the clustering of cardiovascular risk factors including diabetes, obesity, dyslipidaemia and hypertension. The association between metabolic syndrome and cardiovascular diseases raises important questions about the underlying pathological processes. Insulin resistance and visceral obesity have been recognised as the most important pathogenic factors. Metabolic syndrome generally precedes and is often associated with type 2 diabetes. Cardiovascular risk reduction in individuals with metabolic syndrome should include (1) control of obesity, diet and physical activity and (2) control of the individual components of metabolic syndrome, especially atherogenic dyslipidaemia, hypertension, hyperglycaemia and prothrombotic state. Appropriate management of metabolic syndrome should be able to prevent the progression from impaired glucose tolerance to frank diabetes and thus to prevent the increasing prevalence of type 2 diabetes and vascular diseases. Each 1% increase in HbA1c is associated with a 28% increase in risk of incident PAD. Diabetes is also highly associated with progression of PAD and especially with the development of critical limb ischemia. Rigorous control of blood glucose prevents the microvascular complications of diabetes, although similar benefits on the macrocirculation have not been ascertained. Patients with diabetes and PAD should have an aggressive control of blood glucose levels with a HbA1c goal of < 7.0% or as close to 6% as possible. In the new TASC paper this recommendation is graded as C, meaning that it is based on evidence obtained from expert committee reports or opinions and/or clinical experiences of respected authorities, while there are no applicable studies of good quality.

Learning Objectives:

1. To learn the principles of metabolic syndrome and diabetes.
2. To understand how both diseases affect the vascular system.
3. To learn which vascular territories are primarily affected.

A-226 09:00

B. Imaging strategies in the diabetic foot syndrome

R. Iezzi; Rome/IT (r.iezzi@rad.unich.it)

Peripheral arterial disease (PAD) is a common cardiovascular complication in patients with diabetes. In contrast to non-diabetic PAD, it is more prevalent and, because of the distal territory of vessel involvement and its association with peripheral neuropathy, it is more commonly asymptomatic. Diabetic PAD thus may present later with more severe disease and have a greater risk of amputation. The pervasive influence of diabetes on the atherothrombotic milieu of the peripheral vasculature is unique. The abnormal metabolic state accompanying diabetes results in changes in the arterial structure and function. The proatherogenic changes include increases in vascular inflammation and derangements in the vascular cellular components, alterations in blood cells and haemostatic factors. These changes are associated with an increased risk for accelerated atherogenesis as well as poor outcomes. In contrast to the focal and proximal atherosclerotic lesions of non-diabetic PAD, in diabetic patients the lesions are more likely to be more heavily calcified, diffuse, and distal, sparing the proximal vessels and mainly affecting the more distal arteries in the calf and, in a later stage, the foot. By identifying a patient with subclinical disease and instituting preventative measures, it may be possible to avoid acute, limb-threatening ischaemia. The primary imaging modality to be used should be duplex ultrasound, due to its non-invasive nature, lower risks and costs. CT-angiography and MR-angiography are now replacing DSA as standard imaging methods, providing a non-invasive assessment of the localisation and extension of a vascular lesion and allowing an accurate planning of endovascular and/or surgical treatment.

Learning Objectives:

1. To review the typical lesions encountered in the diabetic foot syndrome.
2. To understand the underlying pathophysiology.
3. To learn imaging strategies for the evaluation of the diabetic foot syndrome.

A-227 09:30

C. Imaging prior to revascularisation: CTA, MRA or DSA?

S.O. Schönberg; Mannheim/DE (Baerbel.Reichhard@umm.de)

The choice of the appropriate modality for imaging of the peripheral vascular system strongly depends on the type of disease. In the acute setting of lower leg ischaemia caused by embolism or thrombosis on top of a pre-existing high-grade stenosis CT angiography frequently is the imaging modality of choice due to its 24-hour availability and robustness with reasonable accuracy in the upper leg exceeding 90%. With the introduction of dual energy CT, visualisation of lower leg arteries and highly calcified areas has improved. For elective patients, contrast-enhanced MR-angiography (CE-MRA) is the technique of choice, in patients with renal insufficiency preferably at 3 Tesla with a single dose of macrocyclic contrast agents. Recent continuous table-movement techniques have substantially reduced complexity and scan time and extended the spectrum to the emergency setting. Time-resolved CE-MRA improves the detection of small arteries in the lower leg and reduces artefacts from venous overlay. Accuracy of state-of-the-art CE-MRA exceeds 95% compared to digital subtraction angiography (DSA). New fast spin-echo and steady-state free precession MRA techniques without contrast media are promising, particularly in areas without motion. DSA should be restricted to the display of the target lesion, inflow and run-off during the interventional procedure as well as to the in-detail visualisation of the anastomosis site prior to surgical revascularisation particularly in the lower calf.

Learning Objectives:

1. To learn the anatomy of the arterial system of the lower leg and its variants.
2. To review appropriate imaging protocols for each modality.
3. To review the pros and cons of MRA, CTA and DSA in the diabetic foot syndrome prior to revascularisation.

08:30 - 10:00

Room Q

Paediatric

RC 712

Advanced brain imaging

Moderator:

C. Venstermans; Edegem/BE

A-228 08:30

A. Diffusion tensor MRI

A. Righini; Milan/IT (neurorad@icp.mi.it)

Diffusion tensor imaging (DTI) studies demonstrate progressive apparent diffusion coefficient (ADC) decrease within grey and white matter areas starting from foetal life as sign of brain maturation; meanwhile, fractional anisotropy (FA) increases in some white matter structures. Changes in FA and ADC, together with radial and axial diffusivity values, during cell proliferation-migration and during myelination, well correlate with modifications known from developmental histological studies. Acute ADC decrease (i.e. ischaemia) can be detected already in foetal stroke and its measure is pivotal in monitoring neonatal hypoxic-ischaemic encephalopathy. ADC calculation allows also to assess acute osmotic and metabolic anomalies in neonate (i.e. hypernatremia, hypoglycaemia, etc.). Early FA decrease, with radial and axial diffusivity changes, is observed in white matter areas as sign or early wallerian degeneration after acute brain damage. Chronic regional white matter FA reduction is detectable in sequelae of periventricular leukomalacia or adjacent to malformative cortex. Also, in children with neurodevelopmental delay (autism, ADHD, dyslexia, etc.). FA reduction and radial or axial diffusivity changes have been demonstrated, but in these conditions not on a single case basis rather in cohort quantitative studies. Finally, building fiber tracking and colour coded (RGB) maps from DTI data may help in better characterising suspected structural anomalies on a single case basis (i.e. corpus callosum, hippocampal fornix, optic radiation, cerebellar peduncles malformations, etc.). However, the potentials of fiber tracking applications still need to be fully exploited, especially in view of future higher spatial resolution image acquisitions.

Learning Objectives:

1. To understand the relationship of ADC-FA values with the structural characteristics of the normal developing brain.
2. To understand ADC-FA value changes in paediatric CNS diseases.
3. To learn about the potential impact of fibre tracking in clinical paediatric neuroradiological practice.

A-229 09:00

B. MR spectroscopy

L. Astrakas; Ioannina/GR (astrakas@cs.uoi.gr)

In vivo proton MR spectroscopy is a non-invasive MR technique that is routinely used to assess a number of paediatric neurologic conditions. It is based on the fact that protons belonging to different metabolites resonate at slightly different frequencies (chemical shift). Using water suppression and volume localisation techniques we can obtain a spectrum (single voxel) or spectra (SI) containing metabolite peaks corresponding to predetermined anatomical site(s). In paediatrics the majority of spectroscopy is performed in the brain and the metabolites detected usually are: N-acetyl aspartate, N-acetyl aspartyl glutamate, creatine and phosphocreatine, Choline containing compounds (free choline, acetylcholine, phosphocholine, cytidine diphosphate choline and glycerophosphocholine), myoinositol, myoinositol monophosphate and glycine, aminoacids (glutamine, glutamate and GABA), lactate, lipids and macromolecules. These metabolites participate in fundamental metabolic pathways and their levels are being disturbed by various pathologies. Thus, MR spectroscopy has a vast field of application including paediatric tumours, infarction, hypoxia, ischaemia, infection, inflammation, metabolic disorders neurological disorders and trauma. In many cases, it can redirect or narrow differential diagnoses; in selected instances, it may provide the key finding that points to a final diagnosis. However, MR spectroscopy alone is usually not specific, but can be very helpful especially in combination with other clinical, diagnostic and other MR methods. Finally, particular caution is needed in data evaluation because spectral appearance and concentrations of the most prominent metabolites are affected by (a) experimental and preprocessing factors and (b) brain development.

Learning Objectives:

1. To become familiar with the basic principles of proton MR spectroscopy.
2. To understand what proton MR spectroscopy can offer to the diagnosis and monitoring of various paediatric diseases.
3. To understand how MR spectroscopy combines with other MR techniques.

A-230 09:30

C. Vascular diseases: the role of CTA, MRA, angiography (DSA)

N. Girard, X. Combaz; Marseille/FR (nadine.girard@ap-hm.fr)

Stroke in children is most often of ischaemic origin and thrombophlebitis is the second cause of stroke in children. Stroke is considered as rare compared to the adult population. However, numerous aetiologies impose to look for a cause through series biological investigations. The goal of brain imaging is to confirm the diagnosis of stroke, to evaluate the extension of ischaemia and mostly to participate in the search of a cause for the stroke. Prognostic is mostly related to the aetiology. A lot of cases are performed under general anaesthesia leading to limited indications of MRA in the acute phase compared to adult. The role of CTA at the acute phase is mostly to confirm thrombophlebitis and is the primary method to assess intracranial vessels at the acute phase of haemorrhage of arterial or venous origin. It is also the primary method to assess arterial vessels at the neck level (especially when dissection is suspected). CTA permits to confirm or rule out arterial lesion that was suspected on MR: indeed, cases with pitfalls are numerous with MR angiography. The role of MRA, also always performed in the acute phase or follow-up of vascular diseases, is not as clear as CTA role because of artefacts especially in young children. The role of angiography (DSA) is finally limited to prove vasculitis when the other methods are not contributive and in cases of arterial or arterio-venous malformation to plan the treatment (endovascular procedure versus surgery or radiosurgery).

Learning Objectives:

1. To become familiar with the specific presentation of cerebral vascular diseases in children.
2. To compare and appreciate specific indications for CTA, MRA and DSA.
3. To understand the best imaging approach depending on clinical presentation.

10:30 - 12:00

Room B

ESR meets Brazil

EM 3

Thoracic imaging: a Brazilian approach

Presiding:

M.A. Gomes da Silva; Sao Paulo/BR

Y. Menu; Paris/FR

A-231 10:30

Introduction

S.C.M. Tramontin¹, M.A. Gomes da Silva²; ¹Ponta Grossa/BR, ²Sao Paulo/BR (clanicamanoel@ig.com.br)

Founded on September 15, 1948, the Brazilian College of Radiology comprises 23 Regional Societies and ten thousand associates. The college is a branch of the Brazilian Medical Association (AMB) acting as its Scientific Department of Radiology, Imaging Diagnosis and Radiotherapy. It collects, under the same umbrella medical professionals and legal entities in the field of diagnosis and treatment using imaging methods and/or ionising radiation.

Session Objectives:

1. To get an introduction to the practice of radiology in Brazil.
2. To understand the importance of radiology as a method for diagnosing diseases in Brazil.
3. To become familiar with the great technological advances of radiology in recent years in Brazil.

A-232 10:35

Granulomatous interstitial lung disease: HRCT path correlation

C.I.S. Silva; Salvador/BR (c.isabela.silva@gmail.com)

Granulomatous interstitial lung diseases are a group of lung diseases in which granulomas are an important component of the histologic findings. The most common conditions are hypersensitivity pneumonitis and sarcoidosis. Hypersensitivity pneumonitis is very common in Brazil because of the warm and humid climate in most regions and a large number of birds. The prevalence of sarcoidosis in Brazil seems to be lower than that in North America and Europe. Other ubiquitous causes of granulomatous interstitial lung disease include intravenous talcosis, drug reactions, and some forms of vasculitis (e.g. Churg-Strauss syndrome). The aim of this presentation is to illustrate the characteristic high-resolution CT and histologic manifestations of the most common granulomatous interstitial lung diseases and to summarise the main differential diagnosis based on the pattern and distribution of abnormalities seen on high-resolution CT.

Learning Objectives:

1. To become familiar with the characteristic high-resolution CT and histologic findings of the most common granulomatous interstitial lung diseases (hypersensitivity pneumonitis and sarcoidosis).
2. To learn about the most helpful features in distinguishing the granulomatous interstitial diseases from other parenchymal lung diseases.

Interlude: Brazilian masterminds

10:55

A-233 11:00

Granulomatous pulmonary infections

A.S. Souza Jr.; São José do Rio Preto/BR (asouzajr@gmail.com)

The most common granulomatous lung diseases are fungal infections and tuberculosis. These infections are particularly prevalent in Brazil, the most common fungal infection being paracoccidioidomycosis (South American blastomycosis). Histoplasmosis and coccidioidomycosis may occur but they are uncommon. Paracoccidioidomycosis is the most frequent endemic systemic mycosis in Latin America, being seen particularly in Brazil, Argentina, Colombia, and Venezuela. The lungs are the main target organ of P. Brasiliensis organisms, and infection of the lungs is the leading cause of morbidity and mortality in these patients. Fungal infections need to be considered not only in patients living in endemic regions but also in patients who have travelled to these areas. Although the prevalence of pulmonary tuberculosis has decreased in Brazil in recent years it remains one of the most important causes of pulmonary morbidity and mortality. The aim of this presentation is to discuss the radiologic manifestations of the granulomatous pulmonary infections with emphasis in paracoccidioidomycosis and tuberculosis and to summarise the main differential diagnosis.

Learning Objectives:

1. To become familiar with the characteristic high-resolution CT manifestations of granulomatous pulmonary infections.
2. To learn about the most helpful findings in distinguishing South American blastomycosis (paracoccidioidomycosis) from tuberculosis and other granulomatous and non-granulomatous pulmonary infections.

Interlude: The world is in love with Brazil 11:20

A-234 11:25

Congenital lung disease in children: state-of-the-art imaging

P.A. Daltro; Rio de Janeiro/BR (daltro.pedro@gmail.com)

Congenital pulmonary malformations may involve the lung parenchyma, bronchi, arterial supply, and venous drainage. The pulmonary developmental abnormalities that most commonly result in clinically significant complications in neonates and children are hypogenetic lung syndrome, bronchopulmonary sequestration (BPS), congenital lobar emphysema (CLE), bronchial atresia, congenital cystic adenomatoid malformation (CCAM), and bronchopulmonary foregut cysts. It should be noted that there is often considerable overlap between these conditions and that multiple lesions may be identified in the same patient either separately or as hybrid lesions. The aim of this presentation is to illustrate the characteristic imaging manifestations of the most important congenital lung diseases and their main differential diagnosis. Emphasis will be given to pre-natal diagnosis using ultrasound or magnetic resonance imaging (MRI) and post-natal diagnosis using MRI or low dose CT in multidetector scanners.

Learning Objectives:

1. To review the characteristic imaging manifestations of the most important congenital lung diseases in children and their main differential diagnosis.
2. To understand the role of ultrasound and magnetic resonance imaging (MRI) in the pre-natal diagnosis of congenital lung diseases.

Panel discussion 11:45

10:30 - 12:00

Room E2

Foundation Course: Paediatric Radiology

E³ 820

What should we know about antenatal imaging?

Moderator:

C. Adamsbaum; Paris/FR

A-235 10:30

A. Foetal imaging: current practice and evidence base

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

Ultrasonography (US) is the primary screening modality in prenatal imaging. Its diagnostic accuracy is usually very high so that the indications for foetal MRI should be very rare. In some countries, because US is considered of secondary importance and is not exploited as much as it could be, there is a progressive shift from US to MRI as a prenatal imaging modality. Consequently, there are many discrepancies regarding the relative contributions of foetal US and MRI in the prenatal literature. The main indications for foetal MRI will be discussed, with emphasis on the central nervous system, which remains the main field of application. In daily practice, the technique of foetal MRI has not changed during the last decade and most diagnoses can be assessed using T1, T2 and T2* sequences. The basic technique and patient preparation will be described. New techniques, based on a functional or a metabolic approach, have been developing during the past few years but their impact on daily practice is still very limited. Many studies have underlined the high diagnostic contribution of foetal MRI compared with US. However, the diagnostic accuracy of MRI has not been studied in large series. Comparison between pre- and postnatal data or between foetal MRI and pathological findings make it possible to define the main limits of foetal MRI. Regarding the brain, migration or cortical development disorders are often overlooked or underdiagnosed. A tight collaboration between colleagues practicing prenatal US and MRI should increase diagnostic accuracy, both modalities being complementary.

Learning Objectives:

1. To learn when MRI is recommended for the assessment of foetal abnormalities.
2. To become familiar with patient preparation, the technique and the value of the various sequences used.
3. To understand the main limits of MRI in imaging of the foetus.

A-236 11:00

B. Ventricular enlargement and beyond

E.H. Whitby; Sheffield/UK (e.whitby@sheffield.ac.uk)

This talk will review the current literature and clinical use of foetal MRI in cases with ventriculomegaly. The initial part will discuss antenatal ultrasound in the detection, categorisation and diagnosis at the 20-week anomaly scan. The role of foetal MRI will be discussed including which cases may benefit most from foetal MRI when the resource is limited. The timing of the foetal MR with relation to gestational age and the value of further foetal MR scans at a later gestational age will also be discussed. This is still a controversial and debated area especially when the resource is limited or there are financial constraints. The current literature will be discussed on the issues around foetal MRI in cases with ventriculomegaly both isolated ventriculomegaly and ventriculomegaly associated with other abnormalities. Finally, this section will conclude by looking at the common associated abnormalities seen in cases referred with ventriculomegaly. The final section will discuss the role of foetal MR in imaging the posterior fossa, an area often difficult with ultrasound especially in the later stages of pregnancy. Again the current literature will be discussed and the use of foetal MR in clinical practice. The concluding time will be used to summarise the referral pathway used by local centre in the UK. This will differ with other UK centres and centres worldwide. Hopefully, time will allow an open discussion on this at the end of the session.

Learning Objectives:

1. To learn about the differential diagnoses of ventriculomegaly identified on foetal ultrasonography.
2. To learn when MR should be performed and its value when compared to ultrasonography.
3. To understand the value of MRI in assessing posterior fossa abnormalities.

A-237 11:30

C. Common chest and abdominal problems

A. Darnell¹, C. Martin²; ¹Barcelona/ES, ²Sabadell/ES (andarnell@clinic.ub.es)

Prenatal diagnosis involves obtaining genetic, anatomic, biochemical and physiological information about the foetus and analysing whether there are any alterations that might have repercussions during the foetal period or after birth. Magnetic resonance imaging (MRI) has been useful in the diagnosis of foetal anomalies for many years. Thoracic abnormalities play an important role in infant morbidity and mortality. Survival after birth depends largely on adequate lung development during gestation, and various pulmonary problems can affect foetuses. Heart defects are present in 8 of 1000 live births, and up to 25% of these are associated with other malformations. Other thoracic anomalies (tracheoesophageal malformations, chest wall defects, and tumours, amongst others) can also cause morbimortality. Congenital abdominal anomalies can affect many organs. It is essential to determine the location and morphological characteristics of the lesion to ensure an accurate diagnosis. MRI's excellent contrast resolution between tissues is very useful in the diagnosis of these conditions. Prenatal diagnosis also makes it possible to detect anomalies that can be difficult to recognise clinically in newborns but require early treatment to minimise possible complications. This presentation stresses the importance of diagnosing chest and abdominal problems before birth and analyses the usefulness of MRI in this context.

Learning Objectives:

1. To learn about the MR protocol when investigating the foetal chest.
2. To recognise the situations in which MRI is helpful in assessing chest abnormalities.
3. To understand the value of MRI when compared to ultrasonography in assessing congenital renal and gastrointestinal abnormalities.

10:30 - 12:00

Room G/H

EFOMP Workshop

New technology in diagnostic radiology:

advances in breast imaging

EF 2

Screening and diagnostic breast imaging

Moderators:

K. Faulkner; Wallsend/UK

J. Vassileva; Sofia/BG

A-238 10:30

QA, image quality and dose in screening with digital mammography

H. Bosmans; Leuven/BE (hilde.bosmans@uz.kuleuven.ac.be)

The European Commission states in its council recommendation of 2 December 2003 that mammography screening in women aged 50-69 is justified if performed in accordance with the European Guidelines on Quality Assurance (QA). This recommendation and the Directive 97/43/Euratom on medical exposures made QA an important part of screening programmes. Physico-technical aspects of digital mammography are to be included in QA programmes. As with film-screen systems, both acceptance tests, (half) yearly tests and constancy tests are necessary. Acceptance tests and yearly tests evaluate the performance of the system and the dose settings from blocks of PMMA. Special attention is given to the spatial characteristics of the (digital) detector, the noise properties and the signal-difference-to-noise-ratio. In the European guidelines, performance is ultimately assessed from contrast threshold values for a series of disk diameters. We discuss the use of the CDMAM phantom along with alternative approaches such as detectability indices *d'* (Monnin, Verdun, Marshall et al.) for systems in our QA network. The automatic exposure controller should ultimately be tested in real cases. Patient dose investigations are more important than before. In digital mammography, and especially with direct digital detectors, patient dose surveys can be automated. Constancy checks have to guarantee an optimal quality every day. We will illustrate typical artefacts that occur with digital detectors and viewing stations. Daily homogeneity tests of the detector along with an automatic evaluation of DICOM tags allow both the detection of sudden problems as well as a long-term follow-up of performance.

Learning Objectives:

1. To learn about the particular aspects of QA in digital mammography.
2. To learn about contrast-detail analysis and alternative tests to assess system performance.
3. To learn about the implementation, the results and the added-value of patient dose surveys in digital mammography.

A-239 11:00

MRI diagnostic breast imaging

K. Gilhuijs; Utrecht/NL (k.g.a.gilhuijs@umcutrecht.nl)

Magnetic resonance imaging (MRI) is a highly sensitive technique that provides complementary information to conventional breast imaging (i.e. mammography and ultrasonography) for the detection of multinodular disease and for the assessment of primary tumour extent. The use of MR breast imaging has increased considerably in the past decade. Although its use is well established for some indications, e.g. detection of unknown primary and assessment of uncertain disease extent, breast MRI is still under investigation for other applications such as preoperative assessment in patients eligible for breast conserving therapy on the basis of conventional imaging and clinical examination. Despite its superior ability to visualise disease spread, recent studies have shown increased rates of mastectomy without reduction in positive surgical margins or local recurrence rates. Nonetheless, a shift in paradigm is occurring, focusing on the use of breast MRI to reduce involvement of healthy tissue in breast-conserving therapy. This paradigm involves new methodology to optimise the transfer of information to the surgeons and radiation oncologists. New technological developments, such as diffusion-weighted imaging (DWI) and magnetic resonance spectroscopy (MRS) provide new insights to establish a link with underlying biology of the tumour. Contrast-enhanced MRI, DWI and MRS are examined for their ability to extract prognostically relevant information to individualise therapy to individual patients and tumours. This overview aims to summarise the current status of breast MR imaging and new developments geared towards providing therapists with patient-tailored information for treatment decision, treatment guidance and therapy response.

Learning Objectives:

1. To learn about the current status, indications and new developments in breast MRI.
2. To learn about processing, analysis and transfer of information from MRI to clinical decision making.
3. To understand the limitations and current opportunities for breast MRI.

A-240 11:30

Is there a future for radioisotope breast imaging?

S. Ziegler; Munich/DE (sibylle.ziegler@tum.de)

No abstract available

10:30 - 12:00

Room Z

Standards and Audit

How to write better reports

Moderator:

E.J. Adam; London/UK

A-241 10:30

How to write a good radiological report

L.P. Lawler; Dublin/IE (llawler@mater.ie)

The pixel data set of modern imaging is transformed into a life altering insight for the individual patient through the radiologic report. A good report is patient and service centred, and forms the basis of the reciprocal relationship between radiologist and referring clinician. It is a creative process with serious scientific purpose and becomes part of the permanent record in a person's life. Its primary role is communication of diagnostic and procedure-related imaging information but it has many vital adjunct roles in quality service delivery. In current practice of multidisciplinary care the report content must be of value to all the stakeholders beyond radiology. Structured reports must have uniformity where possible to permit data-mining and audit whilst preserving the individual radiologist practice and style and the individual nature of each patient's health. Report design has a particular role in modern alerting and safety-net systems when unexpected or critical imaging findings are discovered. The properly written report can be vital in medico-legal defence to reflect good practice. Ultimately guidelines and standards on reporting must be meaningful to the users and appropriate to local resources, systems and needs.

Learning Objectives:

1. To comprehend the role of the modern radiological report.
2. To understand the role of the report in communication and patient safety.
3. To become familiar with structured report formulations.

A-242 11:00

Structured reporting: European perspective

R. Silverio; Grosseto/IT (rsilverio@sirm.org)

In the last decade, we observe an increasing interest in structured report (SR). This is a part of the DICOM standard, where the technical and clinical information are organised in a standard format so that it can be retrieved and reused for clinical, statistical and research scopes. Structured reports have three important features: a "structured" format, with fixed paragraphs, heading and subheading in which to describe technical data and clinical findings, impressions and conclusions; a consistent, "itemised" organisation, leading to a better way of reporting, even with automated speech recognition systems; and the possibility, or rather the need, of a common, shared language. When defined terms from a standard lexicon are associated with imaging reports, the information in the report becomes more accessible and reusable. Moreover, SR allows the interoperability between the DICOM world and the complex sphere of the e-health (electronic patient record, patient care, etc). It is possible to convert a radiological report created as SR in a CDA2 (Clinical Document Architecture) document. This clinical document will be used in every computerised healthcare application, as well in the several regional e-health projects (EPSOS, ELGA, Calliope, Renewing Health, etc). promoted by European Community. Integrating the Healthcare Enterprise (IHE) initiative is as a key partner in fostering the adoption of structured report. In short, question of whether SR will be adopted by radiologists is now a question of "when", not "if."

Learning Objectives:

1. To become familiar with structured report.
2. To keep up to date on the developments of e-health projects in Europe.

A-243 11:30

Structured reporting: improving the quality of radiology reports

C.E. Kahn; Milwaukee, WI/US (kahn@mcw.edu)



The radiology report communicates the results of an imaging procedure and provides the enduring legal record of the procedure. Structured reporting uses standardised language and predefined formats to create reports. Structured reports can integrate information collected during the imaging procedure, such as clinical data, technical parameters, measurements, annotations, and key images. In this presentation, well defined structured reporting describes its advantages and disadvantages, and identifies the motivations for its adoption. This session will discuss how structured reporting can make it easier to retrieve reported information, evaluate the appropriateness of exams, and aggregate data across health care enterprises. Structured reporting can support radiology quality improvement, research, and education, and has the potential to improve the quality of communication between radiologists and their referring colleagues.

Learning Objectives:

1. To define structured reporting and its potential role in radiology.
2. To become familiar with current efforts to promote structured reporting of imaging procedures.
3. To learn how structured reporting can improve the quality of radiology reports.

12:15 - 12:45

Room A

Plenary Session

HL 2

Pierre et Marie Curie - Honorary Lecture

Presiding:

Y. Menu ; Paris/FR

A-244

Beyond morphology and into physiology: newer spine imaging techniques

M.M. Thurnher; Vienna/AT

There are major challenges to imaging the spinal cord. A number of technical issues needed to be resolved before the advanced techniques could be used as an adjunct to the clinical evaluation. Small size of the cord, macroscopic motion related to physiological CSF pulsations, breathing and swallowing, and local field inhomogeneities lead to reduction of the image resolution and cause disturbing artifacts. Despite these challenges there are a number of potential solutions that have been introduced in the last decade. Diffusion weighted imaging (DWI), diffusion tensor imaging (DTI), fiber tractography (FT) and functional BOLD (fMRI) of the spinal cord has seen progressive translation from the laboratory to the clinic. The results of recent studies show that significant changes in DTI metrics are present in the cervical spinal cord of patients with demyelinating diseases and other myelopathies, in the absence of spinal cord signal abnormality at conventional MR examinations. There is no doubt that in the future advanced techniques will provide an excellent set of biomarkers for understanding neuroplasticity of the spinal cord and response to therapies. This lecture will focus on evolution of spinal cord imaging and update you on the clinical applications of advanced techniques in imaging the spinal cord.

12:30 - 13:30

Room Z

The Beauty of Basic Knowledge: Interpretation of the Chest

Radiograph

MC 21C

Air-space disease

A-245 12:30

Air-space disease

J. Cáceres; Barcelona/ES (josecac@gmail.com)

Air-space disease is secondary to occupation of the acini and alveoli by oedema, exudates or malignant cells. It presents in the chest radiograph as ill-defined densities which tend to coalesce. The presence of an air bronchogram is pathognomonic. When the disease is widespread it shows the typical "butterfly" appearance. Air-

space disease may be divided into acute or chronic. The most common causes of acute disease are pneumonia, pulmonary infarct and pulmonary edema. Among the chronic causes are alveolar cell carcinoma, tuberculosis, sarcoidosis and other systemic diseases.

Learning Objectives:

1. To learn to recognise air-space disease.
2. To learn about a differential diagnosis of the most common conditions.
3. To evaluate imaging management of air-space disease.

13:30 - 14:00

Room A

Plenary Session

GL

Guest Lecture

Presiding:

Y. Menu ; Paris/FR

A-246 13:30

Slicing through Antiques & Works of Art

M. Ghysels; Brussels/BE (marc.ghysels@skynet.be)

This invited lecture explores the groundbreaking use of CT for studying antiquities and artworks from a wide range of cultures, irrespective of their age or material. Dr. Marc Ghysels, a former interventional radiologist, comes from a family of artists and collectors. About ten years ago he set up a private radiology practice in Brussels where he analyses antiquities and artworks. Over the years he has built an international reputation among collectors and art dealers as well as museum curators and experts working in auction rooms. Art specialists call on his radiological skills and knowledge to authenticate antiquities, and more specifically to show: what methods were used to make the works, what damage they have suffered over the years, how much restoration has been done, and to expose the many tricks used by forgers to deceive not only the discerning eye of the collector but also the methods of scientific analysis more commonly used than CT scans. His presentation will highlight the prominent role of CT as a nondestructive test to explore selected artworks made in wood, terracotta, stone, and ivory.

16:00 - 17:30

Room A

Radiology in Abdominal Emergencies

CC 1017

Missing perfusion: abdominal ischaemic disease

Moderator:

O. Chan; London/UK

A-247 16:00

A. Mesenteric angiography: diagnostic and therapeutic approach

J. Lammer; Vienna/AT (johannes.lammer@akhwien.at)

Acute abdominal organ ischaemia may be caused by hypovolaemic shock, spasm (ergotism), embolisation and aortic dissection. Embolisation is the most common cause. It occurs typically in elderly patients with atrial fibrillation, after myocardial infarction or due to a thoracic aortic aneurysm (TAA). The primary diagnosis is made by CT with contrast enhancement which can also demonstrate cardiac thrombi or a TAA. Interventional treatment can be performed with a thrombectomy device or fibrinolysis with recombinant tissue plasminogen activator (rt-PA; 10 mg loading dose, 5 mg/hr infusion dose). Acute aortic dissection may cause dynamic compression of the true lumen with occlusion of the ostium of the visceral arteries (floating visceral sign). The primary diagnosis is made by CT. Occlusion of the primary entry tear with a thoracic aortic stentgraft may decompress the false lumen followed by reexpansion of the true aortic lumen followed by reperfusion of the visceral arteries. Chronic abdominal ischaemia in younger patients may be due to fibromuscular dysplasia, Takayasu arteritis or neurofibromatosis. In the elderly it is usually caused by arteriosclerosis. The patient may have post-prandial abdominal pain (angina abdominalis), diarrhoea and/or weight loss. Due to the collateral circulation, symptoms usually occur only if more than one of the major arteries (celiac trunk, superior and inferior mesenteric artery) is narrowed. The diagnosis can be made by color Doppler ultrasound (CDUS), CT and MR with contrast enhancement. Endovascular treatment is done by PTA and stent placement.

Learning Objectives:

1. To learn the different causes of ischaemic abdominal emergencies and principles for treatment by interventional radiology.
2. To learn the causes and the optimal imaging strategy for preparing treatment.
3. To understand the principles, techniques and results of interventional radiology for the treatment of acute abdominal bleeding.

A-248 16:30

B. The black bowel

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

Ischaemic bowel disease represents a life threatening disease that requires immediate clinical attention once diagnosed. Expansion of cardiac surgery, surgical interventions in elderly and high-risk patients has created an increasing demand for early diagnostic workup if bowel ischaemia is clinically suspected. Multi-row detector CT with multiplanar reformations including further projection techniques plays a leading role in early detection of bowel ischaemia if blood work and clinical presentation are equivocal or contradictory. Optimal sequencing of intravenous contrast media injection and the scanning delay represents a prerequisite for reliable diagnostic outcomes. Knowledge of typical patterns of the disease, early and late signs of ischaemic bowel disease is mandatory for radiologist in charge. The course will help to understand physiological principles and causes of ischaemic bowel disease. Diagnostic performance of current imaging tests and how to integrate them into clinical practice will be discussed.

Learning Objectives:

1. To understand the underlying physiological principles and causes of ischaemic bowel disease.
2. To become familiar with typical signs of bowel ischaemia and how to use them.
3. To understand the diagnostic performance of current imaging tests and how to integrate them into clinical practice.

A-249 17:00

C. Clinical management: what you need to know

D.E. Malone; Dublin/IE (dmalone@ucd.ie)

Acute mesenteric insufficiency (AMI) is due to arterial or venous occlusion. Arterial AMI is an emergency. The typical patient is elderly, may have atrial fibrillation and has recent onset intense visceral pain disproportionate to clinical signs. CT is the mainstay of diagnosis and may be supplemented by CT angiography (CTA). Waste no time if arterial AMI is suspected. Average mortality rates of 71% (59-93%) have been reported and symptom duration before therapy is an independent predictor of mortality. Age > 70 years, metabolic acidosis and renal failure are other danger signs. Interrupt routine CT lists; ensure that these patients are scanned as soon as possible - neutral oral contrast and high-dose IV contrast are essential. CT appearances should be correlated with serum lactate as acute arterial occlusion without reperfusion may produce falsely 'normal' bowel wall thickness. Early diagnosis and aggressive surgical intervention combining bowel resection with revascularisation offer the best prognosis. Venous AMI may present with a more chronic, intermittent course of pain, fever, abdominal tenderness and ascites. Therapy is bowel resection and anticoagulation. Ischaemic colitis occurs in elderly patients with atherosclerosis spontaneously or after aortic aneurysm repair. There are fewer systemic manifestations, bloody diarrhoea predominates; it may spontaneously resolve. CT or contrast enema is established imaging options. Chronic mesenteric ischaemia presents with 'intestinal angina' and weight loss. Doppler US, CTA/MRA are diagnostic. Surgical or interventional therapy is feasible; the correct choice varies with individual patient anatomic and co-morbidity considerations. Endovascular therapy may have higher re-intervention rates, reducing cost-effectiveness.

Learning Objectives:

1. To review the clinical signs of ischaemic bowel disease.
2. To analyse the clinical management of patients with suspected bowel ischaemia with focus on workflow.
3. To analyse cost-effectiveness and clinical outcome of early diagnosis and interventional treatment options.

16:00 - 17:30

Room B

Interactive Teaching Session

E³ 1020

Infections of the central nervous system: what the radiologist must report

A-250 16:00

A. "Dangerous" viral and prion infections

G. *Wilms*; *Leuven/BE* (Guido.Wilms@uz.kuleuven.ac.be)

The most common viral infection of the brain is herpes encephalitis (HSV1). It is a necrotising encephalitis with a mortality of more than 50%. On imaging studies lesions will be seen in the "limbic system", i.e. the temporal lobes, hippocampi, insular cortex and cingulate gyrus. They appear as hypodensity on CT, T2- and FLAIR hyperintensity on MRI, possibly with haemorrhagic transformation. Diffusion is restricted in the early phase. Enhancement occurs at a later stage. Human immunodeficiency virus (HIV) infection is a multifocal giant-cell encephalitis eventually leading to a progressive leuco-encephalopathy. On MR atypical focal or diffuse symmetrical signal abnormalities are seen neither with mass-effect nor with enhancement and typically sparing the U-fibers. Spectroscopy can show an increase of myo-inositol. Progressive multifocal leuco-encephalopathy (PML) is due to reactivation of the JC polyomavirus in immunocompromised patients, 10% of which are HIV positive. On MRI "scalloped" multifocal asymmetrical lesions are seen with minimal mass-effect and without enhancement. New treatments of HIV, especially highly active antiretroviral therapy (HAART) can lead to a paradoxical worsening of patients due to the immune reconstitution inflammatory syndrome (IRIS). On MRI mass lesions are seen with diffuse patchy enhancement. Cerebral toxoplasmosis appears as multiple enhancing lesions with marked perilesional oedema. Calcification is possible. Prion diseases are caused by a proteinaceous infectious particle leading to Creutzfeldt-Jacob disease in humans. Diffusion weighted MR-images show high signal intensities in the cortex and the basal ganglia. Abnormalities on T2-weighted images and FLAIR occur at a later stage where atrophy is mostly prominent.

Learning Objectives:

1. To be familiar with the imaging pattern of most common viral and prion CNS infections.
2. To learn how to recognise and differentiate between the different viral and prion CNS infections.
3. To learn how to report detected viral and prion CNS infections.
4. To have knowledge about follow-ups and treatment monitoring of viral and prion infections.

A-251 16:45

B. Bacterial and parasitic infections

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

Most of the CNS infections can be treated successfully as long as they are detected early. Radiological evaluations play important role in the diagnosis, subsequent treatment and treatment monitoring. Bacteria, fungi and parasites may cause CNS infections. Infections in newborn and infants differ from the adults. MRI is the modality of choice. Radiological findings may vary according to the causing agent, location and the stage of the infections (for cerebritis; surrounding oedema, mass effect, capsule (thicker rim border near cortex, thinner near ependyma) hypointense on T2WI, hyperintense on T1WI) with central necrotic area, satellite lesions, daughter rings, petechial haemorrhage, heterogeneous enhancement of the rim. DWI shows high signal intensity while ADC maps show low signal. MRS shows lactate and amino acids. Reports should include comments for differential diagnosis among the radiological findings for the infections. Treatment can also be monitored by MRI (for cerebritis: decrease in oedema; decrease in mass effect; decrease in degree of enhancement, shrinking cavity, gliosis; decrease in DWI high intensity and increase in ADC low signal and also turning of lactate and amino acids to normal at MRS). Reports should include comments for the success or failure of the treatment.

Learning Objectives:

1. To learn how to report detected and recognised bacterial and parasitic CNS infections basically.
2. To learn how to assist clinicians for the diagnosis and differential diagnosis of bacterial and parasitic CNS infections.

3. To learn what to include in the report of CNS infections for the treatment planning.
4. To learn how to report follow-ups and treatment monitoring of CNS infections.

16:00 - 17:30

Room C

CLICK (Clinical Lessons for Imaging Core Knowledge): Common Clinical Cases

CC 1018

Palpable abdominal mass

Moderator:

F. *Caseiro-Alves*; *Coimbra/PT*

A-252 16:00

A. Clinical considerations

D. *Akata*; *Ankara/TR* (dakata@hacettepe.edu.tr)

Finding of a palpable mass in the abdomen always raises the possibility of an important clinical problem. A potentially life-threatening process, especially malignancy is the major concern. The list of differential diagnosis of "abdominal mass" is a very long one. In the process of differential diagnosis the most common approach is to evaluate the patient according to the gender, age, patient history and co-existing clinical and laboratory findings. The accompanying symptoms and signs and the location of the abdominal mass are the key indicators in the clinician's way of thinking in the process of differential diagnosis. For instance, a palpable mass with acute abdomen or intestinal obstruction will be assessed differently than a mass found incidentally. Imaging is commonly required to confirm or ascertain the diagnosis. Cross-sectional imaging is required to accurately evaluate a palpable abdominal mass in most situations. Ultrasound and computed tomography have each been used successfully in evaluating patients with palpable abdominal mass. Although each modality is appropriate in most situations, the advantages and disadvantages of each modality in certain situations will be addressed and the appropriateness criteria will be reviewed in this lecture. Knowledge of a detailed clinical history is as important to the radiologist as to the clinician. Its impact on the diagnostic accuracy in the interpretation of the images will also be addressed.

Learning Objectives:

1. To learn more about the clinical conditions causing abdominal space occupying lesions.
2. To be informed about the clinician's way of thinking in the process of differential diagnosis.
3. To become familiar with the potential role of imaging in the establishment of the final diagnosis and planning of therapy.

A-253 16:30

B. Imaging techniques and typical findings

M. *Prokop*; *Nijmegen/NL* (M.Prokop@rad.umcn.nl)

A palpable abdominal mass has a long list of benign and malignant differential diagnoses. These diagnoses may be as different as a hydatid cyst of the liver, a volvulus, an aneurysm, or a giant renal cell carcinoma. The diagnostic approach is based on two major steps: first, the affected organ must be identified. Second, the differential diagnosis must be established based on imaging characteristics. The choice of ultrasound, CT or MRI should be based on location and size of the mass. Despite the fact that ultrasound is frequently used as a first step, the overview and anatomic orientation in large masses may be hampered, making ultrasound a better technique for image-guided biopsy than for primary diagnosis. In the vast majority of cases, multidetector CT is the first technique of choice. A thin-section protocol should be used to allow for high-quality multiplanar imaging. A pre-contrast scan is usually not required but can be helpful in suspected hemorrhage. For most upper and middle abdominal masses, biphasic imaging in the arterial and portal phase is recommended in order to establish the relation of the mass to the vasculature and to assess vascularity. In the small pelvis, MR is the superior imaging technique. Otherwise, MRI is mainly used for problem-solving. This course will discuss how to use the various imaging tool efficiently to narrow the differential diagnosis, decide about the need for biopsy and establish a suitable therapy.

Learning Objectives:

1. To learn about the available imaging modalities to be used for the evaluation of patients with a palpable abdominal mass.
2. To become familiar with the technical imaging considerations and the proper diagnostic algorithm.
3. To know more about the typical imaging findings.

A-254 17:00

C. Interactive case discussion

A.H. Freeman; Cambridge/UK (a.h.freeman@talk21.com)

The patient presenting with an abdominal mass represents a common clinical problem. Clearly, the differential diagnosis is large and obviously will depend on the age and sex of the patient as well as location of the mass. Of course history and clinical examination are mandatory, but formal diagnosis will usually rest on radiological interpretation. Contrast examinations have now been replaced by cross-sectional imaging and endoscopy and it behoves the clinical radiologist to be aware of the advantages and limitations of these methods in order to reach a diagnosis. Particular difficulty may be encountered when the mass is so large that it is difficult to determine the organ of origin. The purpose of this interactive case discussion is to explore the relative merits of ultrasound, CT, MR and endoscopy in establishing a diagnosis in two different cases. The cases concerned are: 1. A 21-year-old man who presents with a right iliac fossa mass, but is otherwise asymptomatic. 2. A 54-year-old woman who presents with anaemia and a large upper abdominal mass. Active audience participation will be encouraged by means of key pads in order to respond to issues raised during the debate.

Learning Objectives:

1. To introduce typical cases illustrating the role of imaging modalities in the differential diagnosis of palpable abdominal mass cases.
2. To motivate the audience by the use of voting pads to be involved in the diagnostic process.
3. To highlight the conclusion that may be drawn on the basis of the discussed cases.

16:00 - 17:30

Room D1

KISS (Keep It Simple and Straightforward): Musculoskeletal MRI

CC 1016

The basics of MSK MRI at 3 T

Moderator:

A. Baur-Melnyk; Munich/DE

A-255 16:00

A. Optimising protocols

C. Glaser; Munich/DE (christian.glaser@nyumc.org)

The most straightforward expectation from 3 T MRI scanners is a gain in SNR that could be translated in improving spatial resolution and/or reducing imaging time at an at least constant CNR. Together with field strength, susceptibility effects, chemical shift and T1 increase and T2 and T2* decrease. Also, relaxation properties of contrast agents are modulated. RF power deposition is higher at 3 T and is often a limiting factor in sequence parameter optimisation. Hence, the need to optimise MRI sequence protocol parameters at 3 T. For cartilage, muscle, synovial fluid and fat, T1 increases by between 14% and 22%, T2 decreases by between 10% and 37% and R1 of Gd Chelates decrease by 5% to 10% when B0 increases from 1.5 T to 3 T. In most applications reduced T2 and increased T1 work synergistically towards a reduced SNR. Since the change in relaxation times is not linear for the different tissues, CNR varies with field strength, too. A relatively straight forward approach is to lengthen TR in order to compensate for longer T1 and to shorten TE to compensate for shorter T2 (*). In non-fat-sat images bandwidth needs to be increased to control chemical shift effects. Because of the better fat and water peak separation, 3 T often helps improve frequency-based fat saturation but may also be greatly impaired by field inhomogeneities in the presence of metallic materials. Field strength (B0) and appropriate dedicated multi-element coils are the hardware prerequisites to bring high resolution (HR) isotropic imaging into clinical routine.

Learning Objectives:

1. To understand the physical differences of MSK MRI at 1.5 T and 3 T.
2. To learn how to optimise MSK sequence parameters at 3 T.
3. To recognise the value of high-resolution and isotropic imaging at 3 T.

A-256 16:30

B. Pitfalls, strengths and weaknesses

T.C. Mamisch; Berne/CH (mamisch@bwh.harvard.edu)

MRI (3.0 T) has gained increasing acceptance for whole-body imaging. Since the introduction of 3.0 T MR systems to clinical human imaging, several difficulties have been described beyond a simple SNR gain including increased energy deposition (as denoted by the specific absorption rate (SAR)), increased magnetic

susceptibility effects, increased radiofrequency (RF) field inhomogeneity and more pronounced magnetic shielding effects. In the mean time, many investigators have proposed strategies to optimise imaging protocols and to decrease SAR levels and to reduce artefacts including optimised coil and hardware design, in combination with parallel imaging and modulation of refocusing flip angles. Many clinical applications in neurology and angiography for high field MRI that were recently being investigated showed benefits over 1.5 T. However, as of to date, virtually no prospective comparative studies have been performed and published that could help to estimate whether or not there would be any clinical benefit of 3.0 T MSK over 1.5 T. Although many authors described the improved SNR of MSK imaging at 3.0 T allowing for higher spatial resolution this has not been prospectively investigated with comparison to 1.5 T. Further studies have to show whether the improvement in speed and resolution will also translate into increased patient throughput and earlier depiction of disease in MSK applications at 3.0 T.

Learning Objectives:

1. To become familiar with artefacts and pitfalls of MSK MRI at 3 T.
2. To recognise and address MR safety issues at 3 T.
3. To identify where 3 T is of most benefit in MSK imaging.

A-257 17:00

C. New techniques and applications

S. Trattig; Vienna/AT (siegfried.trattig@meduniwien.ac.at)

MRI of MSK structures has significantly improved in recent years due to the development of clinical high-field MR systems operating at 3 Tesla with high signal-to-noise ratios. Further improvement was achieved by higher gradient strengths and the application of dedicated coils. This allows high resolution isotropic 3D imaging which provides identical resolution when reformatting in all planes. This isotropic imaging can be used in visualisation of cartilage lesions and repair, ACL reconstructions, complex meniscal tears and labral tears in the shoulder and hip. In addition to the evaluation of gross cartilage morphology by MRI, there is growing interest in the visualisation of ultra structural components of cartilage and other structures such as menisci by MRI. Several MR techniques were developed, which allow detection of biochemical changes that precede the morphological degeneration in cartilage. For visualising the loss of glycosaminoglycans delayed gadolinium-enhanced MRI of cartilage (dGEMRIC) can be used. For the quantification of collagen matrix content and organisation cartilage T2 mapping has become useful. Further new biochemical MR techniques comprise diffusion-weighted imaging, magnetisation-transfer and a variant: chemical exchange saturation transfer (CEST) methods. All of these techniques benefit from the higher SNR and higher resolution capabilities at 3 T. New developments are ultrashort-TE techniques at 3 T which help to visualise MSK structures, which based on their inherent low T2 relaxation times did not provide signal such as cortical bone and tendons.

Learning Objectives:

1. To learn the role of 3 T in the application of new techniques in MSK imaging.
2. To appreciate future clinical applications of new MSK techniques at 3 T.
3. To learn how to apply new techniques in routine practice.

16:00 - 17:30

Room D2

Genitourinary

RC 1007

Imaging of the scrotum and penis

Moderator:

S. Özbek; Izmir/TR

A-258 16:00

A. Acute scrotum

B. Brkljacic; Zagreb/HR (boris.brkljacic@zg.htnet.hr)

Ultrasound is the best imaging modality for evaluation of acute scrotal conditions. MRI is used only rarely, when US findings are equivocal and in cases of suspected infarction. CT is used exceptionally, for example, to detect air in the scrotal wall. High-frequency transducers with modern software like compound imaging and native harmonic, and very good colour sensitivity for low flow in small vessels provide excellent insight into testicular morphology and vascularisation. It is very important to distinguish testicular torsion from the acute inflammation, as it has important therapeutic and even medicolegal consequences. In testicular torsion rapid diagnosis is vital, and salvage rate is directly related to timely operation. Torsion is more common in younger patients and orchiepididymitis is more common in adults. Infection usually starts at the epididymis and then spreads to testis

that is painful and hypervascularised on colour Doppler imaging. In cases of torsion B-mode findings are non-specific, while on colour Doppler flow is absent in complete torsion, but may be present and diminished in incomplete torsion, or increased in intermittent torsion. In cases of trauma ultrasound is important to diagnose haematoma, haematocele to evaluate integrity of testis and assess whether the testicular fracture is present or if the surgery is needed in cases of testicular rupture. Imaging is helpful in cases of rare causes of the acute scrotum, such as Fournier gangrene, testicular appendage torsion, vasculitis, and also in evaluation non-scrotal causes of symptoms, like in cases of renal colic, abdominal inflammatory and traumatic conditions, etc.

Learning Objectives:

1. To learn the imaging signs of testicular torsion.
2. To review the appearance of acute and subacute orchepididymitis.
3. To understand the role of imaging, especially ultrasound, in testicular trauma.

A-259 16:30

B. Scrotal tumours

L.E. [Derchi](mailto:derchi@unige.it); Genoa/IT (derchi@unige.it)

A scrotal mass is an important clinical problem and a source of anxiety to the patient. Radiologists play an important role in the management of these cases, since imaging is required to provide information about precise anatomical location of the lesion, its size and extension and, possibly, to elucidate the nature of the disease. The US and MRI findings of the many different scrotal tumours will be presented in this lecture. Special attention will be given to two topics. The first are the possibilities offered by imaging to differentiate among the different pathologies, especially to differentiate between benign and malignant lesions. The second will be the problem of the small, non-palpable, indeterminate testicular mass. Such lesions have been shown to be relatively frequent. Prevalence of malignancy varies widely in the literature, and orchidectomy seems not justified in all cases. The use of contrast-enhanced MRI and of advanced US techniques (contrast-enhanced US and elastography) may help to narrow the differential. Furthermore, the use of intraoperative US to guide removal of non-palpable testicular nodules can help to perform conservative surgery in lesions with no malignant potential.

Learning Objectives:

1. To understand the typical imaging appearance of benign and malignant scrotal tumours.
2. To review differential diagnosis of intra and extratesticular scrotal tumours and the impact of imaging.

A-260 17:00

C. Imaging of the penis

M. [Bertolotto](mailto:bertolotto@univ.trieste.it); 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 advance 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 haematomas, vascular lesions producing high flow priapism and other pathological changes. Compared with 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 imaging is optimal for tumour staging.

Learning Objectives:

1. To learn the most frequent penile diseases that can be diagnosed by imaging.
2. To understand the respective roles of US and MRI and the technical challenges of imaging.
3. To know how imaging influences treatment and follow-up.

16:00 - 17:30

Room E1

Musculoskeletal

RC 1010

Hip through the ages

Moderator:

E.C. [Kavanagh](mailto:kavanagh@noc.anglox.nhs.uk); Dublin/IE

A-261 16:00

A. The paediatric hip

D.J. [Wilson](mailto:wilson@noc.anglox.nhs.uk); Oxford/UK (david.wilson@noc.anglox.nhs.uk)

Depending on the age of the child, hip symptoms may predict a variety of diseases. In the infant, developmental dysplasia and infection should be considered. After the age of 4, irritable hip most commonly due to transient synovitis is the commonest disease but infection is the more worrying condition. Perthes disease affects some and this condition overlaps into those over 8 who may have a slipped upper femoral epiphysis. Fractures and rare cases of osteonecrosis and chondrolysis are a concern in the adolescent. In the young and indeed in most cases, ultrasound provides a useful first line test. Aspiration of effusion may be both diagnostic and therapeutic. In the older child and, especially when SUFE is a risk, conventional radiographs with an external rotated "frog leg" view is very important. Despite the logistics problems in children, there is an important role for MRI especially in cases where the initial imaging does not explain the symptoms. I will review the imaging pathways and provide examples of common diseases. I will also discuss how to manage the difficult case and show recent audit data on detection rates and clinical management.

Learning Objectives:

1. To understand the age-specific diseases of the hip in children.
2. To appreciate the strengths and weaknesses of each imaging method.
3. To understand how imaging is used in the management of children's hip problems.

A-262 16:30

B. The hip in the young athlete

C.W.A. [Pfirmann](mailto:pfirmann@univ.zurich.ch); Zurich/CH

Femoroacetabular impingement (FAI) is a common condition in the young athlete. FAI refers to a conflict between the proximal femur and the acetabulum. Both an abnormal shape of the proximal femur (FAI of the „Cam-Type“: Aspheric femoral head with a laterally increasing radius and/or a waist deficiency of the femoral neck) and the acetabulum (FAI of the „Pincer-Type“: Acetabular retroversion or a deep acetabulum) or a combination of the two may be present. For a long period the FAI may be asymptomatic and the only clinical finding will be an impaired internal rotation of the hip joint. Later as the disease progresses, cartilage damage (outside-in abrasion of the acetabular cartilage/cartilage delamination) and labral tears occur. Labral tears are most common in the anterosuperior aspect of the acetabulum. A typical labral tear is an incomplete detachment with a tear located at the base of the labrum. Anatomic variants such as a sulcus may be present and should be distinguished from tears. A sulcus is common at the junction of the labrum with the transverse ligament and is generally located beyond the equator of the hip joint. Insufficiency fractures about the hip commonly occur in the region of the femoral neck. Another site vulnerable to overuse is the symphysis pubis. Often, a bone marrow oedema pattern around the symphysis pubis is observed. A characteristic finding is the „Secondary cleft sign“, which reflects a partial tear of the adductor tendon aponeurosis at the symphysis pubis.

Learning Objectives:

1. To understand the mechanisms of injury of the hip.
2. To recognise the imaging pattern of abnormalities of the hip.
3. To become familiar with femoroacetabular impingement.
4. To learn about the typical injuries to tendon attachments around the hip.

A-263 17:00

C. The ageing hip

A.H. [Karantanas](mailto:karantanas@gmail.com); Iraklion/GR (akarantanas@gmail.com)

Understanding age-related changes is essential for interpretation of imaging studies. Age is a risk factor strongly correlated with osteoarthritis (OA) which is the most common hip joint disease seen in adults. The diagnosis of OA is based on a combination of radiographic findings and characteristic subjective symptoms. The lack of a radiographic consensus definition has resulted in a variation of the

published incidences and prevalence of OA. The progression of OA traditionally has been measured using radiographic joint space width (JSW). Weight-bearing radiographs centered on the hip are the most reproducible and reliable ones. The sequence of degeneration includes the following radiographic findings: joint space narrowing, osteophyte formation, subchondral sclerosis, and cyst formation. Current definitions of radiological OA based on reduced JSW and osteophytes display predictive validity for clinical hip OA. Radiographs are also useful for assessing developmental dysplasia and other congenital disorders which may lead to early OA. There are cases though, that radiographs show minor changes and the clinical suspicion of early disease can be confirmed with more sophisticated imaging methods, such as CT and MRI. CT is helpful for additional measurements such as femoral and acetabular abnormal version which might lead to OA. Femoroacetabular impingement has been shown to cause labral and chondral lesions and leads to OA. Prompt recognition of abnormal head-neck junction on radiographs enables proper conservative or surgical treatment planning. MR arthrography is the method of choice for assessing the labra whereas CT arthrography might be used as an alternative for articular cartilage assessment.

Learning Objectives:

1. To become familiar with the radiographic assessment of the ageing hip.
2. To understand the MRI findings of degenerative hip disease.
3. To review the various disorders which predispose for early osteoarthritis.
4. To recognise the advantages and disadvantages of CT and MR arthrography of the ageing hip.

16:00 - 17:30

Room E2

Organs from A to Z: Pancreas

MC 1019

Cystic tumours, endocrine neoplasms and congenital anomalies

Moderator:

I. Lupescu; Bucharest/RO

A-264 16:00

A. Cystic tumours

R. Pozzi-Mucelli; Verona/IT (roberto.pozzimucelli@univr.it)

Cystic tumours of the pancreas include a variety of masses which can be classified into cystic tumours of the exocrine pancreas, cystic tumours of the endocrine pancreas, cystic tumour-like lesions of the exocrine pancreas. In order to simplify the approach only the relatively common cystic tumours - the intrapapillary mucinous tumours (IPMT), the serous cystadenoma (SC) and the mucinous cystadenoma (MC) - will be considered. IPMT are characterised by ductal dilatation. Imaging characteristics of IPMT are best displayed at MR-cholangiopancreatography. On the basis of the extent, these tumours can be divided into IPMT of the main duct (or central), IPMT of the secondary ducts (or peripheral) and mixed IPMT. Central and mixed IPMT have a malignant behaviour and therefore need to be treated surgically, while peripheral IPMT have a benign behaviour and, in general, need only follow-up. SC are characterised by a microcystic architecture in most cases. Imaging features are typical in cases of microcystic appearance and consist of small amounts of fluids interspersed within multiple septae of a "sponge like" mass. The differential diagnosis with a mucinous cystadenoma is difficult in cases with a oligo-macrocystic appearance. MC appears as a uni-oligolocular cystic mass, with a simil-ovarian stroma in the tail of the pancreas. Imaging features include a cystic mass with a definite wall and inner septae. When calcifications and enhancing nodules are present, a mucinous cystadenocarcinoma has to be suspected. Therefore, a careful evaluation of imaging features of pancreatic cystic tumours is needed to differentiate benign form malignant masses.

Learning Objectives:

1. To understand the classification and management of cystic pancreatic tumours using rad/path correlation.
2. To learn how to provide a differential diagnosis and how, when and why imaging techniques should be used.
3. To review pathological and imaging findings of intra-ductal cystic tumours.
4. To learn how to deal with the incidental pancreatic cyst.

A-265 16:25

B. Endocrine and other solid pancreatic tumours

C.J. Zech; Munich/DE (Christoph.Zech@med.uni-muenchen.de)

Endocrine tumours of the pancreas are derived from the APUD cell system. They often show early clinical sign related to the hormones produced by these tumours. The usually very specific symptoms raise the suspicion of an endocrine tumour of the gastro-entero-pancreatic tract and initiate imaging studies for tumour detection. In this setting usually the pancreas is among the most frequent tumour sites. Since endocrine active tumours of the pancreas usually show a strong vascularisation, they can be differentiated from other solid tumours of the pancreas - including adenocarcinoma of the pancreas. Metastases in the pancreas are very rare - however, they represent a potential differential diagnosis either for non-functioning neuroendocrine tumours or for adenocarcinoma of the pancreas. Since the evaluation of the whole pancreas is crucial, transabdominal ultrasound plays an only limited role for the detection of endocrine pancreatic tumours. Usually MRI and CT - alone or in combination with specific nuclear medicine tracers in PET - are needed for accurate diagnosis and staging of these tumours.

Learning Objectives:

1. To understand the clinical manifestations, pathology and imaging findings of functioning and non-functioning endocrine tumours.
2. To learn about imaging protocols and to address management options of these tumours.
3. To review prognostic information.
4. To learn about other causes of solid pancreatic tumours, including metastases, and the role of imaging in management.

A-266 16:50

C. Congenital and developmental anomalies

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

Pancreas develops from ventral and dorsal buds during embryologic development. Radiologic imaging plays an important role in the diagnosis of congenital and developmental anomalies of pancreas, which can involve either pancreatic duct or pancreas parenchyma. The spectrum of congenital pancreatic duct anomalies include the failure of fusion of ventral and dorsal pancreatic ducts, so-called pancreatic divisum, which can be complete or partial. Parenchymal anomalies and variants include cystic dystrophy of duodenum, annular and ectopic pancreas, dorsal (distal) pancreas agenesis, circumportal pancreas, short pancreas, bifid tail of pancreas, fusion of pancreas and spleen. These can cause symptoms (groove pancreatitis and duodenal obstruction) or can be asymptomatic. Dependent stomach and dependent intestine signs can allow diagnosis of dorsal pancreas agenesis. Variations in the fat accumulation of pancreas can cause diagnostic problems and knowing embryology of pancreas can help in diagnosis. The role of ultrasonography, CT, MRI and MRCP in the diagnosis of anomalies of pancreas will be illustrated. A variety of pancreas anomalies can be diagnosed with CT and MRI and this approach can obviate invasive diagnostic procedures.

Learning Objectives:

1. To review the elements of pancreatic embryology that are necessary to understand abnormalities and variants of the pancreas.
2. To learn about the most common variants in the pancreatic ducts, like complete or partial pancreas divisum, and abnormal localisations of pancreatic tissues like cystic dystrophy of the duodenum, annular and aberrant pancreas.
3. To learn about the role of these abnormalities in determining diseases.
4. To learn how imaging should be used to derive the appropriate diagnosis.

Discussion 17:15

16:00 - 17:30

Room F1

New Horizons Session

NH 10

Breast imaging in 2025

Moderator:

T.H. Helbich; Vienna/AT

A-267 16:00

Chairman's introduction

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

Breast cancer is the leading cause of cancer death among women world wide. Imaging plays a key role in the early detection of breast cancer. Mammography is an accepted screening modality with some limitations such as over treatment. To overcome this limitations, research is going on to characterise breast cancer more accurately. Currently researchers are working on different strategies spanning the spectrum from tomography-based systems to MRI and even more molecular imaging. This panel discussion will focus on these different strategies. The auditorium will learn if in 2025 imaging still plays a major role in breast cancer detection or a simple blood test will eventually solve the problem.

Session Objectives:

1. To learn about new breast imaging modalities for 2025.
2. To learn whether these imaging modalities can influence breast cancer screening in 2025.
3. To understand whether today's polemics will remain true in 2025.

A-268 16:05

Is mammography still an accepted modality for breast cancer imaging in 2025?

M.J. Yaffe; Toronto, ON/CA (martin.yaffe@sunnybrook.ca)

X-ray mammography is currently the only imaging modality that when used in routine screening has been demonstrated to contribute to reduced mortality in women in the age range 40-74. But, the accuracy of mammography is limited with respect to both sensitivity and specificity. Digital mammography has provided increased sensitivity in women with dense breasts and three-dimensional methods such as digital breast tomosynthesis or dedicated breast CT promise to yield further improvement. However, these techniques are dependent on detecting rather gross physical changes as masses, microcalcifications or architectural distortions develop and, therefore, their ultimate potential is limited. It is likely that before 2025, detection tools that are more specifically targeted to molecular characteristics or early functional changes associated with cancer will be clinically available. These may be either in the form of an imaging test, based on a specific biomarker for the cancer or possibly an innocuous test designed to sense a circulating biomarker in the blood or urine. In the latter case, a positive test would be followed by an imaging study to provide localisation for therapy. Such tests could not only detect the presence of disease but would also provide prognostic information to guide the type and aggressiveness of therapy so that overtreatment could be avoided. Promising imaging techniques based on targeted imaging with ultrasound, x-ray contrast agents, MR and radio-labelled agents are already under investigation. By exploiting new molecular or functional signals one of these is almost certain to replace mammography before 2025.

Learning Objectives:

1. To understand the current performance of mammography, including its benefits, strengths and limitations.
2. To become familiar with the potential for improvement in breast cancer imaging.
3. To examine possible strategies for evolution of the paradigm for screening and imaging in breast cancer management.

A-269 16:28

Breast cancer screening with MR imaging and nothing else

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

Regarding the early diagnosis of breast cancer, population-based mammographic screening has been shown to help reduce breast cancer mortality. Mammographic screening, reduced post-menopausal hormone intake and the development of new, targeted therapies all contributed to the reduction of breast cancer mortality that has been observed in the last couple of years. Still breast cancer is one of the most frequent cancers overall, and it continues to be the leading cause of

cancer death in women, indicating that there is room and need! for improvement. Magnetic resonance imaging (MRI) of the breast has been introduced a decade ago. Over recent years, it has become increasingly evident that breast MRI by far the most powerful breast imaging technique that is currently available. Across all different clinical and screening scenarios, MRI has been shown to be superior to mammography - be it for diagnosing primary or recurrent, invasive or intraductal, familial or sporadic breast cancer, irrespective of a woman's breast density. And yet is the technique only slowly adopted in clinical practice. Arguments against the use of breast MRI include costs, frequency of false positive diagnoses, lack of trained radiologists, lack of minimally invasive biopsy capabilities, lack of evidence by randomised controlled clinical trials, and, last, fear of overtreatment. In this lecture, these concerns are reviewed, discussed and weighted against the advantages of screening and diagnostic applications of breast MRI.

Learning Objectives:

1. To learn about results of breast cancer screening studies involving breast MRI.
2. To learn current indications for MRI screening.
3. To understand technical MR imaging strategies for screening.

A-270 16:51

The evolving role of the radiologist

P. Brader; Vienna/AT (peter@brader.md)

In the past two decades, enormous strides have been made in medical imaging and many new technologies and agents are now available for breast cancer research, clinical trials and patient care. Advances in experimental and clinical breast imaging are likely to improve our knowledge of how breast cancer arises at the cellular level, which will help not only to identify and locate tumours but also to assess the activity of biological processes within these tumours. This recent and concomitant progress, in imaging in general, and in breast imaging in particular, has been facilitated by the convergence of molecular cell biology, pathology, chemistry, physics and engineering in a multimodality and multidisciplinary way. The challenge for radiology is to begin thinking at the molecular level. It is, therefore, important that the next generation of radiologists become more involved in multidisciplinary research and clinical work, and that younger radiologists receive special training in diagnostic imaging and nuclear medicine, as well as a solid understanding of physics, radiochemistry, pathology and biology. Applying this approach to breast cancer patients should allow earlier detection, stratification of patients for treatment, and objective evaluation of new therapies. The outcome will be considerably better management and care of those with breast cancer.

Learning Objectives:

1. To learn about novel developments in the field of breast imaging, especially those aimed at treating and characterising.
2. To understand what is happening functionally and structurally at the molecular level for breast cancer imaging.
3. To learn about design and development of molecular imaging probes for breast cancer imaging.

Panel discussion:

Breast imaging 2025: blood test or still imaging? 17:14

Breast cancer is the leading cause of cancer death among women worldwide. Imaging plays a key role in the early detection of breast cancer. Mammography is an accepted screening modality with some limitations such as over-treatment. To overcome these limitations research is going on to characterise breast cancer more accurately. Currently researchers are working on different strategies spanning the spectrum from tomography- based systems to MRI and even molecular imaging. This panel discussion will focus on these different strategies. The auditorium will learn if in 2025 imaging still plays a major role in breast cancer detection or whether a simple blood test will eventually solve the problem.

16:00 - 17:30

Room F2

Professional Challenges Session

PC 10

Imaging as the number one tool for oncology trials

Moderators:

F. Meunier; Brussels/BE

P.M. Parizel; Antwerp/BE

A-271 16:00

Chairmen's introduction

F. Meunier¹, P.M. Parizel²; ¹Brussels/BE, ²Antwerp/BE

(francoise.meunier@eortc.be)

Multiparametric imaging techniques provide a non-invasive insight into tumour cell density, vascularisation, and biochemistry. Imaging data have the potential to provide information on disease profiling pertaining to diagnosis, prognosis, selection of therapy, monitoring of response to therapy, and pharmacokinetic information of drugs. Undoubtedly, these methods hold great promise, but how can we standardise these techniques, in terms of acquisition parameters and image analysis (post-processing), and validate imaging parameters as biomarkers in multicenter international cancer trials. Beginning with a review of the frequently used response evaluation criteria in solid tumours (RECIST), the development and optimisation of new imaging parameters as biomarkers of treatment response and optimised monitoring of tumour therapy in multicenter EORTC clinical trials will be presented. DW-MRI is sensitive for tumour detection; ADC is affected by the different cellular density of a tumour. Still, a number of challenges need to be overcome to qualify ADC as a response and prognostic biomarker in a multicenter setting. The large variety in primary tumours and imaging methods, as well as the large variety and continual evolution of imaging equipment, point towards the need for a concerted design of imaging protocols in order to assure that these protocols are applicable to multicenter trials. Furthermore, reliable evaluation of imaging data requires imagers experienced in the area of the definite cancer targeted in this trial and in the use of imaging tools for lesion quantification. From this session, a roadmap for future collaboration between EORTC and ESR combining different imaging modalities will emerge.

Session Objectives:

1. To prove that advanced multiparametric imaging techniques play a crucial role in the diagnosis, staging, treatment monitoring and follow-up of oncological patients.
2. To explore avenues for future collaboration between EORTC and ECR.
3. To suggest input of radiologists in the design and implementation of multicenter trials.

A-272 16:06

The EORTC Imaging Group: vision and strategy on cancer imaging

S. Stroobants; Antwerp/BE (Sigrid.Stroobants@ua.ac.be)

Response to cancer treatment is evaluated by subsequent assessments of target lesions and is defined as a significant decrease in measurable tumour dimensions (WHO, RECIST). The new targeted therapeutics which cause cytostasis rather than cytotoxicity have challenged volume-based response criteria and tumour regression is increasingly recognised as an unreliable end point. New imaging modalities looking at tumour biology, like positron emission tomography (PET) or diffusion weighted (DW) and dynamic contrast enhanced (DCE) magnetic resonance imaging (MRI) or increasingly used to identify subpopulation of patients most likely to respond. Recently, new response criteria were introduced that incorporate FDG-PET (RECIST 1.1 for solid tumours and new Cheson criteria for lymphomas). Since imaging is becoming increasingly important in novel trial design, the EORTC decided to invest in an imaging platform. EORTC has established a medical imaging exchange infrastructure allowing to store imaging data linked to the clinical databases. A functional imaging expert group is set up to review protocols, organise central review and develop specific initiatives for imaging biomarker validation. EORTC is part of the QuicCONCEPT consortium that within the EU innovative medicine initiative (IMI) will try to validate the use of novel PET probes and DW-MRI as biomarkers for apoptosis and proliferation. Functional imaging techniques can only evolve successfully into biomarkers that are clinically valuable and important for drug development, when there is agreement on the standards for measurement and analysis and working groups are set up in collaboration with the different professional organisations (ESR, EIBIR, EANM) to set up imaging guidelines.

Learning Objectives:

1. To review frequently used response evaluation criteria in solid tumours (e.g. RECIST).
2. To evaluate the development and optimisation of new imaging parameters as biomarkers of treatment response and optimised monitoring of tumour therapy in multi-center EORTC clinical trials.
3. To present an innovative medicine initiative as a roadmap for future collaboration between EORTC and ESR, combining different imaging modalities.

A-273 16:24

Can we assess cell density of tumours with imaging techniques?

D.-M. Koh; Sutton/UK

Imaging is increasingly used to define endpoints of clinical trials in oncology. Tumour cellular density may be inferred by diffusion-weighted MR imaging (DW-MRI) and measurement of the T2 relaxation time. DW-MRI is unique as the mechanism of contrast is based on differences in the mobility of water between tissues, which can be quantified by the apparent diffusion coefficient (ADC). Tumours are frequently more cellular compared with their tissue of origin which impedes water diffusion, resulting in increased conspicuity on DW-MRI and lower ADC values. Studies have shown negative correlations between histopathologically determined cell density and ADC in several tumour types, including prostate cancer, soft tissue sarcomas and cerebral tumours. DW-MRI is sensitive for tumour detection, especially for disseminated peritoneal disease, liver and bone metastases. Whole body DW-MRI with background suppression (DWIBS) is an emerging technique that has shown substantial promise for staging of lung cancer, prostate cancer, lymphoma and multiple myeloma. Effective treatment results in reduction in cell density due to cell lysis, apoptosis and necrosis, leading to a rise in ADC value. ADC increase has been observed within 30 days of anti-tumour treatment (including chemotherapy and radiotherapy); and as early as one to two weeks after treatment. Quantitative ADC measurements may also be prognostic as tumours with higher pre-treatment ADC have been shown to respond poorer to chemotherapy and radiotherapy. Nevertheless, a number of challenges still have to be overcome to qualify ADC as a response and prognostic biomarkers in a multi-centre setting across different imaging platforms.

Learning Objectives:

1. To show that MRI-derived parameters (e.g. apparent diffusion coefficient, T2 relaxation time) are good indicators of tumour cell density.
2. To evaluate the role of diffusion-weighted imaging to assess tumour growth and metastases (whole body imaging).
3. To show the prognostic role of imaging parameters with regard to potential metastatic activity and tumour aggressiveness.
4. To demonstrate that diffusion imaging can be used to monitor cytotoxic treatment response.

A-274 16:42

Which imaging techniques are useful to evaluate tumour angiogenesis?

D. Sahani; Boston, MA/US (dsahani@partners.org)

Angiogenesis is an essential process whereby tumours derive vascular supply from adjacent tissue, to sustain tumour growth and metastatic spread. Newer targeted antiangiogenic therapies differ significantly from current cytotoxic therapies for cancer. The methods of dose selection are either invasive, such as biopsy and histology, or time consuming, such as tumour shrinkage and time to disease progression, both of which take months to assess and fraught with other limitations. Moreover, cancer is a very variable disease, which means that some patients will respond to a particular therapy while others will not. There is, therefore, a great need to establish surrogate markers for drug response that are both rapid and reliable, not only for clinical trials of new drugs but also to aid in the selection of optimal treatment for individual patients. Although functional imaging has been a domain of nuclear medicine (PET), dynamic CT and MRI using a kinetic model can derive tumour vascular characteristics. It has been demonstrated that tumour contrast uptake characteristics correlate with recognised marker of tumour angiogenesis. By capturing temporal changes in contrast enhancement reflecting the tumour vasculature, functional imaging techniques can facilitate diagnosis, risk-stratification and therapeutic monitoring. Various imaging techniques and protocols have been used with each having its own advantages and limitations. Similarly, various post-processing methods such as semi-quantitative or quantitative analysis can be used to produce functional maps. Other novel imaging techniques such as multi-energy CT, diffusion MR and MR spectroscopy also have potential in assessing tumour biology and response.

Learning Objectives:

1. To prove that modern imaging techniques, such as perfusion MRI, can be used to measure tumour angiogenesis and vascular permeability.
2. To show that imaging parameters can be directly correlated with molecular markers such as vascular endothelial growth factor (VEGF).
3. To correlate tumour perfusion with histopathologic changes (e.g. hypercellularity, pleomorphism, vascular endothelial proliferation, mitotic activity, and necrosis).

A-275 17:00

Challenges for morphologic imaging in oncology trials: reproducibility and reading

F.E. Lecouvet; Brussels/BE (frederic.lecouvet@uclouvain.be)

Beside clinical endpoints and biological or molecular parameters, beside emerging perfusion or diffusion imaging techniques, morphologic imaging remains the cornerstone of the evaluation of treatment response in the majority of primary or metastatic tumours. The large variety in cancers and imaging methods, as well as the large variety and permanent evolution in imaging equipments, raises the need for a concerted design of imaging protocols to guarantee transposability of these protocols to multiple centers. The reliable evaluation of imaging studies obtained in trials requires readers experienced in the area of the definite cancer targeted in this trial, and in the use of imaging tools for lesion quantification. The imaging group of the EORTC targets this optimisation of imaging protocols. First, the different "organ groups" of the EORTC will benefit from the availability of expert radiologists in the different fields of oncology, involved in the choice and tuning of adequate and generalisable imaging tools from the beginning of trials design. The design of CT or MRI studies should target acquisition parameters transposable in a large number of centers; there is no need for "cutting edge" protocols for a reliable assessment of response in a majority of cancer patients. Second, the central review of imaging studies will be possible based on the involvement of expert radiologists, and on a robust imaging platform that guarantees availability, quality control, and "side by side" evaluation of baseline and follow-up examinations. Principles and limits of response evaluation by morphologic imaging in oncology will be illustrated.

Learning Objectives:

1. To illustrate the setting up of an independent image analysis platform in the EORTC Imaging Group.
2. To underline the need for defining imaging protocols reproducible and transposable to multiple centre trials, facing technical and manufacturer dependent variability.
3. To illustrate how "simple" protocols may guarantee robust imaging monitoring of cancer (compared to some advanced and multiparametric protocols).

Panel discussion:

Can we use imaging parameters as biomarkers in multicentre trials and predict tumour response? 17:18

16:00 - 17:30

Room G/H

Neuro

RC 1011

Common disorders of the paediatric brain

Moderator:

O. Flodmark; Stockholm/SE

A-276 16:00

A. Foetal MR imaging: more than just T2-weighted images

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

The objective of this talk is to introduce other techniques than SS FSE T2 in use when scanning the foetal brain. The most frequent indications for MRI are ventriculomegaly, asymmetry of the ventricular system, brain malformations, infection and others. Most of the MR scan is done with Single Shot FSE T2 (SSFSE2), this is a sequence allowing the acquisition of slice by slice of the brain, and thus minimising the effect of foetal movement on the scan. Today, fast FRFSE2 are available, this is a very short T2 sequence in which the white and gray matter junction is visualised very well. T1 or FSPGR is used with limitations due to the foetal movements. It is necessary to perform T1 to demonstrate the myelination. DWI is a very important tool in understanding the ischaemic changes in the adult brain, allowing the diagnosis of acute infarcts. Ischaemic insult can occur in foetuses with

conditions such as TTTS in twin pregnancies and foetal demise. The living foetus can also suffer from abnormal blood supply to the CNS, and thus showing small or even large hemispheric infarcts. Other diffusion technique, DTI is also used to demonstrate the white matter formation of the foetal brain. MRS is also used in the evaluation of the foetal brain. The values of the NAA, Choline and the existence of lactate are different than the values in the paediatric and adult brain.

Learning Objectives:

1. To explore the new imaging techniques for the study of the foetal brain.
2. To understand the use of diffusion-weighted imaging in the foetal brain.
3. To become familiar with the accurate use of T1-weighted sequences in the foetal brain.
4. To understand the possibilities of tractography in the fetal brain.

A-277 16:30

B. Normal findings and pitfalls in paediatric neuroimaging

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 understand a different approach to neuroimaging in the developing paediatric brain and spine.
2. To appreciate that, despite the wide and potentially complex spectrum of diseases seen in neuropaediatrics, most interpretations can be made through the thoughtful application of basic neuroradiological analytical techniques.
3. To be aware of certain areas where common pitfalls, myths and misunderstandings occur.

A-278 17:00

C. Neuroimaging in the acutely ill child

E. Vázquez; Barcelona/ES (evazquez@vhebron.net)

The ability to develop more aggressive treatments of acute neurological disorders in children is nowadays improving; however, infants and children are often uncooperative, clinical signs are not always easily localised, and diagnosis and therapy may be both delayed. Effective imaging of the central nervous system assumes an increasingly important role in the evaluation of these critically ill children. This lecture will review the main indications to perform a neuroimaging procedure in children with a neurological emergency. With didactic purposes, acute conditions will be classified in traumatic and non-traumatic (ischaemic and haemorrhagic stroke, infection and acute metabolic disorders). Differential diagnosis will be discussed based on representative cases selected from the daily routine in a paediatric tertiary hospital. The varied neurological complications that can occur in the child admitted at the intensive care unit will also be presented in a didactic manner, including PRES (posterior reversible encephalopathy syndrome), acute liver failure, osmotic demyelination syndrome, hypoglycaemic encephalopathy or induced neurotoxicity. Eventually, some peculiarities in oncologic and immunosuppressed children, particularly opportunistic infections, will be highlighted. Practical algorithms with the preferential use of either CT or MRI will be developed for each section. CT continues being the primary modality for trauma, although it should be better used in cases of non-available MRI in the other acute conditions to save radiation in children. MR imaging is nowadays better for imaging these children owing to the new 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 the characteristic neuroimaging findings that may be useful in establishing differential diagnoses.
2. To understand the various neurological complications that can occur in the intensive care unit and to become familiar with their most typical imaging patterns.
3. To consolidate knowledge of the best neuroimaging protocols for the acutely ill child and establish the main indications for the use of MR imaging, particularly diffusion and spectroscopy.

16:00 - 17:30

Room I/K

Chest

RC 1004

Diffuse lung diseases: what the radiologist should know

Moderator:

C. Schaefer-Prokop; Amersfoort/NL

A-279 16:00

Chairman's introduction

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

With the advent of volumetric data acquisition and with increasing knowledge of patho-radiological correlations, HRCT has further matured over the last decade and provides the radiologist with an excellent tool for accurately demonstrating gross lung anatomy and precisely analysing abnormal findings. The radiologic diagnosis of many pulmonary abnormalities is based on an assessment of their pattern and distribution. While the pathologist has the advantage of being able to evaluate specimens microscopically, the radiologist is confined to the assessment of more gross disease. However, the radiologist is able to examine the entire lung providing him with information about the distribution of disease and about additional diagnostic clues in mediastinum and pleura. Both together, characterisation of the gross findings and knowledge of their distribution represent the key features for arriving at a confident diagnosis.

Session Objectives:

1. To become familiar with the standardized and internationally accepted terminology for describing and analysing HRCT findings.
2. To learn how a structured analysis of the predominant pattern and its distribution represent the key for making a specific diagnosis in the best case scenario or to understand how it helps to narrow the differential diagnosis.
3. To promote the understanding how the variability of manifestations of some diseases can cause an overlap of findings being responsible for difficulties the radiologist encounters when categorizing diffuse diseases of the lung parenchyma.

A-280 16:05

A. The glossary of terms for thoracic imaging: old and new definitions

J.A. Verschakelen, W. De Wever, J. Coolen; Leuven/BE
(johny.verschakelen@uz.kuleuven.ac.be)

Most radiological reports consist of a 'descriptive part' in which the radiologist describes the findings and a short 'conclusion part' containing the interpretation of what is seen. Both parts are filled with 'jargon'. Some terms are typical radiological 'language' while others refer to terminology also used by clinicians and pathologists. Some terms are purely descriptive but others may contain already some interpretation of what is seen and hence narrow the differential diagnosis. The meaning of a term may also change over time. It is very important that both radiologists and the readers of their reports speak the same language and know and understand the meaning and full content of each term. This is especially important when radiological findings in patients with diffuse lung diseases are described and interpreted. Diagnosis of diffuse lung disease is indeed largely based on the recognition and description of the appearance pattern of the disease because this often allows developing an appropriate list of differential diagnosis. Members of the Fleischner Society have introduced a glossary of terms for thoracic imaging. This presentation will emphasise on the importance of such a glossary for both describing and interpreting chest images. Special attention will be given to the terms used to describe the different patterns in diffuse lung diseases: (1) reticular and short linear opacities, (2) nodular opacities, (3) increased lung opacity and (4) cysts and decreased lung opacity.

Learning Objectives:

1. To understand the importance of a glossary of terms for thoracic imaging.
2. To become familiar with the new definitions introduced in the last glossary of terms proposed by members of the Fleischner Society.

A-281 16:28

B. From pattern recognition to disease diagnosis: a practical approach (part 1)

M.-L. Storto; Chieti/IT (ml.storto@radiol.unich.it)

A practical approach to HRCT of the chest for diagnosis of diffuse lung diseases includes: recognition of the abnormalities, definition of their distribution within the secondary lobule or the lung, identification of associated findings. When combined with the patient clinical history, these 3 steps allow to shorten the list of differential diagnoses and may sometimes lead to a specific diagnosis. A reticular pattern consists of multiple lines as the result of interlobular septal thickening, intralobular lines or cystic walls of honeycombing. When present as a predominant abnormality, thickening of interlobular septa has a limited differential diagnosis which includes pulmonary oedema/haemorrhage, lymphangitic spread of cancer, sarcoidosis and alveolar proteinosis. Honeycombing represents destroyed and fibrotic lung tissue containing numerous cystic airspaces with fibrous walls and is considered a CT feature of established pulmonary fibrosis. When honeycombing is present, UIP is likely the histologic pattern and IPF is the most likely diagnosis, in the absence of a known disease. A nodular pattern consists of multiple rounded opacities 2-10 mm in size. The distribution of nodules is the most important factor in making an accurate diagnosis. A centrilobular predominance of nodules that typically spare pleural surfaces is a frequent sign of bronchiolitis and airway disease. A perilymphatic distribution is most frequently seen in patients with sarcoidosis, silicosis and lymphangitic spread of cancer. A random distribution with nodules diffusely and uniformly distributed can be the result of infection, haematogenous metastases and other rare diseases such as Langerhans cell histiocytosis.

Learning Objectives:

1. To understand the different patterns on HRCT scans of the chest.
2. To learn about a systematic approach to differential diagnosis of diffuse lung diseases.
3. To review key imaging findings.

A-282 16:51

C. From pattern recognition to disease diagnosis: a practical approach (part 2)

T. Franquet; Barcelona/ES (tfranquet@santpau.es)

The diffuse interstitial lung diseases (DILDs) are a heterogeneous group of disorders which principally affect the lung parenchyma. Basic HRCT patterns are common to many disease processes and are usually non-specific. However, their distribution and their temporal evolution are often characteristic enough for diagnostic purposes. Increased lung opacity: air-space consolidation, by definition, occurs when alveolar air is replaced by fluid, cells, or other material. On HRCT, consolidation results in an increase in lung opacity associated with obscuration of underlying vessels. Conversely, ground-glass opacity is defined as: "... hazy increased attenuation of lung with preservation of bronchial and vascular margins". The significance of ground-glass opacity depends on the clinical scenario. Cysts and decreased lung opacity: a cyst appears as a round parenchymal lucency or low-attenuating area with a well-defined interface with normal lung. Lung diseases characterised by cysts include Langerhan's cell histiocytosis, lymphangioleiomyomatosis, LIP, postinfectious pneumatoceles, and amyloidosis. Recently, lung cysts have been reported in association with extrinsic allergic alveolitis. Honeycombing is a process characterised by the presence of cystic spaces. The determination of the presence or absence of honeycombing on HRCT in patients with idiopathic interstitial pneumonia is of great importance. Honeycombing may have an atypical distribution particularly in asbestosis, sarcoidosis, non-specific interstitial pneumonia (NSIP), drug-related fibrosis and hypersensitivity pneumonitis. HRCT is now an integral component of the clinical investigation of patients with suspected and established interstitial lung disease. A knowledge of the close relationship between histopathological changes and CT appearances.

Learning Objectives:

1. To understand the different patterns on HRCT scans of the chest.
2. To learn about a systematic approach to differential diagnosis of diffuse lung diseases.
3. To review key imaging findings.

Panel discussion:

How do we report CT of the chest? 17:14

The radiology report is often the primary method of communicating imaging findings to the referring physician. Practical guidelines on how to report CT scans of the chest for diffuse infiltrative lung diseases will be provided by the panel. Emphasis will be placed on both report content and style in order to provide the clinician a tool for good patient care.

16:00 - 17:30

Room L/M

Radiographers

RC 1014

Radiography as an ethical practice

Moderators:

B.T. Andersson; Lund/SE

A.L. Baert; Kessel-Lo/BE

A-283 16:00

A. The relationship between man and technology in radiographic practice: a narrative approach

B.R. Mussmann; Odense/DK (borm@ucl.dk)

The purpose is to examine the relationship between man and technology within radiography without considering man and technology as separate entities. The study is designed as an observational study which took place in a Danish radiological department. It involved 20 examinations followed up by three semi-structured interviews. Through emergent narratives radiographers construct a practice in which the relationship between man and technology is marked by a struggle of domination of one over the other. The struggle expresses itself through two competing plots: a diagnostic plot with a prevailing, but not merely chronological structure mostly composed of events tied to pathology. The life story, in opposition, plots the examination as a significant experience in the patient's life, transforming it into events stretching towards a future yet unknown. Most often the radiographers contributed to the domination of man over technology through active engagement of their narrative alertness. Errors and failure to keep the time schedule can, however, lead the radiographers to a change of perspective that makes them displace man from the scene of radiography by playing on the premises of technology. In several stories technology can be labelled 'setting' while the patient plays the main role. The radiographers act with the patient as point of origin, but they reason with technological arguments. Hence, the human aspects of radiography constitutes an underground practice, which is not explicitly articulated valuable. This creates a field of tension between man and technology, with risk of technological dominance.

Learning Objectives:

1. To gain knowledge about narrative analysis in a radiographic context.
2. To appreciate humanistic aspects of radiography.
3. To consolidate knowledge of ethics in radiographic practice.
4. To understand how perspectives of illness and disease influences the patients experience.

A-284 16:30

B. Ethical codes across Europe

D.S. Oreti; Monfalcone/IT (graig@virgilio.it)

The private life of everyone of us as well as the everyday practice of our profession is deeply embedded in ethical/deontological aspects which play a critical role into: our profession, the relationship with our patients, with our colleagues, with the health care team we work with, and with ourselves. The radiographer's everyday practice has to take this aspects into account. Ethics finds its origins in the fusion of three different sources, as if it were a compromise between: the species we belong to, the society we live in, and ourselves. Yet, we are not obliged to abide to these three elements. It is through our actions that we decide how to behave in certain situations. And this is the reason why every single action towards the others gathers importance, the simple rites when individuals meet play a pivotal role in the creation of a relationship with the others. Shaking hands, greeting and using polite forms of speech, all these actions are ethically important, they allow us to catch the benevolence of our interlocutor and to discourage any possible hostility. What would happen if our professional identity were perceived and acknowledged through the way we can interact and relate to others? In this case, the work no longer ennoble the man, but it is the man, through his actions, who ennoble his profession. Behaving ethically towards one's own profession, towards the others and towards ourselves, is it, or could this be the common ground of European professional ethics?

Learning Objectives:

1. To gain knowledge about the border between philosophical, ethical and personal application in the professional field.
2. To understand the ethical aspect of daily practice, starting from simple actions.
3. To appreciate how the ethic can exploit the profession of the radiographer.
4. To consolidate knowledge of the role of the ethic within the profession of the radiographer in Europe.

A-285 17:00

C. Ethical problems in diagnostic radiology in terms of radiation protection

K. Paalimäki-Paakki; Oulu/FI (karoliina.paalimaki-paakki@oamk.fi)

The purpose is to describe ethical dilemmas related to the use of radiation in Finnish radiographer's work in diagnostic imaging. The data were collected during the spring and summer of 2008, and it consisted of thematic interviews of diagnostic radiographers (N=8) whose working experience varied from 4 to 31 years. The data were analysed by the method of data-oriented qualitative inductive content analysis. Ethical dilemmas related to the use of radiation were found to concern justification and optimisation principles, which were found to be inadequately implemented by radiographers. The background factors of these dilemmas were found to be both dependent on and independent of the employee, resulting in worsened well-being at work and in seeking for change. The current processing methods of dilemmas were found to be insufficient, and suggestions for better processing methods were made. The results suggest that there may be shortcomings in radiographers' knowledge of radiation usage. Attitudinal problems within the work community seem to maintain ethical shortcomings. Instead of ethically inadequate routines and passing the baton to other professionals, radiographers should be encouraged in committing themselves into responsibility and safety culture. Respondents repeatedly described powerlessness and inability to intervene in ethical problems.

Learning Objectives:

1. To consolidate knowledge of basic radiation protection principles.
2. To become familiar with ethical dilemmas in radiographers work.
3. To gain knowledge about ethical dilemmas in the implementation of justification and optimisation principles in diagnostic radiographer's work.
4. To consider and learn to recognise ethical dilemmas in the use of radiation.

16:00 - 17:30

Room N/O

Head and Neck

RC 1008

Runny and stuffy noses: paranasal sinus imaging

Moderator:

M.G. Mack; Frankfurt a. Main/DE

A-286 16:00

Chairman's introduction

M.G. Mack; Frankfurt a. Main/DE (m.mack@em.uni-frankfurt.de)

The common cold is one of the most frequent illnesses in Europe and the United States. Although most colds are mild and resolve within a short time period, colds cost billions of dollars per year, mostly due to lost time at work and school. The common cold is a group of symptoms caused by one of a large number of viruses. Rhinoviruses cause the greatest number of colds; there are more than 100 different varieties of rhinovirus. The average adult experiences two to three colds per year, while children average 8-12 colds per year. In most cases, colds do not cause serious illness. Most colds last for 3-7 days, although many people continue to have symptoms (coughing, sneezing and congestion) for up to 2 weeks. Some viruses that cause the common cold can also depress the immune system or cause swelling in the lining of the nose or airways; this can lead to bacterial infection. One of the more common complications is sinusitis, which is usually caused by viruses and rarely (about 2% of the time) by bacteria. However, it can be difficult to distinguish bacterial sinusitis from sinusitis caused by a cold because the signs and symptoms can be similar. However, due to the fact that a runny nose can also result from inflammation, trauma, foreign body and other abnormal processes, including tumours, an excellent diagnostic workup is necessary.

Session Objectives:

1. To discuss the epidemiology of runny and stuffy noses.
2. To discuss the pathophysiology of runny and stuffy noses.
3. To become familiar with facts concerning the economic aspects of runny and stuffy noses.

A-287 16:05

A. Functional anatomy and anatomic variants

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

The paranasal sinuses develop in pairs from the nasal cavity and grow from early pregnancy to late puberty. They humidify and warm inspired air, increase the surface area for olfaction, are thought to regulate intranasal pressure, lighten the skull, provide resonance and absorb shock. They are all lined by ciliated columnar

epithelial cells. The mucociliary transport drains each sinus in a specific pattern through its ostium to the nasal cavity and ensures a constant flow of mucus containing bacteria and particulate matter. Functional endoscopic sinus surgery (FESS) aims to enlarge the preformed ostia to allow physiologic drainage. Preoperatively, anatomic variants have to be ruled out or shown by CT to avoid injury. Special emphasis lies on the ostiomeatal unit, a complex anatomic region at crossroads of mucociliary drainage from frontal, anterior ethmoid and maxillary sinuses (uncinate process, Haller, Agger and frontoethmoidal cells, inverse turbinate). Description of the level of the cribriforme plate in relation to the roof of the ethmoid is another key element in a report to avoid skull base injury (Keros I-III). Preoperative identification of variations in the location of the optic nerve and the cavernous portion of the internal carotid artery is also mandatory. Furthermore, the close proximity of the sinuses to neighbouring structures and their thin bony walls predispose to certain pathways of spread.

Learning Objectives:

1. To become familiar with the normal anatomy and surgically relevant anatomic variants.
2. To learn about the functional anatomy and patterns of disease.

A-288 16:28

B. Sinusitis: imaging findings before and after treatment

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

Runny and stuffy noses may be due to a long list of pathologic conditions, which require distinct imaging strategies and treatment options. Acute rhinosinusitis, for example, is normally managed by GPs without any imaging study. Occasionally, signs and symptoms suggest orbital or intracranial complications: in such cases MSCT allows a prompt diagnosis and is preferred to MRI for wider availability and faster acquisition. Persistence of signs/symptoms for longer than 12 weeks classifies rhinosinusitis as chronic (CRS); the condition may or may not be associated with the presence of nasal polyps. In patients affected by CRS cross-sectional imaging aims at precisely depicting bone structures and air conduits. In detail, imaging shows the anatomic arrangement of sinus drainage pathways and their patency, maps anatomic variants that may facilitate CRS or increase surgical risk, depicts bone changes induced by CRS or by the mechanical pressure exerted by polyps. These tasks are better accomplished by CT, even more so after the advent of multislice technology allowed multiplanar reconstructions along oblique planes. After surgery, imaging is required when signs/symptoms recur - to assess presence and extension of CRS or nasal polyps - or when late complications are suspected - such as mucosal synechiae impairing mucus drainage or mucocele. MRI plays a limited role in sinusitis because it fails to demonstrate thin bone structures; nonetheless, its use is advocated in aggressive inflammatory diseases (such as invasive mycoses and Wegener's granulomatosis) to demonstrate the involvement of deep spaces of the face and of the skull base.

Learning Objectives:

1. To understand the value of different imaging techniques.
2. To review imaging findings in acute infections and chronic inflammatory disease.
3. To become familiar with postoperative changes.
4. To learn about a template for a structured report.

A-289 16:51

C. Sinonasal tumours

H.B. Eggesbø; Oslo/NO (h.b.eggesbo@medisin.uio.no)

Sinonasal tumours are rare and comprise only 1% of all malignancies. The clinical and radiological challenge is to differentiate malignancy from benign or inflammatory changes. Most malignant tumours present at advanced stages. Malignant tumours are most common in the 5th-7th decades and have a male preponderance. Squamous cell carcinomas are the most prevalent (80%) followed by adenocarcinomas. Squamous cell carcinomas are most common in the maxillary sinus, next the nasal cavity and ethmoid sinuses, while adenocarcinomas are most often seen in the ethmoid sinuses, and commonly caused by occupational exposures, e.g. nickel and hardwood workers. Inverting papilloma is one of the most common benign tumours and have been associated with human papillomavirus. CT should be the first modality in paranasal sinus imaging, while complementary MRI before and after gadolinium i.v. is mandatory to differentiate tumour from inflammatory disease. A general rule is that tumours more often have unilateral extension and that malignant tumours usually erode the bone. However, malignancy may mimic benign tumours with thickening or remodelling of the adjacent bone. While CT is superior to demonstrate changes in the bone, MRI can differentiate tumour from inflammatory changes and demonstrate tumour invasion and perineural spread. Malignant tumours are: squamous cell carcinoma, adenocarcinoma, adenoid

cystic carcinoma, mucoepidermoid carcinoma, haemangiopericytoma, melanoma, olfactory neuroblastoma, osteogenic sarcoma, chondrosarcoma, rhabdomyosarcoma, lymphoma, extramedullary plasmacytoma, and metastatic tumours. Benign tumours are: papillomas, osteomas, fibrous dysplasia, juvenile angiofibroma, schwannomas and neurofibromas. Till date, the TNM classification is used only for maxillary sinus carcinoma.

Learning Objectives:

1. To understand the value of different imaging techniques.
2. To review imaging findings in benign and malignant disease.
3. To become familiar with TNM staging of sinonasal neoplasms.
4. To learn about a template for a "structured report".

Panel discussion:

Diagnostic considerations in runny and stuffy noses 17:14

A runny or stuffy nose can be due to colds, allergies, sinus infections or the flu and sometimes the nose is stuffed by a tumour. Do we need imaging at all in runny and stuffy noses? When should imaging be performed? Which type of imaging is indicated?

16:00 - 17:30

Room P

Physics in Radiology

RC 1013

Diagnostic radiology and pregnancy

Moderators:

R. Padovani; Udine/IT
H. Ringertz; Linköping/SE

A-290 16:00

A. Conceptus doses and risks from maternal diagnostic x-ray examinations

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

Whenever a diagnostic x-ray examination of a pregnant patient is considered to be necessary, conceptus dose estimation is an important step in assessing the risks to the unborn child. Accurate estimation of conceptus dose is also needed after inadvertent irradiation of a pregnant patient from a diagnostic x-ray procedure. Several methods have been developed to estimate conceptus dose from radiologic examinations. When the uterus is remote from the directly exposed tissues, the conceptus is exposed to scattered radiation and its dose is negligible (< 1 mGy). Examinations involving the abdomen-pelvis may deliver higher dose to the child. Variations in maternal body size and uterus position should be taken into account to obtain accurate conceptus dose estimation. Multidetector CT (MDCT) scanners have replaced conventional CT technology. Conceptus doses from abdominal MDCT range from about 13 to about 31 mGy during the first post-conception weeks for a scan acquired at 120 kVp, 200 mAs with a pitch of 1.0, depending on maternal body size and uterine position. Multi-phase abdominal CT examinations may deliver relatively high doses to the unborn child. Doses to the conceptus below 100 mGy should not be considered a reason for termination of pregnancy. The risk to the embryo/foetus for stochastic effects is assessed on the basis of dose using appropriate risk factors. Although these risks from a single diagnostic procedure are low for the majority of diagnostic x-ray examinations, it is important to ensure that doses are kept as low as reasonably achievable.

Learning Objectives:

1. To learn how to manage and counsel pregnant patients in case of (a) intentional and (b) accidental exposure.
2. To learn how to estimate conceptus radiation dose from diagnostic x-ray examinations.
3. To learn how to assess the radiogenic risks to the embryo/foetus from diagnostic x-ray examinations.

A-291 16:30

B. X-ray imaging and pregnancy: justification and optimisation of exposure

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

As outside pregnancy, justification and optimisation are the main steps to be done when an imaging examination using ionising radiation is considered during pregnancy. However, the risk concerns the embryo/foetus in addition to the mother which means that justification has to be more critical whenever the uterine dose is not neglectable. The practical approach to an examination in any woman of child-bearing age starts by ruling out pregnancy, whether by taking history or by a laboratory test. When pregnancy cannot be ruled out, further steps will depend on the type of examination needed and the urgency of diagnostic clarification. Ultrasound is the alternative to be preferred when it can answer the clinical question. But even among x-ray examinations, the uterine dose is varying widely which asks for a careful selection, optimisation and, maybe, for postponing the test. Once pregnancy is confirmed, the major question is whether the specific type of diagnostic examination will include the uterus in the primary radiation field. Examinations not involving the uterus by direct radiation - despite a potentially significant exposure by scattered radiation - can usually be performed without a relevant risk to the embryo/foetus. The situation is more critical when the uterus is within the examination field and when therapeutic interventions are considered. The presentation will discuss the practical approach to these different situations, the influence of the stage of pregnancy, optimisation methods and the choice between alternative methods in some frequent clinical situations.

Learning Objectives:

1. To become familiar with the radiologist's practical approach to justification during pregnancy.
2. To learn how to optimise imaging protocols for x-ray examinations performed on pregnant patients.
3. To present the role of imaging modalities in the evaluation of pregnant patients.

A-292 17:00

C. Pregnancy and MRI: risks to the unborn child

J. De Wilde; Edinburgh/UK (jdewilde@staffmail.ed.ac.uk)

This paper explores the risks to the foetus when magnetic resonance imaging (MRI) is used. MRI uses three main components to produce images from inside the body: a static magnetic field; a pulsed radio-frequency (RF) fields and time-varying gradient electromagnetic fields. The exact frequencies of these fields depend on the MRI system purchased, for example; a 0.5T scanner uses 21 MHz RF, a 1.5 T system uses 63 MHz and a 3 T system uses 127 MHz RF. There is also a wide range of options for gradient strengths and slew rates to be considered as well. The overall exposure for the foetus depends ultimately on the imaging sequence used and the area being scanned. This paper will discuss particular hazards that need to be addressed for pregnant women including biological effects of the static and time-varying magnetic fields, heating effects of the RF pulses and acoustic noise generated by the spatial encoding gradients. The circumstances for foetal exposure in MRI will also be discussed including the following situations: the patient may not be aware that she is pregnant, likely to be in the first trimester; the mother is referred for direct foetal imaging after ultrasound (normally second or third trimester); the expectant mother may need diagnosis; research on pregnant volunteers. The exposure for pregnant staff working in MRI is also an essential consideration. Finally, how to minimise the exposure for the foetus during MR imaging will be discussed.

Learning Objectives:

1. To understand the risks to the foetus in MRI from static and time-varying magnetic fields, with particular reference to the radiofrequency field.
2. To consider the exposure of the foetus to noise during MRI.
3. To understand how to minimise the exposure of the foetus during MR imaging.

Postgraduate Educational Programme

Sunday, March 6

08:30 - 10:00

Room A

Neuro

RC 1111

Imaging stroke

Moderator:

R. Siemund; Lund/SE

A-293 08:30

Chairman's introduction

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

During the last decade imaging of stroke has developed from a minor field dealing with a barely treatable disease to one of the most dynamic parts of neuroradiology. The routinely treatment with intra-venous thrombolysis within the 4.5 hour time window and the continuously expanding treatment of severe strokes with intra-arterial thrombectomy have lead to increasing requests from clinicians and interventional neuroradiologists to provide imaging information for treatment guidance. All radiologists involved in the management of stroke are facing mainly three demands: first, to have good knowledge of the causes and the pathophysiology of ischaemic stroke and a proper understanding of the current models for infarct development, as a prerequisite for rational decision making and efficient communication with the clinicians. Second, to be able to choose and to use appropriate imaging modalities for the acute work up of patients with stroke and to be aware of the benefits and drawbacks of CT and MRI. Finally, is good knowledge about the therapy options mandatory in order to be able to support the clinicians in the time critical treatment decision. This session will try to cover these three demands in order to give an overview on the current status and the opportunity to discuss future perspectives.

A-294 08:35

A. Aetiology and pathophysiology of stroke

R. von Kummer; Dresden/DE (ruediger.vonkummer@uniklinikum-dresden.de)

„Stroke“ is the commonly used diagnosis for disturbances of brain blood supply due to ischaemia, haemorrhage, or venous obstruction. It is evident that „disturbances of blood supply“ in stroke patients do not represent a useful concept in order to develop effective treatment. It is the radiologist's task to describe the acute brain pathology, its conditions (pathophysiology), and its aetiology to give directions for specific treatment and prophylaxis. The approach is vascular and brain tissue imaging. Brain ischaemia is the cause of stroke in about 85% of patients, intracranial haemorrhage in 15% of patients. Arterial obstruction causing brain ischaemia is thrombotic or embolic. It can as well be caused by arterial wall dissection or inflammation. Arterial wall diseases and heart diseases including a patent foramen ovale are sources for brain embolism. The obstruction of a brain supplying artery causes brain tissue ischaemia of various degrees depending on the capacity of collaterals supplying the same arterial territory. The chances for collateral compensation depend on the site of obstruction and the development of collateral vessels. Neurons cannot tolerate low cerebral blood flow (CBF) below 10 ml/100 g x min for more than 20 minutes and develop first cellular then irreversible ionic oedema. They survive, but do not function with low CBF between 10 and 20 ml/100 g x min. Enhancement of CBF in such regions, e.g. by arterial recanalisation can mean functional recovery. The imaging diagnosis of damaged brain is therefore the first aim in acute ischaemic stroke patients.

Learning Objectives:

1. To comprehend the etiology and pathophysiology of stroke.
2. To learn to differentiate between different types of stroke.
3. To consolidate knowledge of the key imaging findings in different types of stroke.

A-295 08:58

B. Stroke imaging in the acute phase or in critically ill patients

P.M. Parizel, C. Venstermans, F. De Belder, J.W. Van Goethem, L. Van den Hauwe, T. Van der Zijden, M. Voormolen; Antwerp/BE

Acute stroke is the most common non-traumatic neurological emergency. Clinical history and physical examination do not provide reliable information regarding the extent and localisation, vascular distribution territory, and aetiology of the stroke. The role of stroke imaging has changed dramatically in recent years, thanks to the arrival of aggressive new therapies aimed at re-establishing blood flow, reducing infarct size and protecting the brain at risk. Multiparametric neuroimaging, involving CT, MRI or both, has opened new insights to determine the pathophysiology of stroke,

in terms of cerebral perfusion (rCBF, rCBV, MTT and TTP) and cell metabolism (cytotoxic versus vasogenic oedema, diffusion restriction). The fundamental goals of stroke imaging in the acute phase are: 1. to rule out intracranial haemorrhage, and other non-stroke causes of the patient's symptoms; 2. to show occlusion of a major blood vessel, e.g. by CT or MR angiography; 3. to demonstrate ischaemic brain tissue (cytotoxic oedema), e.g. by diffusion-weighted MRI; 4. to reveal tissue blood flow and to identify areas of salvageable brain tissue („penumbra“), e.g. by perfusion CT or MRI; 5. to select candidates for thrombolytic therapy within the critical 3 to 6 hour time window. The purpose of this presentation is to review how new developments in neuroimaging improve our understanding of the pathophysiology of acute stroke and to demonstrate that multiparametric techniques now play a crucial role in the rapid diagnosis, clinical management, therapy and outcome prediction of patients with an acute stroke.

Learning Objectives:

1. To illustrate the objectives of neuroimaging in patients admitted with an acute neurologic deficit.
2. To show that perfusion imaging is useful to differentiate the infarct core from the penumbra.
3. To discuss the role of CT versus MRI in the management of acute stroke patients.

A-296 09:21

C. Intervention in stroke

M. Leonardi; Bologna/IT (marco.leonardi@centauro.it)

Organisation is crucial to the practice of dethrombosis. The first step is to grasp the fact that ischaemic stroke is an emergency. Stroke victims require an organisation similar to that provided for heart attack patients. Patients must be taken to hospital in an ambulance manned by a specifically trained crew. Ideally equipped with a mini CT scanner recently made available. This device provides an immediate morphological scan and CT angiogram to be sent by satellite to the reference hospital so that the problem will be clear and the medical team ready on the patient's arrival. Clinical and neurological assessment of the patient must be undertaken immediately along the lines of UK practice implementing a simple, clear and rapid procedure. If the clinical, CT and CT angiography findings indicate intra-arterial treatment, responsibility shifts to the neuroradiology team, organised to work a 24 hour shift, at the hospital or at least on call. Dedicated imaging systems must be available: a multi-layer CT device (CT angiography and perfusion studies). Dedicated angiography suite is essential. A flat panel system would be ideal. There is growing evidence supporting the availability of an MR system. This device would certainly enhance the possibilities of a stroke unit but it is not essential in the initial stages. A stroke unit should be based on a dedicated facility, with emergency access separate from the general emergency room, dedicated equipment, dedicated ambulances and appropriate links including a dedicated ward and a rehabilitation unit essential to the success of the project.

Learning Objectives:

1. To learn about the benefits and risks in stroke intervention.
2. To consolidate knowledge of different methods of intervention in stroke therapy.
3. To learn about the different imaging methods used to decide on and perform stroke intervention.

Panel discussion:

Where do we stand in stroke therapy today? 09:44

Stroke is a common health problem with high socio-economic costs. In recent years much effort has been focused on finding ways to ensure early intervention as well as new methods not only for early detection but for early treatment. The discussion will focus on where we stand today and whether we think stroke imaging and treatment will advance further.

08:30 - 10:00

Room B

Interactive Teaching Session

E³ 1120

Common radiological problems: palpable lower neck mass - thyroid or not?

A-297 08:30

A. Thyroid nodule

H. van Overhagen; Den Haag/NL (h.voverhagen@hagaziekenhuis.nl)

Thyroid nodules are common. In 4-8% of adults nodules can be palpated and at ultrasonographic examination nodules are seen in 10-41%. Most nodules are benign, the eventual diagnosis in patients with a palpable nodule is carcinoma in only 5% of cases. The incidence of thyroid carcinoma is low. Papillary carcinoma is the most common type and is found in 75-80% of thyroid cancer. Lymph node metastases in thyroid carcinoma are primary to the paratracheal and prelaryngeal nodes (Level VI), and the upper (Level III) and lower (Level IV) jugular nodes. Malignancy should be suspected when there is rapid growth, a firm or fixated mass, when enlarged lymph nodes are present or in case of vocal cord paralysis. In patients with multiple thyroid nodules the cancer risk per patient is not altered. Ultrasound is the primary imaging technique in patients with a palpable thyroid nodule. It is best performed with the patient supine, the neck slightly extended and using a high frequency linear-array transducer. Several ultrasonographic features are more often associated with benign or malignant nodules. However, while some ultrasonographic features may strongly suggest malignancy it may be very difficult to rule out malignancy by means of these features alone. Ultrasound-guided fine needle biopsy can be performed in an attempt to differentiate between benign and malignant nodules. Unfortunately, even with ultrasound guidance, an important number of cytological examinations will be non-diagnostic. In addition, in follicular lesions it is usually impossible to differentiate cytologically between benign and malignant follicular nodules.

Learning Objectives:

1. To learn about the optimal settings for US examination of the thyroid.
2. To identify morphologic characteristics of benign and malignant thyroid nodules.
3. To identify the most common pathways of lymph node metastases in the thyroid.
4. To learn about the role of US-guided fine needle aspiration cytology in the thyroid.

A-298 09:15

B. Outside the thyroid

N.J.M. Freling; Amsterdam/NL (n.j.freling@amc.uva.nl)

The neck is host to a large variety of benign and malignant diseases ranging from simple cysts to acute inflammation with complications to highly malignant sarcomas and imaging plays an important role to assess the nature and the extension of disease. Patient history and clinical findings will decide which imaging technique is best suited to resolve the diagnostic dilemma. Ultrasound is recommended to differentiate between a cystic or solid lesion, to guide FNA, being quick and accurate. Pathologic flow within or around a lesion can be assessed adding Doppler technique. In acute illnesses with anticipated complications, such as a deep neck abscess, contrast-enhanced CT is required to evaluate local extension and demonstrate spread from the neck deep to the mediastinum. MRI is indicated to assess non-inflammatory, subacute or chronic diseases, such as vascular malformations, branchial cleft cysts, benign and malignant soft tissue tumours, brachial plexus pathology and neurologic diseases. Vascular malformations are easily depicted with MRI using T2 sequences in different image planes. Persistent fistulas of the branchial system can also be depicted by MRI running from the anterior border of the sternocleidomastoid muscle to the lateral pharyngeal wall. Assessing the origin of a soft tissue tumour has major implications for surgery. Staging a malignant soft tissue tumour must comprise the skull base and upper mediastinum including local extension, pathologic neck nodes and perineural spread. Follow-up during chemotherapy and postoperative monitoring of malignant disease are important indications for (MR) imaging, the more so in young patients, diminishing ionising radiation.

Learning Objectives:

1. To identify different compartments in the neck.
2. To be able to choose the optimal imaging technique relating to request.
3. To become familiar with the most common pathology in adults and children.
4. To be able to address a short list of differential diagnoses.

08:30 - 10:00

Room C

CLICK (Clinical Lessons for Imaging Core Knowledge): Common Clinical Cases

CC 1118

Surprise in the liver

Moderator:

C. Bartolozzi; Pisa/IT

A-299 08:30

A. Clinical considerations

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

Focal liver lesions are part of our everyday practice because radiologists performing various types of examinations may encounter them without being aware of any clinical condition rising the suspicion of these changes. In a situation like this several important decisions are to be made by the radiologists, like: is the lesion clinically significant, is the lesion benign or malignant, are additional imaging examinations necessary, does it require medical, surgical or interventional radiological action, should it be, and if yes, how frequently followed up, etc. For providing a well-established answer to these questions the reporting radiologist has to be familiar with medical history and results of former examinations (physical, laboratory, imaging, etc.); consider the age, gender, physical condition, eating and drinking habits, potential drug abuse of the patient; bearing in mind the prevalence and statistical probabilities of different pathologic conditions. With all this information at hand the thorough analysis of images obtained by different modalities will allow a rather reliable differential diagnosis and a well-established planning of therapy of the incidentally detected lesions.

Learning Objectives:

1. To learn more about the clinical conditions that may result in the appearance of focal liver lesions.
2. To be informed about the clinician's way of thinking in the process of differential diagnosis.
3. To become familiar with the potential role of imaging in the establishment of the final diagnosis and planning of therapy.

A-300 09:00

B. Imaging techniques and typical findings

C.J. Zech; Munich/DE (Christoph.Zech@med.uni-muenchen.de)

The spectrum of differential diagnoses is broad in the liver. Therefore, incidentally discovered liver lesions represent a challenging clinical situation. Fortunately, there are specific imaging features for the most common benign and malignant liver lesions (such as, e.g. hemangioma, FNH, cysts, vascular pseudolesions, HCC and metastases) so that a minimal-invasive diagnosis with a biopsy is not needed in a lot of cases. In ultrasound, the echogenicity and recently also the contrast agent behaviour are used for liver lesions characterisation. In CT, attenuation and also contrast agent behaviour are used for characterisation. MR imaging offers several options including T1- and T2-weighted images, use of chemical shift imaging, GRE sequences with long echos and diffusion weighted images, so that tissue components such as fat, water, glycogen, iron, etc. can be evaluated already in the pre-contrast examination. Beside the evaluation of dynamic signal characteristics in the early dynamic phase after contrast agent application, MR can utilize also tissue-specific contrast agents dedicated to the RES or to the hepatocytes. Other modalities such as angiography, PET or other nuclear medicine methods usually only play a minor role nowadays in the evaluation of incidental liver lesions in non-oncological patients. In oncological patients the clinical consequences and also the range of diagnoses and pre-test probabilities are different from the non-oncological group; therefore, the demands to imaging are even higher. In case of atypical presentation of otherwise benign liver lesions such as sclerosed hemangioma close follow-up or even biopsy can be necessary in such a setting.

Learning Objectives:

1. To learn about the available imaging modalities to be used for the evaluation of patients with incidentally detected focal liver lesions.
2. To become familiar with the technical imaging considerations and the proper diagnostic algorithm.
3. To know more about the typical imaging findings.

A-301 09:30

C. Interactive case discussion

G. [Brancaatelli](mailto:gbranca@yahoo.com); Palermo/IT (gbranca@yahoo.com)

Incidental lesions are frequently discovered during routine radiographic evaluations. Correlation with clinical history and additional confirmatory imaging is essential to the development of an accurate, focused differential diagnosis and for appropriate management. The objective of this presentation is to describe the imaging findings associated with incidentally found liver lesions and to review those clinical and radiologic features, which should be considered in development of an ordered and accurate differential diagnosis.

Learning Objectives:

1. To introduce typical cases illustrating the role of imaging modalities in the differential diagnosis of unexpected liver lesion cases.
2. To motivate the audience by the use of voting pads to be involved in the diagnostic process.
3. To highlight the conclusion that may be drawn on the basis of the discussed cases.

08:30 - 10:00

Room D1

Abdominal and Gastrointestinal

RC 1101

Inflammatory bowel disease: which test and when?

Moderator:

Z. [Tarján](mailto:ztarjan@gmail.com); Budapest/HU

A-302 08:30

Chairman's introduction

Z. [Tarján](mailto:ztarjan@gmail.com); Budapest/HU (ztarjan@gmail.com)

The diagnosis of IBD is based on complex evaluation of clinical signs, endoscopic appearance, radiological imaging, laboratory tests and histology. Besides Crohn's disease (CD) and ulcerative colitis (UC) the modern classification advises to use the term IBDU (IBD unclassified) colitis to those 10% of cases, where the distinction between CD and UC is impossible based on the results of multiple exams. These cases are usually clinically more severe, with humbler therapeutic results. The new classification of CD types includes besides the phenotype (B1: inflammatory non stenosing non penetrating, B2: stenosing, B3: penetrating) the age (A1: ≤ 16 y, A2: 17-40 y, A3: > 40 y) the location (L1: ileum, L2: colon, L3: ileocolic, L4: upper GI tract) and P perianal involvement. In UC the most important clinical factors are extent, type and severity. The classification includes length and clinical types as acute, relapse-remission and chronic continuum. The radiological imaging in CD is needed for lesions not reachable by the endoscope, for categorising, for follow-up and detecting complications. Different modalities fit best for these different tasks. The goal of imaging in UC is rather to help differential diagnosis and detection of complications. While in UC there are good correlation between laboratory and endoscopic signs of activity and severity so there is not much need for radiological activity indices, in CD the clinical activity does not correlate with the histological changes. Although CDAI is widely used for clinical studies, it includes several subjective factors, thus radiological activity indices may be of help.

A-303 08:35

A. Role of US in diagnosis and follow-up

V. [Válék](mailto:vlvalek@med.muni.cz); Brno/CZ (vlvalek@med.muni.cz)

Crohn's disease is more likely a systemic disease governed by a shift in the immune response, thus affecting the whole MALT system. Bowel ultrasound is a quick, simple and effective investigation. The method is simple and requires no bowel preparation. We use both - convex (C 5-1 - overview, anatomical orientation) as well as linear transducer (L 12-5 - preferred, incl. CEUS; L 17-5 - children and very slim patients, L 9-3 - TDPs, deep structures). We examine patients in supine position, first small bowel, then mesentery and large bowel. Finally, we examine the terminal ileum and cecum or the areas of anastomoses. We assess folds, hastrum, wall thickness, vascularity, echogenicity of the surrounding fat, the presence of nodes and peristalsis. In some cases we use intravenous contrast (CEUS). At least four studies have prospectively compared the diagnostic accuracy of US with radiological studies, endoscopy or surgery in those with suspected Crohn's disease. In these studies, the sensitivity of US ranged between 84% and 90% and its specificity reached 98% and 100%. In our prospective study we investigated patients by ultrasound and enteroclysis. We established the diagnosis by enteroclysis in 94

patients (92%) and by ultrasound in 95 patients (93%). The activity of the disease was assessed correctly in 91% patients by ultrasound, compared to 74% patients by enteroclysis. There was no statistically significant difference. Bowel US is a useful investigation for the diagnosis and follow-up of patients with Crohn's disease.

Learning Objectives:

1. To learn about US techniques used in the assessment of patients with inflammatory bowel disease.
2. To learn tips for interpretation of US in the diagnosis and follow-up of patients with inflammatory bowel disease.
3. To understand the pros and cons of using US, including CEUS, in the diagnosis and follow-up of patients with inflammatory bowel disease, including assessment of disease activity.
4. To appreciate the accuracy, reproducibility and usefulness of US compared with other imaging techniques in assessing patients with inflammatory bowel disease.

A-304 08:58

B. Role of CT in diagnosis and follow-up

S. [Romano](mailto:stefromano@libero.it); Naples/IT (stefromano@libero.it)

The use of computed tomography (CT) in the diagnostic imaging of patients affected by inflammatory bowel disease (IBD) has a long standing history. CT techniques such as CT-enteroclysis and CT-enterography have been reported as efficient tools for a radiological assessment of disease. The state-of-the art methods will be reported and their potentialities in diagnostic accuracy discussed in different clinical type of IBD. The acute setting of unknown IBD could be demanded as well to CT examination performed in emergency without endoluminal contrast medium administration. The CT appearance of the intestinal wall of the segments involved by an active disease could be not correctly interpreted if the knowledge of basic and classic typical findings of IBD is not combined to consider different pathologic entities that could affect the intestine, offering similar but not even equal signs. The entire abdominal background needs to be evaluated according to the clinical symptoms, signs, laboratory parameters and history of the patient. CT examination could be an efficient tool to determine the degree of disease activity in patient with known IBD as well as to assess the presence of an acute inflammatory disease of the intestine in patients with unknown IBD affection. The actual role of CT in the early diagnosis of IBD, in disease staging and detection of complications as well as monitoring therapy in follow-up will also be considered and discussed.

Learning Objectives:

1. To learn about state-of-the-art CT techniques for the assessment of patients with inflammatory bowel disease.
2. To learn tips for interpretation in terms of diagnosis and differential diagnosis of inflammatory bowel disease.
3. To discuss the value of CT in determining disease activity and monitoring therapy.

A-305 09:21

C. CT versus MRI

M.A. [Patak](mailto:michael.patak@usz.ch); Zurich/CH (michael.patak@usz.ch)

The aim of this lecture is to give an overview of the techniques and typical findings for imaging Crohn's disease (CD) with either multidetector row computed tomography (MDCT) or with magnetic resonance imaging (MRI) and compare the two different modalities. Optimal imaging of CD begins with the preparation phase. The small bowel has to be distended for a concise examination. This can be done either invasively, i.e. enteroclysis or orally, which is named enterography. There is much debate on which of these two preparation methods is better. For the administered intraluminal contrast, best is water with some additives, which are neutral in CT and biphasic in MR. Imaging in MDCT is done 40 sec and 70 sec after IV administration of iodinated contrast with a thin collimation. All image data are reconstructed in axial, coronal and sagittal planes. The aim of imaging in CD should be to establish the following: (1) presence, severity, and extent of the disease; (2) its activity; and (3) extra-intestinal complications. Both modalities have proven to be a good tool to evaluate the extent, the activity of the disease and the presence of extraluminal complications. Both are also able to identify the type of the disease, being either the active/inflammatory, the fistulising/perforating, the fibrostenosing or the reparative/regenerative type. The challenge for MRI is mostly the in-plane resolution of the image data whereas radiation dose is for CT.

Learning Objectives:

1. To consolidate knowledge of MR techniques and results in the assessment of inflammatory bowel disease.
2. To consider the pros and cons of CT and MRI in inflammatory bowel disease.

- To compare the diagnostic accuracy of CT versus MRI in Crohn's disease.
- To learn about a strategy for the use of CT and MRI in the radiological work-up of patients with inflammatory bowel disease.

Panel discussion:

Five good reasons for the radiologist to be at the forefront 09:44

The chairman and speakers will debate the optimum imaging paradigms according to (1) the clinical indication, (2) assessment of those with suspected but as-yet-undiagnosed disease, (3) staging of the small bowel in those with newly diagnosed Crohn disease, (4) evaluation of response to therapy and (5) assessment of those with long standing disease. The optimum approach to assessing and monitoring disease activity will be discussed.

08:30 - 10:00

Room D2

Interventional Radiology

RC 1109

Venous intervention

Moderator:

L. Lonn; Copenhagen/DK

A-306 08:30

A. DVT and prevention of pulmonary emboli

C. Binkert; Winterthur/CH (christoph.binkert@ksw.ch)

Deep vein thrombosis (DVT) is a common condition which can lead to possible life-threatening pulmonary embolism (PE). The primary imaging modality nowadays is Duplex ultrasound. In cases where the pelvic veins and/or the vena cava is involved, a venous-phase CT is helpful to determine the exact extend of the clot burden. Standard therapy for DVT is anticoagulation. However, if there is a contraindication or a complication (bleeding) to anticoagulation a vena cava filter is a good option to prevent PE. A filter should also be considered if a catheter directed thrombolysis is performed. With the new optional filters the filtration can be terminated either by removing the filter or by converting the filter into a stent. One problem which was observed with these optional filters is that (too) many of them are left in place. Despite a low complication rate of filters, a filter may cause an increased risk of further DVT, or a caval occlusion and in rare cases even a migration or penetration is possible. Therefore, patients with optional filters should be followed and filters should be retrieved when clinically no longer needed.

Learning Objectives:

- To learn about optimal examination and imaging.
- To understand the role of IVC filters in the management of DVT.
- To learn about filter concepts.

A-307 09:00

B. Endovascular treatment of varicose veins

D.J. West; Stoke-on-Trent/UK (david.west@uhns.nhs.uk)

Varicose veins are an early manifestation of venous insufficiency of the lower limbs which can also lead to skin changes including extensive ulceration. It is a very common problem affecting up to 30% of adults in Europe. Patients presenting with venous insufficiency must first be assessed by a history and clinical examination to determine the presence and extent of the disease. A duplex ultrasound examination is essential to determine the cause from which an appropriate treatment plan can be decided. Depending on the patients wishes and their funding options it is perfectly reasonable to treat all stages of the disease even if just cosmetic. Treatment aims to eliminate the reflux in all contributing veins starting proximally and moving distally. Surgery used to be the commonest treatment offered to patients but this has been largely superceded by endovenous methods which have significant advantages including: no general anaesthesia, outpatient based, no cuts, no scars, low recurrence, rapid convalescence. There are several endovenous methods using laser, RF, foam sclerotherapy and most recently steam heating and a combined mechanical/sclerosant system (ClariVein (R)). Laser and RF give almost identical results and 95% permanent truncal vein closure is to be expected. Foam sclerotherapy is cheaper and quicker but long-term results are poorer and patients often have to return for repeat procedures. Having ablated the main truncal veins using laser or RF at least 50% of patients require additional treatments for residual varicosities, e.g. microavulsions or foam sclerotherapy.

Learning Objectives:

- To learn about diagnostic strategies and options.
- To know the principles of treatment and discuss the indications.
- To review the short term and long term results.

A-308 09:30

C. Central venous occlusions

P. Haage¹, C. Hoh²; ¹Wuppertal/DE, ²Siegburg/DE

The central venous vasculature and particularly the upper venous system may be obstructed by either benign or malignant lesions. Malignant central venous obstructions are mainly due to bronchial carcinoma, mediastinal metastasis, mesothelioma or lymphoma. The most common cause for benign central venous obstruction is haemodialysis related; other benign reasons are rather uncommon but increasing due to the omnipresent use of permanent central venous access catheters as well as implantable cardiac rhythm management devices. The incidence of haemodialysis-related central venous obstruction resulting in angioplasty is described to be more than 10 times higher compared to, for example, pace-maker-induced stenosis. In any case, early detection and treatment of complications are essential to provide adequate care. Contrast venography for many years has been the standard of reference; yet this procedure has its shortcomings. Sonography is not consistently reliable for detection of central pathologies, owing to difficult access to these vessels. Today contrast enhanced CT is employed to define the site of the obstruction and the presence of possible thrombosis and reveal surrounding soft tissue alterations. MRI is of comparative or even higher sensitivity and specificity in evaluating the patency of the central veins. The efficacy and safety of stent placement in central venous occlusion of benign and malignant origin lead to rapid relief. Stenting provides fast symptomatic help. Repetitive percutaneous intervention can prolong the cumulative patency. Thrombolysis may be required to improve the final result, should, however, not be employed as a sole means for revascularisation.

Learning Objectives:

- To review imaging modalities for SVC, IVC, hepatic and portal venous occlusions.
- To learn about interventional radiological treatment options.
- To learn about different indications and routes of treatment.

08:30 - 10:00

Room E1

Musculoskeletal

RC 1110

Sports injuries: US or MRI?

Moderator:

G.M. Allen; Oxford/UK

A-309 08:30

Chairman's introduction

G.M. Allen; Oxford/UK (georgina.allen@gtx.ox.ac.uk)

US and MR are excellent imaging techniques for studying tendons and muscles. During this integrated session we will review the advantages and disadvantages of US and MR for the diagnosis and follow-up of sports injuries. Tricks of both techniques will be addressed, together with some useful guidelines for specific sports injuries. Ultrasound is being used at the pitch side and in sports medicine practice as an adjunct to clinical practice. With this in mind there are a number of questions that will be answered in these talks. 1. When US and MRI are the primary imaging and when they are complimentary. 2. What advances have there been in US and MRI imaging to help advance our use of these techniques in tendon and muscle injury. 3. Should we be aspirating haematomas and using autologous blood injections or PRP to treat tendon or muscle disease. 4. Can we predict the athletes return to sport?

A-310 08:35

A. Muscle and US

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

Muscle imaging is inherently complex and presents unique morphologic challenges and continuing integration of dynamic, physiologic and functional capabilities. In sports medicine, ultrasound (US) has proved to be an excellent tool to evaluate muscle strain and contusion injuries in athletes providing good correlation with clinical findings. In the acute phase, US has nearly equal sensitivity to MR imaging to diagnose muscle strains, except in the first few hours after the injury, when fresh haemorrhage and oedema have similar echogenicity to normal muscle and strains may go unnoticed. Later in the process, US has been shown to be a useful tool in assessing the sequential stages of muscle repair, showing progressive resolution of blood fluid products, decrease in oedema and formation of scar tissue, thus aiding rehabilitation planning. Dynamic US during muscle contraction can be valu-

able to monitor the healing process. Local complications, such as vein thrombosis, irritation of adjacent neurovascular bundles, chronic haematoma and myositis ossificans can be demonstrated with this technique as well. However, US tends to underestimate the extent of injury and the abnormalities seen disappear more quickly when compared with MR imaging. At least in elite athletes, MR imaging seems, therefore, to play a more significant role in management of muscle injury, particularly when decisions regarding the time at which the patient can return to play are needed. By contrast, US is more accessible, and cheaper than MR imaging. In most clinical settings, US should be regarded as the first-line imaging choice for assessing skeletal muscle injury.

Learning Objectives:

1. To understand the mechanism of injury of muscles in athletes.
2. To understand the role of US in the diagnosis of muscles injuries.
3. To recognise the imaging pattern of abnormalities in athletes.
4. To understand how US might be used in the management of sports muscle for diagnosis and follow-up.

A-311 08:58

B. Tendon and US

A. [Klauser](mailto:andrea.klauser@i-med.ac.at); Innsbruck/AT (andrea.klauser@i-med.ac.at)

Sports activity can affect tendons due to chronic overuse or acute injury. Both can result in complete tendon rupture. US is helpful in precise assessment of rupture severity and extent, but enables also assessment of tendon degeneration, where rupture of individual collagen fibres stimulates a chronic cycle of reparative response caused due to repetitive microtrauma. In chronic tendinopathy histopathological changes, such as hypoxic, mucoid, calcifying, or lipid degenerations are present. US enables for differentiation of partial tears, tendinosis, tenosynovitis or paratendinosis, because of active and passive dynamic examination possibilities, and high-resolution capability when using high frequency probes. US developments as power Doppler US, sonoelastography and contrast enhanced US allow further for new insights into tendinopathy. With the use of US, tendon changes can be diagnosed before they become symptomatic and a reduction of tendon load and initiation of treatment before the condition becomes chronic seem to gain important place in therapeutic regimes. Furthermore, US-guided therapies are advisable over blinded-guided injections to minimise side effects and to allow an accurate targeted therapeutic approach.

Learning Objectives:

1. To understand the mechanism of injury of tendons in athletes.
2. To understand the role of US in the diagnosis of tendon injuries.
3. To recognise imaging patterns abnormality in athletes.
4. To discuss how US might be useful in the management of tendon injuries for diagnosis and follow-up.

A-312 09:21

C. Muscle and tendon by MRI

U. [Aydingoz](mailto:uaydingo@hacettepe.edu.tr); Ankara/TR (uaydingo@hacettepe.edu.tr)

Although diagnosis of acute muscle injuries in athletes is usually clinical, magnetic resonance imaging (MRI) is a very helpful adjunct tool in this setting, showing the location, extent and severity of the injury and thereby streamlining the management of the patient. Portability of ultrasonography (US) on the playfield in the acute setting is not matched by MRI, which nevertheless has distinct patterns of grade 1-3 muscle strains; however, it is usually with nonacute and deeper injuries of the muscles that MRI is especially helpful. Presence of bone contusion, stress reaction, or stress fracture is readily displayed by MRI and this is practically beyond the limits of US. Evolving haematomas, fibrosis, scarring, and myositis ossificans are sequelae of direct or indirect muscle injury which are usually outlined in a single field of view by MRI. Delayed onset muscle soreness and chronic exertional compartment syndrome, as well as acute and chronic stages of muscle denervation changes, are readily diagnosed with MRI. By providing an understanding of distinct muscular denervation changes, MRI may actually noninvasively point to the entrapped or involved nerve and guide medical or surgical intervention. Foci of mucoid degeneration within the muscle, myotendinous junction, or tendon itself are readily shown by MRI, which thereby displays potential sites of failure during sport activities. Diffusion tensor imaging may have a role in displaying the subtle architectural disruptions of directly or indirectly injured muscles.

Learning Objectives:

1. To understand the specific role of MRI in the evaluation of muscle and tendon injuries in athletes.
2. To recognise imaging patterns of tendon abnormalities in athletes: acute and over-use injuries.
3. To review different mechanisms of muscle injuries: direct and indirect.
4. To understand how MRI might be used in the management of athletes.

Panel discussion:

What is the best imaging modality for diagnosing sports injuries? 09:44

US and MR are excellent imaging techniques to study tendons and muscles. During this integrated session we will review advantages and disadvantages of US and MR for the diagnosis and follow-up of sports injuries. Tricks of both techniques will be addressed, together with some useful guidelines for specific sports injuries.

08:30 - 10:00

Room E2

Organs from A to Z: Pancreas

MC 1119

Imaging adenocarcinoma

Moderator:

T.K. Helmlinger; Munich/DE

A-313 08:30

A. MDCT: how to diagnose, how to stage

W. [Schima](mailto:Wolfgang.Schima@khgh.at); Vienna/AT (Wolfgang.Schima@khgh.at)

Adenocarcinoma is the most common pancreatic malignancy, affecting the head in 60-70%. MDCT is very effective in detection and staging of adenocarcinoma, with a sensitivity of up to 90% for detection and accuracy of 80-90% for staging, but it has limitations (detection of small cancers, characterisation). MRI is a problem-solving tool in equivocal CT to depict small cancers. MRI with MRCP helps to differentiate between adenocarcinoma and focal pancreatitis. The "duct penetrating sign" at MRCP is indicative of an inflammatory mass. Examination protocols for MDCT include oral administration of 1-1.5 l of water ("hydro-CT"), IV contrast administration of 2 ml/kg b.w. (app. 140-150 ml), a flow rate of 4-5 ml/s, and a biphasic scan in parenchyma and venous phases. MRI protocol should include non-fatsat and fat-sat T1w GRE, T2w TSE, DWI, MRCP, and contrast-enhanced sequences. Gadolinium-enhanced T1w 3D-GRE are helpful for assessment of vessel infiltration and cystic tumours, whereas mangafodipir-enhanced sequences improve delineation of small tumours. In patients with locally advanced tumours, neoadjuvant chemoradiation may be used for tumour downsizing to make it amenable to radical surgery. However, pancreatic cancer often does not shrink after tumour response, which renders MDCT or MRI unreliable for tumour assessment in this setting. PET/CT may play a role in this indication. In conclusion, CE hydro-MDCT is an excellent and robust tool for pancreatic cancer detection and staging. MDCT in combination with MRI or EUS provides high accuracy for characterisation of tumours. Further improvement is needed to assess tumour response after neoadjuvant chemoradiation.

Learning Objectives:

1. To understand the main pathologic features of pancreatic adenocarcinoma and how it governs imaging findings.
2. To learn how to set up imaging protocols for detection and staging purposes including contrast media considerations.
3. To learn about the current role of endosonography and PET/CT.
4. To understand the role of image-guided biopsy.
5. To review current trends in tumour management, including the role of preoperative neoadjuvant therapy.

A-314 08:55

B. MR imaging: a main course or just a side dish?

M. [Zins](mailto:mzins@hpsj.fr); Paris/FR (mzins@hpsj.fr)

CT is the established imaging technique for evaluation of pancreatic adenocarcinoma. MRI, however, can play a major role in this disease. Technical advances of MRI including parallel imaging techniques, multichannel receive coils of the abdomen, dynamic gadolinium-enhanced T1-weighted fat sat 3D GRE sequences, 3D MRCP sequences, mangafodipir-enhanced MRI and diffusion weighted imaging (DWI) have greatly improved the results of MRI in the assessment of pancreatic tumours. Standard imaging sequences include T1-weighted GRE with fat saturation, in-phase and opposed phased T1-weighted, axial single-shot turbo spin-echo (TSE) and coronal/oblique 2D and/or 3D MR cholangio-pancreatography (MRCP) pulse sequences, post-gadolinium-enhanced 3D T1-weighted fat sat sequence and DWI with multiple b values. MR imaging may be useful as subsequent examination for: (1) detection of small non-contour-deforming tumours with isoattenuated appearance at CT, (2) evaluation of local extension and vascular encasement, (3) detection of the presence of lymph node and peritoneal metastases, and (4) detection and characterisation of associated liver lesions and liver metastases. Diffusion-weighted imaging may be helpful as a complementary imaging method in the differentiation between mass-forming focal pancreatitis and pancreatic adenocarcinoma. Due to its superior soft-tissue contrast compared with CT, MRI ap-

pears to be particularly useful for characterisation of small liver metastases and for direct visualisation of small pancreatic tumours.

Learning Objectives:

1. To learn how to set up a useful protocol for pancreatic evaluation for different high field equipments.
2. To understand the current role of diffusion-weighted imaging and ADC values.
3. To review the role of organ-oriented contrast media.
4. To understand the technique and role of diffusion-weighted imaging of the pancreas.

A-315 09:20

C. Detection and staging: multimodality comparison

D.E. Malone; Dublin/IE (dmalone@ucd.ie)

Evidence-based radiology (EBR) is based on best current evidence, traditionally acquired radiological expertise, the ALARA principle and the values of referring doctors and patients. Any appropriately trained radiologist can formulate an answerable question, search the literature, appraise the retrieved evidence, apply their findings to local practice and evaluate the results. This presentation will describe and illustrate the 'EBR' process. Patients with chronic pancreatitis (CP) may present with features resembling pancreatic carcinoma, for which CP is a risk factor with an incidence of 5.9% after 20 yrs. EBR methods were applied to the problem of differentiating mass-forming CP from pancreatic adenocarcinoma. A focused question and literature search found no secondary literature or imaging guidelines. Primary literature searching found 53 relevant papers, 9 comprised current best evidence. For CT, time-attenuation curve characteristics had a sensitivity of 94% and a specificity of 83% for carcinoma. For MR, dynamic time intensity curve characteristics were only reported in a descriptive study but the Duct Penetrating Sign (MRCP) had a sensitivity of 85% and a specificity of 96%. For PET/CT, ¹⁸F-FDG had a sensitivity for carcinoma between 86% and 96% with specificity of 87%-100%. For EUS/FNA, the sensitivity for carcinoma in pre-existing CP was consistently low (54-74%), but the specificity was 100%. Simple Bayesian analysis was used to establish the best order in which to apply these studies in practice. An algorithmic approach will be presented. The presentation will also consider other 'grey areas' in the field of pancreatic adenocarcinoma imaging using EBR methods.

Learning Objectives:

1. To learn about evidence-based methods of literature searching and appraisal.
2. To understand how these methods can be used to produce diagnostic algorithms using the differentiation of pancreatic adenocarcinoma from mass-forming chronic pancreatitis as an example.
3. To learn about diagnostic algorithms based on different clinical scenarios (local and distant staging, advance versus early disease) involving multiple imaging techniques.

Discussion 09:45

08:30 - 10:00

Room F1

Radiology in Abdominal Emergencies

CC 1117

The hole in the guts

Moderator:

G. Mathis; Rankweil/DE

A-316 08:30

A. Wasting time with plain radiography?

M. Laniado; Dresden/DE (michael.laniado@uniklinikum-dresden.de)

In recent years, continuing trends in radiology have diminished the importance of plain films of the abdomen significantly. Ultrasonography and MDCT are applied with enormous success to the investigation of many abdominal conditions in the emergency setting. In the eyes of the radiologist, plain films, therefore, seem irrelevant in the presence of such powerful imaging procedures. Surprisingly, referring physicians, mostly surgeons, gastroenterologists and urologists, still request plain films although the potential of MDCT is obvious to them as well. In their perception, the plain film is either a definitive examination before initiation of treatment (e.g. stone at the ureteropelvic junction in US proven hydronephrosis) or a preliminary study prior to MDCT or surgery (exclusion of pneumoperitoneum or ileus). In the present climate of cost and radiation consciousness this trend may continue. Moreover, many surgeons, gastroenterologists, urologists, etc. have greater skills in reading plain films than in understanding MDCT. Therefore, the radiologist should

be as much familiar as the referring physician with plain film appearances of many types of abdominal pathology and established roentgen signs. The purpose of the presentation is to review remaining indications for abdominal plain films and to revisit common imaging findings.

Learning Objectives:

1. To review the most common causes of hollow organ perforation.
2. To know the optimal technique for plain film of the abdomen in the emergency setting, signs of perforation.
3. To know if there are still indications for plain film of the abdomen in the era of US and CT.

A-317 09:00

B. Defining the role of US

J.B.C.M. Puyllaert; The Hague/NL (dr.jbcm.puyllaert@wxs.nl)

When a defect occurs in the bowel wall, air will appear within the peritoneal cavity, most frequently due to perforated peptic ulcer and perforated sigmoid diverticulitis. In most perforating gastrointestinal conditions however, the -imminent- perforation is walled-off by neighbouring bowel loops, mesentery and especially by the omentum, nick-named "policeman of the belly". If this walling-off process occurs timely and effectively, no or only minimal free air will appear. The most important causes of walled-off gastrointestinal perforation are appendicitis, peptic ulcer disease, sigmoid diverticulitis, bowel malignancy, Crohn disease and -often underdiagnosed- accidentally ingested sharp foreign bodies, as toothpicks, fish bones, chicken bones, etc. The extent to which the perforation is walled-off, determines the eventual course of the disease. The US hallmark of -imminent- perforation is inflamed fat around the involved bowel structure. Inflamed fat on US corresponds to what is often called "dirty fat" on CT scan: hypodense fat is interspersed with hyperdense streaks. This represents oedema or cellular infiltration of the fatty mesentery and omentum, which have migrated towards the site of the imminent perforation in an attempt to seal it off. On US inflamed fat is recognised as hyperechoic, non-compressible fatty tissue often interspersed with hypoechoic streaks. If fluid collections occur within the inflamed fat, this implies abscess formation. Inflamed fat is an important and valuable sign in perforating gastrointestinal conditions. If found in the absence of bowel pathology, the diagnosis is usually epiploic appendagitis or omental infarction.

Learning Objectives:

1. To understand the strength of US as the primary imaging modality.
2. To know typical signs of bowel perforation.
3. To be aware of the limitations and pitfalls of US.

A-318 09:30

C. In search of the hole: CT

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

MDCT is an extremely powerful tool when the search for a GI perforation is required. The high spatial and contrast resolutions make MDCT the most accurate imaging method to identify even small amount of free intraperitoneal air. There is general consensus about the acquisition of a contrast-enhanced scan acquired during the portal venous phase of enhancement (delay of around 60-70 sec). Controversies are still present in the literature about the utility of a pre-contrast scan as well as the need for a preliminary administration of an oral soluble iodinated CM or for an enema or gaseous distention of the distal GI tract. Image reviewing needs the use of a workstation because multiplanar reformations have been demonstrated to improve the detection of small amount of free air. An appropriate window setting is mandatory and it makes MDCT 100% accurate for identification of free air and almost 90% accurate in the identification of the precise site of perforation. The aim of the examination is not only to assess the presence of free air but also to detect the site of perforation: this is an extremely useful clinical information especially if surgeons decide to perform a laparoscopic repair. Several CT signs have been described, able to guide the diagnosis and to differentiate between a perforation originating in the upper GI tract (stomach and duodenum), in the small bowel or in the colon.

Learning Objectives:

1. To learn the appropriate imaging protocols in patients with suspected bowel perforation.
2. To learn useful signs for the detection and localisation of perforation.
3. To become familiar with imaging strategies in case of clinical suspicion of bowel perforation.

08:30 - 10:00

Room F2

Breast

RC 1102

Interventional: from diagnosis to treatment

Moderator:

G. Acunas; Istanbul/TR

A-319 08:30

A. Practical tips for a successful needle biopsy procedure

M.T.G. Gaskarth; Cambridge/UK (matthew.gaskarth@addenbrookes.nhs.uk)

The objective of percutaneous needle biopsy of the breast is to obtain an accurate preoperative diagnosis with a low upgrade rate post-surgery. Indications arise in both symptomatic and screen-detected lesions. A range of biopsy needle designs are available and their selection depends on being aware of the range of needle design types, their advantages and limitations. Cutting needles, guns, vacuum systems and MR compatible devices will be discussed. Guidance technique for ultrasound, x-ray stereotaxis and MR-guided procedures is extremely important, beginning with patient positioning and anaesthesia prior to commencing the procedure. Accurate needle placement under direct vision using high frequency ultrasound probes, x-ray stereotaxis with digital systems and MR guided - with the option of using a CAD system for distance calculation - will be presented. Typical imaging signs and potential pitfalls of each technique, both anatomical and technical, will be highlighted. Methods to increase accuracy including the use of meticulous technique, adequate sampling and correlation of specimen pathology with imaging findings at multidisciplinary meetings are essential.

Learning Objectives:

1. To consolidate knowledge of needle selection for successful biopsy.
2. To consolidate knowledge of guidance technique for successful biopsy.
3. To learn about possible solutions to increase accuracy in needle biopsies.

A-320 09:00

B. Underestimation of disease in needle biopsies

I. Schreer; Kiel/DE (ischreer@email.uni-kiel.de)

There is always the possibility of a false negative biopsy results in any type of percutaneous image-guided needle biopsy (FNAC, core biopsy, vacuum-assisted biopsy). The risk depends upon the quality of the harvested cytologic or histologic material. The quality is closely related to the amount of material collected and the accurate targeting of a lesion. Some lesions are at a higher risk of underestimation (sizes < 5 mm, architectural distortions, microcalcifications, stellate lesions) than others (i.e. focal lesions). The false-negative rates for microcalcifications using vacuum-assisted biopsy were reported to be 1.2%, for mass lesions 0.8%. Using ultrasound-guided 14 g-core needle biopsy the false-negative rates were reported to be in the range of 2.5%. Radiologic-histologic correlation plays a key role in the definite and correct judgement of the diagnostic result. In case of imaging-histologic discordance re-biopsy, possibly using larger needle diameters, or even open biopsy should be considered. The European Guidelines for Quality Assurance of Breast Cancer Screening and Diagnosis define outcome parameter for breast biopsies. Guidelines from the European Society of Breast Imaging published in 2007 define the standards and skills necessary to perform these procedures. Documentation standards should be used (B1-B5) to allow continuous yearly evaluation of the individual institution results and quality improvement. The aim of any needle biopsy is to get as much, i.e. representative material as possible. Nevertheless, a certain amount of underestimation, caused by lesion type (ADH, DCIS, LIN, papilloma, for example) will remain and has to be reflected.

Learning Objectives:

1. To realise the risk of a false negative result in needle biopsies.
2. To understand the performance standards needed to minimise the risk of underestimation.
3. To evaluate the importance of radiologic-pathologic correlation before definite diagnosis.

A-321 09:30

C. New developments: therapeutic interventional procedures

B.D. Fornage; Houston, TX/US

The various modalities currently available to ablate breast masses include thermotherapy using radiofrequency current, laser irradiation, microwave irradiation, or insonation with high-intensity focused ultrasound (HIFU) waves, cryotherapy, which freezes tissues through the use of refrigerant gases, and irreversible electro-

poration. All these techniques remain investigational at this time for the treatment of breast cancer. The limitations of and challenges associated with each ablation technique and the issues raised by early pilot studies, which have so far prevented these techniques from replacing standard surgical techniques, will be discussed.

Learning Objectives:

1. To learn about current therapeutic interventional procedures for malignant lesions.
2. To learn about current therapeutic interventional procedures for benign lesions.
3. To learn about the possible role of therapeutic interventions in the future.

08:30 - 10:00

Room G/H

Special Focus Session

SF 11

Can we predict premature ageing?

Moderator:

G. Guglielmi; Foggia/IT

A-322 08:30

Chairman's introduction

G. Guglielmi; Foggia/IT (g.guglielmi@unifg.it)

In the elderly the co-existence of several diseases, the prevalence of involuntional and degenerative aspects, together with physical and cognitive problems represent 'the norm'. It is therefore important to know how to distinguish the healthy elderly from those in need of treatment to avoid overdiagnosis and overtreatment. So the question is how to be aware of the potential and limits of diagnostic imaging and its applications in geriatric patients.

Session Objectives:

1. To recognise the coexistence of several diseases in the elderly.
2. To distinguish the healthy elderly from those in need of treatment.
3. To be aware of the potential and limits of imaging in geriatric patients.

A-323 08:35

Brain ageing/dementia

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

Brain development occurs rapidly during the last trimester of pregnancy and continues at a rapid pace in the first two years of life. More subtle maturation, for example in the white matter, occurs well into the third decade of life, as evidenced by diffusion tensor imaging (DTI). Evidence of brain degeneration is occurring soon afterwards and includes mild brain volume loss, reductions in white matter integrity on DTI, widening of Virchow-Robin spaces and accumulation of incidental white matter lesions (WML). Severe WML and incidental cerebral microbleeds (MBs) are associated with known cardiovascular risk factors and while the concurrent impact may be subtle in terms of cognition, they carry a poor prognosis in the long run. The same is true for silent cerebral infarcts, which increase the risk of dementia. Neurodegenerative (general brain volume loss, ventricular dilatation and hippocampal atrophy) changes also occur well before the onset of clinical signs of dementia. In genetically predisposed subjects (e.g. APOE4 carriers) abnormal (compensatory) brain activity on functional MRI and increased (compensatory) cerebral metabolism on FDG-PET have been observed that predict subsequent cognitive decline. More recently, PET studies employing amyloid tracers have shown abnormal binding in a significant proportion of cognitively elderly, suggesting that these subjects are at risk to develop Alzheimer's disease - the pace of which is currently undetermined.

Learning Objectives:

1. To learn which structural brain changes occur with normal ageing.
2. To understand imaging biomarkers that predict premature ageing.
3. To learn how to diagnose dementia as early as possible using MRI and PET.

A-324 08:58

Bone and joint ageing

A. Cotten; Lille/FR (anne.cotten@chru-lille.fr)

Musculoskeletal disorders are frequent in the elderly population. The loss of mobility and physical independence resulting from fractures, osteoarthritis, and osteoporosis can be devastating, both physically and psychologically. A current increase in geriatric imaging is likely to persist into the near future and requires radiologists to be more aware of musculoskeletal complaints and conditions pertaining to the geriatric population. The aim of the lecture is to review the main musculoskeletal

disorders that affect the elderly population. Some misleading radiological presentations typically occurring in this population will be also presented.

Learning Objectives:

1. To recognise the increased incidence of trauma, degeneration and malignancy in ageing.
2. To understand that the loss of mobility and physical independence resulting from fracture, arthritis and osteoporosis affect both the physical and psychological quality of life.
3. To be more aware of musculoskeletal complaints and conditions pertaining to the geriatric population.

A-325 09:21

Cardiovascular ageing

T. Saam; Munich/DE (Tobias.Saam@med.uni-muenchen.de)

Cardiovascular ageing is a universal phenomenon associated with an increased likelihood of the development of cardiovascular diseases and of adverse outcomes once disease does develop. In fact, most complications of cardiovascular disease, including myocardial infarction, stroke, congestive heart failure, atrial fibrillation, and cardiovascular death, occur in the increasing number and proportion of our population that is 65 years of age and older. Traditionally, imaging techniques that have been used to assess the vasculature have focused on depicting the arterial lumen. However, luminal narrowing occurs late in the atherosclerotic disease process and it is commonly accepted that knowing the degree of luminal stenosis alone is insufficient to determine the vulnerability of atherosclerotic lesions. Thus, a number of imaging methods, such as ultrasound, PET/CT and high-resolution black-blood MRI have emerged that are able to assess the composition and morphology of atherosclerotic plaques. IMT measurements of the carotid arteries and calcification in the coronary arteries are well validated imaging markers that are associated with adverse outcomes independent of other traditional cardiovascular risk factors. Recent studies suggest that several other imaging markers, such as arterial FDG-uptake as assessed by PET/CT or intraplaque haemorrhage and fibrous cap thickness as assessed by MRI are associated with an increased risk of future cardio- or cerebrovascular events. It still remains a hotly debated topic whether atherosclerosis is reversible. This talk will also provide an update of the latest imaging studies which examined the effects of anti-atherosclerotic drugs on plaque regression and progression.

Learning Objectives:

1. To consolidate knowledge of the underlying pathophysiology of cardiovascular ageing.
2. To learn about different imaging strategies to assess cardiovascular ageing.
3. To become familiar with imaging features that might be able to predict premature ageing.
4. To learn about imaging studies that examine the effects of drugs on the regression/progression of the 'cardiovascular age'.

Panel discussion:

What specific knowledge do you need to be able to interpret and understand the radiological scenarios in geriatric patients? 09:44

In the elderly the coexistence of several diseases, the prevalence of involuntal and degenerative aspects, together with physical and cognitive problems represent 'the norm'. It is therefore important to know how to distinguish the healthy elderly from those in need of treatment to avoid overdiagnosis and overtreatment. So the question is how to be aware of the potential and limits of diagnostic imaging and its applications in geriatric patients.

08:30 - 10:00

Room I/K

Chest

RC 1104

CT angiography of the chest beyond aorta

Moderator:

C. Engelke; Göttingen/DE

A-326 08:30

A. CT angiography for PE diagnosis during pregnancy and post-partum

M.-P. Revel; Paris/FR (marie-pierre.revel@egp.aphp.fr)

The risk of venous thromboembolism (VTE) is increased by a factor of four to five during pregnancy and in the postpartum period owing to factors such as the higher concentration of procoagulant factors and venous stasis. In developed countries, PE is the leading cause of maternal death. Because clinical symptoms are non-

specific, reliable diagnostic tests are needed. CT angiography (CTA) is reported to have more frequent inconclusive results (up to 20%) in pregnant and postpartum patients, mainly because of poor opacification. Suboptimal opacification is explained by physiological changes during pregnancy and persisting in postpartum such as the increase in blood volume, which reaches 50% by the 36th week. Shallow breathing during CTA acquisition is better than suspended full inspiration to avoid massive return of non-opacified blood from the inferior vena cava. The amount of contrast medium must also be adapted to the weight. Using standard CTA protocols, mean maternal radiation dose is roughly 8 times that of lung scintigraphy. Reduced kilovoltage or bismuth shielding are different options to reduce skin entry dose to the breast, the main radiosensitive organ. Dedicated studies using Monte Carlo simulations have shown foetal dose is less for CTA than for V-Q scan, both being negligible. CTA allows identifying an alternate diagnosis in 12% to 27% of the pregnant and postpartum patients with negative results for VTE. In postpartum patients, CT venography following CTA leads to an absolute increase in the VTE detection rate of 12%, by allowing detection of iliac or ovarian vein thrombosis.

Learning Objectives:

1. To understand the role of CTA in the diagnosis of acute PE during pregnancy and post-partum.
2. To learn how to optimise CTA protocols for PE during pregnancy and post-partum.
3. To review key imaging findings.

A-327 09:00

B. CT angiography of large vessel vasculitis

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

The presentation will discuss the role of large vessel arteritis within the spectrum of thoracic vascular diseases. It will detail the pathological entities and their morphological, functional, and clinical characteristics. It will present typical CT and MRI findings and discuss key elements to the differential diagnosis. It will finally discuss the clinical relevance of these diseases, with a special emphasis on overall evolving importance of thoracic vascular disorders.

Learning Objectives:

1. To understand the role of CTA in the diagnosis of large vessel vasculitis.
2. To learn how to optimise CTA protocols in patients with known or suspected large vessel vasculitis.
3. To consolidate knowledge of typical imaging findings in patients with large vessel vasculitis.

A-328 09:30

C. CT angiography for severe haemoptysis

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

Severe haemoptysis can occur in about 5% of patients. It is associated with high mortality due to asphyxiation, if not treated, and needs urgent and comprehensive evaluation of the lung parenchyma, airways, and thoracic vasculature. Multi-detector row CT angiography is a very useful noninvasive imaging modality for initial assessment of haemoptysis in stable patients. It can accurately identify the source and the most common predisposing causes of haemoptysis (bronchiectasis, chronic bronchitis, lung malignancy, tuberculosis and fungal infection) and the effects of haemorrhage on the lungs and airways. Moreover, the combined use of thin-section axial and complex reformatted images allows clear depiction of the origins and trajectories of abnormally dilated systemic arteries that may be responsible for the bleeding in over 90% of cases requiring intervention with arterial embolisation or surgery. Nonbronchial arteries may also represent an important cause of haemoptysis. The road maps of dilated bronchial and nonbronchial arteries provided by CT angiography represent a useful guide for endovascular treatment. CT angiography is a quick and noninvasive tool that is helpful in the diagnosis and management of haemoptysis.

Learning Objectives:

1. To understand the role of CTA in the clinical management of patients with haemoptysis.
2. To learn how to optimise CTA protocols for evaluating patients with haemoptysis.
3. To consolidate knowledge of typical imaging findings in patients with haemoptysis from different etiologies.

08:30 - 10:00

Room L/M

Radiographers

RC 1114

Radiation protection and optimisation of radiological procedures

Moderators:

K. Åhlström Riklund; Umeå/SE
D. Katsifarakis; Athens/GR

A-329 08:30

A. Diagnostic quality and patient dose management in digital radiography systems

L.J.O.C. Lanca; Lisbon/PT (luis.lanca@estesl.ipl.pt)

Several digital systems are currently available for projection radiography. Digital systems are traditionally split into two broadly defined categories: computed radiography (CR) and digital radiography (DR). CR systems use storage-phosphor image plates with a separate image readout process and DR technology converts x-rays into electrical charges by means of a direct readout process using TFT arrays. DR systems can be further divided into direct and indirect x-ray conversion systems. Digital detectors offer several advantages when compared to analogue detectors such as wide dynamic range, adjustable image processing, better image quality, rapid image acquisition and image access at remote locations. The management of diagnostic quality and patient dose is a very important issue to be considered by radiographers when working with digital systems. Exposure has a direct influence in image quality representation and dose delivered to the patient could be inappropriate for diagnostic purpose. Diagnostic accuracy could be affected by inadequate exposure and thus an appropriate exposure level should be achieved. Digital detector technologies have the potential to reduce patient exposure while maintaining diagnostic quality using appropriate methods of process optimisation.

Learning Objectives:

1. To get a global overview of digital radiography systems (both CR and DR).
2. To gain knowledge about advantages when using digital radiography technologies.
3. To learn about strategies for the management of diagnostic quality and patient dose.

A-330 09:00

B. The radiographer's position in the initial optimisation procedure

D. Pekarovic; Ljubljana/SI (dean.pekarovic@kclj.si)

Radiological procedures are performed because of medical benefits to patients, but they also cause some harm because of the dose. If medical benefit outweighs detriment the procedure is justified. The purpose of the optimisation is then to adjust the procedure in a way to maximise the ratio of benefit over harm. Question is who is responsible to do it and how it can be done. Who should participate: we believe there is a major role of radiographer as she/he is present at each and every radiological procedure performed. But it is absolutely mandatory for them to understand benefits of the procedure and understand harm (dose). Radiographer's position is the connection between radiologist, medical physicist and vendor's engineers. Radiologists usually do not have in depth knowledge of technology and dose and physicists and engineers on the other hand do not understand in depth the medical aspects of procedure. Radiographers must also understand operational possibilities of every x-ray machine. To get to know them they should be there at the acceptance of the x-ray machine and talk to service engineers and applicators. They should also talk to physicist when he/she is doing tests. And finally simulation of procedure(s) using different phantoms is the best way to understand how machine parameters are affecting image quality and dose. In presentation, some examples for different modalities will be given.

Learning Objectives:

1. To gain knowledge about how to start with optimisation of radiological procedures.
2. To understand the basics of quality control (QA) for radiographic modalities and how to use experience acquired from QA in daily work.
3. To become familiar with guidelines and applications for good radiological practice and how to implement them in the optimisation process.
4. To consolidate knowledge of technology of radiographic modalities and the use of materials in daily practice according to guidelines, and to be familiar with the radiographers responsibility in the field of radiation protection.

A-331 09:30

C. Radiation dose optimisation and the radiographer's role

A. Henner; Oulu/FI (anja.henner@oamk.fi)

Fast development in the area of imaging modalities demands a lot of work in dose and image quality optimisation and management. Deterministic harms have been reported both in interventional and diagnostic radiology. There are also some special groups (e.g. children) which need a lot of attention and especially tight indications for x-ray examinations. Radiation dose and image quality optimisation can be applied with small steps in everyday clinical work as a part of self assessment, if the safety culture is agreed by all professionals. The vendors put the settings high in order to reach the best image quality. After installation the settings must be re-evaluated before starting clinical use of the equipment. Also, the sensitivity of AEC (automatic exposure control) must be turned according the detector. Using the air gap (30 cm) instead of grid, e.g. in hip axio-lateral project or scoliosis, dose decrease can be even two thirds. The role of radiographer is expanding to new areas. Quality assurance and dose and image optimisation could be parts of the expanded role. The new technical solutions in imaging offer a lot of possibilities for dose reduction, if we want, but there is also danger of dose creeping if the doses are not followed up frequently. The management and legislation offer the basics but the work must be done among those who are working in radiological departments. Commitment to the safety culture on all levels in medical radiation offers better care and procedures with lower doses to the patients.

Learning Objectives:

1. To understand the importance of radiation dose optimisation.
2. To become familiar with procedures to optimise the radiation dose.
3. To consolidate knowledge of the radiographer's role in radiation dose optimisation.

08:30 - 10:00

Room N/O

Joint Course of ESR and RSNA

(Radiological Society of North America)

MC 1125

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

Moderator:

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

A-332 08:30

A. Principles of oncologic imaging and reporting

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

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-333 08:50

B. Lung cancers (primary, metastases)

C.J. Herold; Vienna/AT

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-334 09:25

C. Colon cancer

R.M. Gore; Highland Park, IL/US

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 P

Physics in Radiology

RC 1113

High field MRI: Beyond 3 T

Moderators:

M. Tosetti; Pisa/IT

A.J. van der Molen; Leiden/NL

A-335 08:30

A. Challenges of high field MR

M. Bock; Heidelberg/DE

Over the recent years the clinical MRI field strengths have gradually been increased to 3 Tesla; however, whole body MRI systems with higher fields of up to 9.4 Tesla have become available in experimental settings. Compared to clinical field strengths, MRI at very high magnetic fields has several advantages but also some unique challenges. With increasing field strength the signal-to-noise ratio increases, which can be used to either increase the spatial resolution in the images, or to acquire the images more rapidly. Unfortunately, the energy deposited in the human body via the RF excitation scales quadratically with the field strength. Thus, the specific absorption rate (SAR) is a critical factor in all rapid imaging protocols, and requires the design of RF pulses with low SAR, (e.g. VERSE pulses). Inhomogeneities of the RF field which are induced by standing wave phenomena have to be compensated, and make the design of efficient spin echo pulse sequences very difficult. At higher field also the field inhomogeneities become larger and stronger imaging gradients are required to overcome the susceptibility-induced image distortion. Stronger gradient systems are difficult to manufacture, and the usable gradient slew rate is limited by peripheral nerve stimulation thresholds. Furthermore, stronger and faster gradients become very loud at high fields, and special measures for sound protection are required. Despite these limitations, high-field MRI offers image with very high resolution, it provides unique contrasts, a better spectral separation of the resonance lines and high signal for non-proton applications.

Learning Objectives:

1. To understand how the increased field strength affects exposure and image quality characteristics.
2. To learn about MR imaging protocols developed for ultra-high field MRI.
3. To become familiar with technology for specific absorption rate reduction.

A-336 09:00

B. A complicated solution to a complicated problem: transmit array

K.P. Pruessmann; Zurich/CH (pruessmann@biomed.ee.ethz.ch)

Clinical MRI usually aims to depict anatomic regions of interest with uniform coverage and contrast behaviour. To this end it is essential to use suitably homogeneous radiofrequency (RF) magnetic fields for spin excitation, refocusing, and saturation. Traditionally, such uniform transmit fields are generated by volume resonators based on quasi-stationary electrostatics, which, however, gradually cease to apply as clinical MRI explores high field strengths of 3 T and beyond. The concomitant increase in operating frequency entails shorter RF wavelength and increasing tissue interactions, which render the tailoring of RF fields substantially more complex and patient-dependent. One promising response to this challenge is to depart from volume resonators and perform RF transmission by multiple, individually fed transmitter elements. With such transmit arrays the effective RF field can be tailored on a per-patient and per-scan basis by adjusting the relative magnitude and phase of driving the elements (RF shimming). In advanced imple-

mentations the phase and magnitude relations are even varied during RF pulses. In combination with equally dynamic gradient waveforms such fully individual control permits particularly fast spatially tailored RF pulses (Transmit SENSE). Array transmission entails a generalisation of RF pulse design, for which a range of efficient mathematical methods have been developed. One important challenge that remains, however, is the need to calibrate array transmitters in terms of the individual channels' RF field contributions, both magnetic and electric. The latter, in particular, underlie power deposition in the tissue and hence need to be closely controlled to enforce strict SAR limits.

Learning Objectives:

1. To learn about the need to control radio-frequency fields, particularly at high B₀.
2. To understand the principles of doing so by multiple-channel transmission.
3. To become acquainted with the methods of obtaining uniform and tailored excitation within SAR limits.

A-337 09:30

C. Is 7T ready for clinical use?

R.W. Bowtell; Nottingham/UK (richard.bowtell@nottingham.ac.uk)

The availability of magnetic resonance (MR) scanners operating at 7 T and above has already proved beneficial for MR imaging and spectroscopy of the human brain and promises similar benefits in the human body. These advantages result from the increases with the magnetic field of the intrinsic signal-to-noise ratio, blood oxygenation level dependent (BOLD) contrast, which forms the basis of the vast majority of functional MR imaging (fMRI) experiments, and chemical shift dispersion. These gains can be exploited in improving the spatial and/or temporal resolution of anatomical and functional MRI experiments and in increasing the spectral resolution in volume selective spectroscopy or chemical shift imaging. Operation at the increased magnetic field also offers easier access to T₂⁻contrast and improved implementation of susceptibility-weighted imaging (SWI) in which the phase of gradient echo images provides information about local variation of magnetic susceptibility. In the brain, such variation appears to be dominated by differences in iron concentration and myelin content, so that high-field SWI may provide useful information about the progression of neurodegenerative disease. The elevated T₁ relaxation times at 7 T also offer benefits for arterial spin labelling and time of flight angiography. Current and potential future applications of high-field MRI in clinical and pre-clinical studies in a number of areas and will be discussed in this presentation, along with the barriers to wider usage of 7 T systems for clinical studies.

Learning Objectives:

1. To become familiar with the advantages that 7T provides for magnetic resonance imaging and spectroscopy.
2. To recognise the areas of clinical application where 7T already offers significant benefits over lower fields.
3. To understand the barriers to clinical usage of 7T.
4. To recognise the technical developments that will help to overcome these barriers and allow wider clinical usage of 7T.

08:30 - 10:00

Room Q

Paediatric

RC 1112

Abdominal emergencies in children

Moderator:

M. Haliloglu; Ankara/TR

A-338 08:30

A. Non-traumatic acute abdomen

C. Veyrac; Montpellier/FR (c-veyrac@chu-montpellier.fr)

The purpose is to present and discuss the role of imaging in non-traumatic acute abdomen, with particular focus on ultrasound (US). The neonatal GI tract emergencies, associated with specific disorders and imaging strategies, are excluded. Acute abdomen in children refers to a wide variety of conditions ranging from benign disorders, such as gastroenteritis, to threatening disease, such as midgut volvulus or intussusception. The recognition of a surgical emergency requires usually, after a competent clinical evaluation, an imaging investigation in order to avoid negative or unnecessary surgery. Abdominal plain film is known as poorly sensitive in most situations, except bowel obstruction. Ultrasound requires experience and a thorough examination but has demonstrated a high sensitivity and specificity for diagnosing bowel obstruction, midgut volvulus, intussusception, acute appendicitis,

hypertrophic pyloric stenosis, etc. It enables some differential diagnosis such as infectious ileocolitis, ischaemic colitis, Henoch Schonlein purpura, complicated Meckel diverticulum or duplication, etc. or even pyelonephritis. It can provide some findings suggesting mesenteric adenolymphitis, viral gastroenteritis, etc. The US findings will be described as well as the potentialities and limitations of US in each of these conditions. The accurate knowledge of the clinical findings together with the results of US will guide the need for another imaging modality: enhanced CT in case of suspected appendicitis with inconclusive US, upper GI series in an infant with bilious vomiting and impossibility to display the mesenteric vessels, etc. At last, some aspects of pancreatic and biliary tract emergencies will be shown.

Learning Objectives:

1. To understand the role of sonography in acute digestive disease.
2. To become familiar with the specific imaging findings of intussusception and appendicitis.
3. To learn about the acute pathology of the liver, biliary tract and pancreas.

A-339 09:00

B. GU emergencies in children: kidney, ovary, testis

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

The purpose is to discuss the role of emergency imaging in acute paediatric GU conditions, with particular focus on the potential of ultrasound (US). Besides GU tract trauma conditions such as urosepsis, renal failure, renal colics, ovarian or testicular torsion with all the respective relevant differential diagnoses have to be considered and urgently addressed adequately. Particularly with respect to radiation protection (ALARA-principle) and due to the superb US potential in childhood, US is often used as the primary imaging tool. In many conditions US will reveal all treatment relevant information and no additional imaging is necessary in the acute setting. However, in other conditions such as severe (multiple) trauma CT remains the best primary imaging tool, however, only by using age-adapted CT protocols. The work-up and follow-up may also require imaging, usually achievable by US and partially by MRI, scintigraphy and/or cystography. All these lead to imaging algorithms that differ from adults. The most important conditions, their imaging appearance, the potential pitfalls and some important methodical details will be presented, also discussing the recommended dedicated paediatric imaging algorithms. In most paediatric acute GU conditions US is adequate as the first and often sufficient imaging modality. Rarely other imaging is necessary particularly in the acute setting - except for CT in severe (multiple) trauma. All imaging should be indicated with respect to therapeutic consequences and the ALARA principle, and proper paediatric protocols as well as methodical skills (e.g., dedicated paediatric US) should be provided 24 hours throughout the year.

Learning Objectives:

1. To learn about the diagnostic imaging approach in acute urinary tract disease.
2. To recognise the sonographic aspects of ovarian emergencies.
3. To understand the role of sonography in acute scrotum diseases.

A-340 09:30

C. Abdominal trauma in children

M.P. García-Peña; Barcelona/ES (pilagarcia@vhebron.net)

Trauma is a leading cause of morbidity and mortality in children. The clinical evaluation of children with potential blunt abdominal injury presents a difficult and challenging task. Therefore, diagnostic imaging plays an important role in the evaluation of injured children. The most common indication for abdominal imaging following trauma in children is haematuria. The majority of children with haematuria do not have urinary tract injury. Certain clinical variables have been associated with a higher risk of abdominal injury. These include gross haematuria, abdominal tenderness, ecchymoses, and a low trauma score. Lap belt ecchymoses represent an important high-risk marker for injury. They are associated with complex bony injury. Sonography has limited utility in the assessment of paediatric abdominal trauma. Computed tomography (CT) is the imaging method of choice in the evaluation of abdominal injury after blunt trauma in haemodynamically stable children. An unstable patient needs to be stabilised prior to CT or to proceed directly to surgery. Evaluation with CT allows for accurate detection and quantification of injury to solid and hollow viscera, and can also identify an active haemorrhage. CT can help prioritise optimal management by diagnosing the major or most life-threatening site of haemorrhage or injury. CT can also demonstrate associated bony injury to ribs, spine, and pelvis. A normal CT examination may prevent other unnecessary explorations. The decision for operative intervention in the small percentage of children who require surgical haemostasis is primary made based on clinical criteria and not on CT findings.

Learning Objectives:

1. To learn about traumatic lesions of the abdomen in children.
2. To learn the diagnostic strategy after abdominal trauma.
3. To discuss the diagnosis improvement with the new technology.

08:30 - 10:00

Room Z

ENCITE Session

Visualisation of cell therapy meets clinical application

Moderator:

G.P. Krestin; Rotterdam/NL

A-341 08:30

ENCITE - a translational approach for novel cell therapy applications

S. Aime; Turin/IT

ENCITE (European Network for Cell Imaging and Tracking Expertise) is an EU integrated project aiming at developing tools and procedures for an efficient in vivo image-guidance for cell therapy. It relies on a large interdisciplinary consortium that includes chemists, biologists, physicians and imaging scientists. It consists of six sub-projects devoted to: 1. Novel imaging technologies; 2. Novel imaging reporter probes; 3. Novel tools for cell labelling; 4. Pre-clinical validation; 5. Translation towards clinical applications; 6. Dissemination and training. The research work carried out in the project is providing important contributions to get a better understanding of the mechanisms by which cell therapy works. The availability of dedicated methods and probes will allow an improved in vivo spatio-temporal tracking of labelled cells thus providing the clinicians with the possibility of monitoring innovative cell therapies to cure major diseases.

A-342 08:50

Visualising transplanted neural stem cells and tissue regeneration by MRI

M. Modo; London/UK

Neural stem cells are in the process of finding their translation into the clinic. However, it is well-known that the cells by themselves do not regrow lost tissue. To this end, neural stem cells need further support and guidance. Tissue engineering is using biomaterials to provide a structural support for cells, but can also incorporate the release of factors that guide the fate of transplanted cells. Ideally, an in vivo imaging approach would encompass all these processes. We here demonstrate the use of a 19 F MRI contrast agent to detect clinical-grade human neural stem cells non-invasively over 7 days within a tissue cavity formed by stroke. To provide structural support for these transplanted cells within the tissue cavity, cells were mixed with an engineered de-cellularised extracellular matrix (ECM). Using diffusion MRI, we were able to detect the presence of the ECM within the stroke cavity. This approach hence provides a novel approach as to how we can study transplanted cells and tissue regeneration in vivo by MRI.

A-343 09:10

Imaging dendritic cell vaccinations in melanoma patients

M. Srinivas, E.H.J.G. Aarntzen, F. Bonetto, A. Heerschap, W.J. Oyen, O.C. Boerman, C.J.A. Punt, C.G. Figdor, I.J.M. de Vries; Nijmegen/NL

Our lab has been among the first to exploit dendritic cell (DC) therapy to treat melanoma patients. Over the past years, immunological responses are increasingly reported and clinical responses have consistently been observed. Moreover, DC therapy often has much milder side effects than standard chemotherapy. A key hurdle in the development of the DC therapy is accurate delivery of the cells to lymph nodes (LNs), or their successful migration from the site of injection to LNs. In particular, tools for measuring cell migration in vivo are necessary. Ideally, we would be able to quantify the number of DCs at the relevant site, with high resolution anatomical context to allow differentiation of LNs and the possibility of longitudinal data acquisition. Furthermore, functional data on the ensuing immune response is also required. Towards these ends, we have been working on developing imaging techniques to study DCs in vivo, for example with scintigraphy on ¹¹¹In-labelled DCs, and magnetic resonance imaging (MRI) on iron-labelled DCs. Scintigraphy is quantitative, but it is restricted to the relatively short half-life of the radioisotope and is unable to resolve individual LNs. MRI allows high resolution anatomic localisation, but the use of contrast agents such as iron oxide is not quantitative. Our recent work has focused on imaging the functionality of these DCs using positron emission tomography (PET) to study LN activation. Finally, we have also developed in vitro assays that closely mimic in vivo DC migration in 3D scaffolds imaged using quantitative ¹⁹F MRI, as a substitute for in vivo optimization. We plan on applying ¹⁹F MRI to the tracking of DCs in vivo, as the technique allows both quantification and high-resolution anatomic detail.

A-344 09:30

Monitoring of transplanted pancreatic islets in humans by MRI

M. Hájek, D. Jiráček, M. Dezortová, V. Herynek, P. Girman, J. Kříž, F. Saudek;
Prague/CZ

Purpose: Labelling pancreatic islets (PI) with superparamagnetic markers enables their detection as hypointense spots on magnetic resonance (MR) images. We tracked PI transplanted into the liver and quantified their signal loss in liver tissue using MR imaging over a six-month period.

Methods and Materials: PI were labelled with ferucarbotran 5 µl/ml for 6-44 hours and transplanted into the portal vein in 8 C-peptide negative recipients (12 infusions). The liver was examined prior to transplantation and subsequently 1 day and 1, 2, 4 and 24 weeks after transplantation using a 3 T MR scanner.

Results: In all recipients significant C-peptide levels and near-normal HbA1c values were achieved with 50-80% insulin dose reduction. No side-effects related to the labelling procedure were documented. A significant decrease in the number of islet spots was detected at 1 week post-transplantation (on average 60%) with a subsequent only slight decrease for up to 24 weeks. In two subjects with a labelling period of less than 6 and 10 hours respectively only a few islet spots were detected corresponding to poor islet visualization in phantoms labelled for the same period of time.

Conclusion: PI visualization was successful in all recipients but was less efficient if the labelling period was less than 16 hours. A significant decrease in islet spots occurred at 1 week post-transplantation suggesting early islet destruction or impaired engraftment. Then, the decrease in islet spot numbers slowed and islets were still detected at 24 weeks post-transplantation. Data shows that MR detection of ferucarbotran-labelled islets correlates with sustained C-peptide production.

Discussion and exchange 09:50

10:30 - 12:00

Room B

ESR meets Iran

EM 4

Interventional radiology: from scratch to innovation

Presiding:

Y. Menu; Paris/FR

A. Sedaghat; Tehran/IR

A-345 10:30

Welcome and introduction

A. Sedaghat; Tehran/IR (radiologysociety@gmail.com)

Iran, is one of the largest countries in the Middle East, with the population of over 75 million people. Iran has always had special geographic, social, cultural, and economic situations. Iran is the cradle of civilisation and home to great people like Cyrus the Great, who mentioned the human rights as Cyrus Cylinder and Ibn Sina the author of Qanun, one of the most reliable text books in past medicine. At the present time, there are 17 medical schools that are training more than 300 radiologist assistants, and over 1600 radiology practitioners are working in IRAN. The Iranian Journal of Radiology, the scientific organ of the Iranian Society of Radiology is published in English and has passed seven years of publication. During the past decade, the Iranian Society of Radiology has expanded its overseas-activities. Besides local societies and their congresses, ISR has established a close and appropriate connection to the European Society of Radiology (ESR) justified as the large attendance of Iranian radiologists in ECR, the submission of numerous articles to ESR, the membership of Iranian radiologists in ESR as corresponding members, the significant presence of European radiologists in the Iranian annual congress of radiology (ICR). Interventional radiology has developed in Iran at the same place as in other countries, so that we can offer most of the interventional services, such as vertebroplasty, chemoembolisation, various stent placements, aneurysm treatment and uterine fibroid embolisation in Iranian radiology centers by Iranian radiologists.

Session Objectives:

1. To learn about prominent clinical situations in which interventional radiology plays an important role in the treatment of patients.
2. To understand how interventional radiology can be created and organised from the beginning.
3. To learn about the Iranian strategy for the development of interventional radiology.

A-346 10:40

How to start interventional radiology

H. Ghanaati; Teheran/IR (ghanaati@yahoo.com)

Interventional techniques deeply changed approach to treatment of diseases. In each country, interventional radiology practice establishment varies according to local factors, but following a standard strategy seems better to set up this facility. According to above-mentioned points, I decided to establish this specialty in our hospital since 1996 as the pioneer center in interventional radiology Iran. At first the procedures included percutaneous laser disc decompensation (PLDD), and vertebroplasty followed by vascular procedures such as UAE in later years. Now, we are performing all interventional procedures in our country including aortic stent and all neurointervention procedures. The following items will be discussed: 1. Prepare step by step strategies for establishing intervention. 2. Solving issues regarding interventions procedures. 3. Modified techniques for lowering costs to cover interventions in poor people. 4. Setting of fellowship courses. 5. Co-operation with dedicated and pioneer international centers such as using neocrylate for treatment of brain aneurysms in conjunction with UCSD for the first time on human. When presenting our experience we want to review how we should start interventional radiology in developing countries.

Learning Objectives:

1. To understand why interventional radiology is a mandatory resource.
2. To learn about the milestones of a strategy for building an interventional suite.
3. To understand what the priorities are.

A-347 10:55

Uterine artery embolisation for treatment of symptomatic fibroids

K. Firouznia; Tehran/IR (k_firouznia@yahoo.com)

Fibroids are the most common benign tumours of the uterus during female reproductive age. Uterine artery embolisation (UAE) is a procedure in which using embolic particles (PVA, Gelfoam, etc.) we block blood supply to uterine fibroids. It has been reported as a relatively safe, effective, and durable nonsurgical alternative method diminishing fibroid-related symptoms. UAE is typically performed in both uterine arteries by an experienced interventional radiologist. After UAE, reduction in menorrhagia has been reported as 80-93% and the mean decrease in fibroid size varies from 50% to 78% in the literature. Complications including amenorrhoea are frequency ranging from 1% to 7% in the literature. UAE may be followed by menopause in 1% of the cases. Nevertheless, it is usually encountered in women in their late 40s. It seems that the future of UAE depends on optimal selection of patients based on the prediction of volume-shrinkage, the outcome of fertility, and the long-term efficacy. Although pregnancy is possible after embolisation, neither fertility preservation nor its improvement can be definitely guaranteed. Women who desire to become pregnant should definitely be cautioned about potential complications during pregnancy. In this presentation we are going to review the position of UAE in Iran and to present our experience about the efficacy, and safety of UAE. Besides, we will discuss some methods of dose reduction during UAE and the effects of UAE on fertility and pregnancy outcome.

Learning Objectives:

1. To understand the technique of uterine artery embolisation.
2. To learn about the results and complications through literature and experience.
3. To learn about the future of this technique, including clinical benefit and comparison with other strategies.

A-348 11:10

Interlude (I): Persian physicians' contribution to the evolution of medicine

K. Vessal; Shiraz/IR

A-349 11:15

Interventional procedures in liver transplantation

A. Rasekhi; Shiraz/IR (DrRasekhi@yahoo.com)

Advances in immunosuppressive therapy, the early diagnosis of complications and treatment by interventional methods have all led to prolonged survival of liver transplantation. Interventional radiologist is always a part of transplantation team and has a very important role to face with complications. During 2001 to 2010, 846 patients with end stage liver disease underwent liver transplantation in Shiraz University of medical science. Among the complications 13 HA, 6 HO and 39 biliary structures treated by interventional endovascular methods. HA thrombosis was treated mostly by direct thrombolytic injection in the clot. The patients treated by ballooning the site of strictures and putting an internal-external drainage. 8 HV strictures treated by endovascular stenting and ballooning. 11 of 13 patients with

hepatic artery thrombosis treated by direct intra-vascular injection of streptokinase, flow is again restarted. 2 patients underwent surgery because of right stenosis and organised clot. Among 39 biliary strictures 32 strictures were at the site of anastomosis, and 3 patients had changes in favour of sclerosing cholangitis and 4 patients had multiple stones and casts. All 8 patients with hepatic vein stricture stented successfully. In conclusion, a close working relationship between radiologist and liver transplantation team has always been and continues to remain an essential component of a successful liver transplantation program.

Learning Objectives:

1. To understand the main clinical situations in which intervention is necessary in patients with a transplanted liver.
2. To become familiar with illustrative cases of the most important procedure.
3. To learn about the role of imaging work-up in the planning of intervention.

A-350 11:30

Interlude (II): Persian physicians' contribution to the evolution of medicine

K. Vessal; Shiraz/IR (k_vessal@yahoo.com)

A-351 11:35

Radiochemoembolisation of hepatic metastases

S. Akhlaghpour, M. Fatehi, A. Aziz Ahari, M. Amoui, S. Tolooee, H. Poorbeigi, S. Sheibani; Tehran/IR

Liver metastases are of the most difficult therapeutic challenges in oncologic managements. Surgery is frequently impossible due to disease extent and systemic chemotherapy usually fails. In other body parts, the combination of radiotherapy and systemic chemotherapy is used for several types of malignancies. We successfully adopted a novel image-guided form of this combination for such masses referred to as radiochemoembolisation, which substantially intensifies the treatment locally. Patients underwent transarterial radiochemoembolisation with chemotherapy protocol of mitomycin, doxorubicin, and cisplatin and embolisation with radioisotope particles of ³²P. The effectiveness of method was determined by comparing contrast-enhanced CT images, pre- and post-intervention. Treatment response was evaluated using RECIST criteria. We also used some arbitrary criteria such as tumoural mean density and enhancement pattern. For stable and partial-response cases, the procedure was repeated. We did not repeat the treatment for progressive diseases. Complete-response cases were only followed. After completing treatment sessions, regardless of the tumour source, considerable amount of patients showed substantial response. In terms of RECIST criteria, a significant portion of patients gained at least a "Partial Response". But the decrease in tumour density and the appearance of non-enhancing tissues were more promising. Radiochemoembolisation is an effective method for the treatment of patients with unresectable hepatic metastases. Although this study lacks a control group, it shows the effectiveness of the treatment. Literature review showed the response to treatment with regard to RECIST criteria had been better in our study comparing with studies only used chemoembolisation or radioembolisation.

Learning Objectives:

1. To understand the technique of radiochemoembolisation and the necessity of multidisciplinary cooperation.
2. To learn about the possibilities and limits of radiochemoembolisation.
3. To understand the potential role of radiochemoembolisation in the treatment strategy of hepatic metastases.

Panel discussion 11:50

10:30 - 12:00

Room C

Interactive Teaching Session

E³ 1220

Breast cancer: what the radiologist must report

A-352 10:30

Breast cancer: what the radiologist must report

A. Tardivon¹, J. Camps Herrero²; ¹Paris/FR, ²Valencia/ES (anne.tardivon@curie.net)

In a patient with a recently diagnosed breast cancer, the clinicians (oncologist, surgeon and radiotherapist) need information relative to the location of the cancer, its size, the relationship with adjacent structures, its distribution (multifocal, extensive intraductal component, multicentric, bilateral, extension to the nipple-

areolar complex), the presence of other imaging findings (extension to the skin, inflammatory cancers) and the status of regional lymph nodes. This information influences the type of treatment given to the patient and it is very important to gather as much information as possible in order to obtain a one-step surgical excision with free margins at pathology. On the basis of this information and on discussions held in multidisciplinary meetings, markers will be placed wherever needed in order to locate the exact distribution of the tumour(s). The different parts of a structured report (clinical data relevant to the report, technical description of the diagnostic or the interventional modality, pitfalls during the exam, description of breast composition, description of lesions, categories and overall assessment) should always be included in order to guarantee that all the important information is there. Breast imaging, like other subspecialties in radiology, is a multimodality area of knowledge where it is vital to integrate the information obtained through diagnostic and interventional procedures in order to supply the clinician with a body of data that is useful and straightforward.

Learning Objectives:

1. To know the pertinent information the clinicians need in a breast cancer patient.
2. To learn the different parts of a structured report using the BI-RADS system.
3. To learn how to integrate the information from various modalities in a report.

10:30 - 12:00

Room N/O

Joint Course of ESR and RSNA

(Radiological Society of North America)

MC 1225

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

Moderator:

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

A-353 10:30

A. Pancreatic cancer

F. Caseiro-Alves; Coimbra/PT

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-354 10:55

B. Kidney cancer

E.K. Fishman; Baltimore, MD/US

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.

A-355 11:20

C. Ovarian cancer

H. Hricak; New York, NY/US

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

10:30 - 12:00

Room Z

EuroAIM Session

Evidence-based radiology: why is evidence-based radiology crucial?

Moderators:

G.P. Krestin; Rotterdam/NL
F. Sardanelli; Milan/IT

A-356 10:30

Applying EBM to radiology - the EuroAIM project

F. Sardanelli; Milan/IT

During ECR 2010, the EuroAIM initiative promoted a European working group for Evidence-Based Radiology. A search on PubMed and EMBASE database using 12 terms identifying imaging modalities and their explosions was performed to retrieve secondary studies (systematic reviews/meta-analyses, cost-effective analyses, guidelines, and position papers) on both diagnostic imaging procedures (DIPs) and interventional therapeutic procedures (ITPs) published from January 2000 to May 2010. Imaging-guided needle biopsy procedures were included in DIPs. A total of 3,147 abstracts were initially found and evaluated. Primary studies, papers not concerning imaging procedures, and congress abstracts were discarded (n=1,699). The remaining 1,448 papers were classified as secondary studies on: DIPs performed by radiology/nuclear medicine specialists (R-DIPs=807; 56%); ITPs performed by radiologists (R-ITPs=45; 3%); the effect of a treatment using a DIP as an end-point (Treat-DIPs=195, 13%); DIPs also performed by non-radiology/nuclear medicine specialists (NR-DIPs=243; 17%); ITPs also performed by non-radiologists (NR-ITPs=158; 11%). The following ratios were calculated: (R-DIPs+R-ITPs)/(NR-DIPs+NR-ITPs)=852/401=2.12; R-DIPs/NR-DIPs=807/243=3.32; R-ITPs/NR-ITPs=45/158=0.28. From 2000 to 2005, the mean number of published secondary studies per year was 28.5 R-DIPs, 1.5 R-ITPs, 7.7 Treat-DIPs, 10.4 NR-DIPs, and 5.1 NR-ITPs; from 2006 to 2010, 41.7, 2.0, 10.5, 12.4, and 9.8, respectively. Secondary studies on R-DIPs and R-ITPs are relatively underrepresented in comparison with those concerning NR-DIPs and especially NR-ITPs. A delay of production of radiological secondary evidence negatively impacts on the challenge of an evidence-based demonstration of the clinical role of our discipline. The EuroAIM and the European EBR working group should make radiologists fully aware of this gap.

A-357 10:50

Secondary evidence for diagnostic imaging

L.M. Sconfienza; Milan/IT

A search on PubMed/EMBASE using 12 terms identifying imaging modalities and their explosions was performed to retrieve secondary studies (systematic reviews/meta-analyses, cost-effective analyses, guidelines, and position papers) published from January 2000 to May 2010 on diagnostic imaging procedures (DIPs), including imaging-guided needle biopsy procedures. A total of 2,944 abstracts were initially found and evaluated. Excluding congress abstracts, non-secondary studies and those not imaging-related, 1,245 papers, published with a rate of 120.5/year, were classified as studies on: DIPs performed by radiology/nuclear medicine specialists (R-DIPs=78.1/year), evaluation of a treatment using a DIP as an end-point (Treat-DIPs=18.9/year), DIPs also performed by non-radiology/nuclear medicine specialists (NR-DIPs=23.5/year). For the R-DIPs group, the mean number of studies/year according to the subspecialty was as follows: neuro/head-neck 19.5; gastrointestinal/abdominal 11.7; cardiovascular 10.9; breast 9.8; musculoskeletal 6.9; thoracic 5.7; pediatric 4.8; oncology (general) 4.2; urogenital 2.3; maternal/fetal 0.7; other 1.5; for Treat-DIPs, 5.3, 2.2, 1.5, 0.8, 3.1, 1.6, 0.9, 0.7, 0.2, 0.2, 2.4; for the NR-DIPs group, 9.1, 0.9, 6.7, 0.0, 0.1, 0.2, 0.7, 0.2, 1.1, 4.4, 0.3, respectively. One subspecialty (neuro/head-neck) has more than 20 studies/year, five have more than 10. About 20% of all studies concerns NR-DIPs, 23% excluding Treat-DIPs. Moreover, the role/number of radiologists in the authorship of radiological secondary studies as well as the publishing journal (general medicine, clinical specialty, imaging) should be considered. The EuroAIM EBR working group should encourage the diffusion of EBR culture and practice in order to fill the gap identified with this preliminary analysis.

A-358 11:10

Secondary evidence for interventional radiology

D. Vorwerk; Ingolstadt/DE

A search on PubMed/EMBASE using 12 terms identifying imaging modalities and their explosions was performed to retrieve secondary studies (systematic reviews/meta-analyses, cost-effective analyses, guidelines, and position papers) on imaging-guided interventional therapeutic procedures (ITPs) published from January 2000 to May 2010. A total of 1,902 abstracts were initially found and evaluated. Excluding congress abstracts, non-secondary studies, and those not imaging-related, secondary studies concerning diagnostic imaging procedures as well as those concerning imaging-guided needle biopsy procedures, 203 papers concerning ITPs were found, published with a rate of 19.6/year. Of these 203 studies, 45 (22%) were studies concerning ITPs performed by radiologists (R-ITPs=4.4/year), while 158 (78%) were studies concerning ITPs also performed by non-radiologists (NR-ITPs=15.3/year). The overall R-ITPs/NR-ITPs resulted 0.29. The mean number of studies/year per body district was as follows: neuro/head-neck, 1.8 (R-ITPs) and 0.4 (NR-ITPs); gastrointestinal/abdominal, 1.3 and 5.9; cardiovascular, 0.5 and 7.2; musculoskeletal 0.5 and 0.5; thoracic, 0.0 and 0.3; pediatric, 0.0, and 0.1; urogenital, 0.3 and 0.6; maternal/fetal, 0.0 and 0.2, respectively. For seven out of eight body districts (neuro/head-neck being the only exception), the number of studies for NR-ITPs is equal or greater than the number of studies for R-ITPs. These data show the under-representation of interventional radiology in terms of secondary evidence. To analyze whether this is due to the lack of primary studies or to the lack of systematic reviews and meta-analyses of existing primary studies is one of the aims of the EBR working group promoted by EuroAIM.

A-359 11:30

The American College of Radiology Imaging Network (ACRIN): twelve years of conducting trials of medical imaging

B.J. Hillman; Charlottesville, VA/US

The American College of Radiology Imaging Network (ACRIN) is a U.S.-based, National Cancer Institute (NCI)-funded network of institutions and individuals collaborating in the design, conduct, and analysis of scientifically rigorous clinical trials of diagnostic imaging and image-guided therapy. Since its inception in 1999, ACRIN has conducted over 40 trials focused on all applications of imaging: screening and early detection, diagnosis and staging, image-guided treatment, and response to treatment. An important early focus was the design of large screening trials that have had an important impact on medical practice. These include: the Digital Mammographic Imaging Screening Trial (DMIST), which showed the superiority of digital mammography for younger and perimenopausal women, as well as those with dense breasts; the National CT Colonography Trial (NCTCT), demonstrating the equivalence of CTC with colonoscopy; and the National Lung Screening Trial (NLST) which has preliminarily reported a 20% decrease in lung cancer-specific mortality associated with annual CT screening. ACRIN's current focuses include the assessment of emerging imaging biomarkers for the prediction of and monitoring of response to treatment and the extension of its activities to disease processes beyond cancer.

Discussion 11:50

12:15 - 12:45

Room A

Plenary Session

HL 3

Wilhelm Conrad Röntgen - Honorary Lecture

Presiding:

Y. Menu; Paris/FR

A-360 12:15

Detecting liver tumours: the search for the Holy Grail

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

For decades, abdominal imagers have focused on liver tumour detection and characterisation as their holy grail. Most general abdominal CT techniques aim to optimise liver mass lesion detection/characterisation, recognising it as (1) prevalent disease yet difficult to optimise and (2) one of few areas in abdomen where contrast material volumes and timing of scanning is critical. Despite being one of the most common topics of publication over the last 30 years in radiology, there is not concurrence among the radiology community or with clinical colleagues as to the best

imaging modality or technique for this problem. Increasing technological capabilities and knowledge of how to optimise CT/MR contrast utilisation provides better ways to characterise tumours than ever before such that key clinical specialties outside of radiology now recommend nonbiopsy imaging diagnosis of HCC to triage patient treatment. Radiologists must work extra diligently to learn the clinical issues, triage points and implications that are associated with specific clinical presentations and imaging findings. The perfect test that does not require cognitive interpretation of the constellation of imaging findings with integration of the patient clinical presentation to optimise patient care is not in our near future. This lecture emphasises historical advances in liver imaging and how data in the literature impacted patient care decisions in ways that may be different than expected from radiologists. An emphasis on pathologic-imaging correlation will be used to put apparent disparate published results in proper perspective to allow radiologists to meaningfully interact with clinical colleagues in determining optimal patient treatment.

Learning Objectives:

1. To understand the pathologic changes and imaging correlates in cirrhosis that lead to neoplastic development.
2. To gain an awareness of the key role of diagnostic imaging in triaging patients with cirrhosis and hepatocellular carcinoma among treatment options.
3. To better understand apparent disparate published results to allow radiologists to meaningfully interact with clinical colleagues in determining optimal patient treatment.

12:30 - 13:30

Room Z

The Beauty of Basic Knowledge: Interpretation of the Chest

Radiograph

MC 21D

Rounded lesion(s)

A-361 12:30

Rounded lesion(s)

J. Cáceres; Barcelona/ES (josecac@gmail.com)

Rounded lesions of the lung may be solitary or multiple. It is important to separate pulmonary from extra-pulmonary nodules, because the significance is different. Multiple pulmonary nodules are usually due to metastatic disease. In managing the solitary pulmonary nodule it is imperative to exclude pseudonodules due to skin or rib lesions and it is of the utmost importance comparing with previous studies.

Learning Objectives:

1. To understand the importance of rounded opacities.
2. To review the most frequent causes of rounded lesions.
3. To learn current imaging management of the solitary nodule.

14:00 - 15:30

Room A

Abdominal and Gastrointestinal

RC 1301

Abdominal MRI: protocols that work

Moderator:

S. Yarmenitis; Iraklion/GR

A-362 14:00

A. Liver

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

Liver MRI is undertaken to assess the liver parenchyma, vasculature, and biliary system. It is necessary to use a variety of unenhanced and contrast-enhanced MR pulse sequences to achieve lesion detection and characterisation. A set of T1-, T2-w and DWI sequences is now standard for lesion delineation and assessment of liver fat and iron content. In-phase and opposed-phase T1-w GRE images show focal or diffuse fatty infiltration and focal sparing. A fat-suppressed T2-w TSE sequence is robust and provides high tumour contrast, with 3.0 T units now allowing acquisition of isotropic 3D-TSE sequences. The quite popular T2-w half-Fourier single-shot TSE (e.g., HASTE) pulse sequences show anatomic detail (including bile ducts), but lack lesion contrast. In case of suspected iron overload (i.e., haemosiderosis and haemochromatosis) an additional T2*-w GRE is recommended. Acquisition of DWI

pulse sequences with low and high b-values improves lesion detection. Administration of a contrast agent is mandatory in liver MRI, because many focal lesions are only highlighted by enhanced pulse sequences. Dynamic gadolinium-enhanced T1-w GRE pulse (preferably 3D interpolated) sequences are versatile and useful for lesion detection and characterisation as well as assessment of the vasculature (i.e., hepatic artery aneurysms, Budd-Chiari-S., portal vein thrombosis, etc). Liver-specific contrast agents render excellent results for detection and differentiation between metastasis and haemangioma or FNH. Manganese- or superparamagnetic iron oxide liver-specific contrast agents can be administered in patients with renal insufficiency. The choice of contrast material should be based on availability, the specific clinical question, and renal function of the patient.

Learning Objectives:

1. To learn about the standard basic pulse sequences for liver imaging and the critical technical parameters.
2. To appreciate the diagnostic value of non-specific gadolinium chelates and different liver-specific contrast agents as well as optional sequences, depending on the clinical question.
3. To learn how to optimise pulse sequences and use advanced protocols including 'knife-edge' sequences and functional/structural imaging.

A-363 14:30

B. Small bowel and colon

N. Papanikolaou; Iraklion/GR (nickolas.papanikolaou@gmail.com)

The advent of powerful gradient systems resulted in substantial improvement of image quality in ultrafast magnetic resonance (MR) imaging and therefore novel clinical applications emerged including gastrointestinal tract imaging. Within this context, MR enteroclysis and MR colonography were developed, providing luminal, transmural and extramural diagnostic information at the same imaging session. Two different protocols have been developed for imaging the small bowel with MR. These include MR follow-through and MR enteroclysis. MR follow-through is based on the oral ingestion of an adequate amount of contrast agent and acquisition of consecutive sequences. In a clinical setting, sufficient luminal distention that guarantees accurate individual lesion detection can be achieved by MR enteroclysis. Two MR colonography protocols have been proposed. According to the first, termed as 'bright lumen MRC', a gadolinium-spiked water solution is administered endorectally to the patient who has previously undergone colonic cleansing to distend the colon, resulting in a homogeneous high-signal intensity on heavily T1-weighted 3D gradient echo images. Polyps are demonstrated as filling defects while air bubbles can be differentiated by performing the examination in both supine and prone positions. According to the second approach, termed as 'dark lumen MRC', dense barium or tapped water is used to distend the colon in conjunction with post-gadolinium 3D gradient echo with fat-saturation sequences. The colonic wall and the corresponding polyps exhibit high signal intensity as a result of gadolinium uptake while the colonic lumen presents with low signal intensity.

Learning Objectives:

1. To review the basic technical aspects of MR enteroclysis and MR colonography.
2. To review MR enteroclysis imaging features of Crohn's disease.
3. To understand the use of optional sequences depending on the clinical question in patients with Crohn's disease.
4. To recognise the potential of MR colonography in the era of CT colonography and propose advanced imaging protocols.

A-364 15:00

C. Pancreas and bile ducts

C. Matos; Brussels/BE (cmatos@ulb.ac.be)

MR imaging of the pancreas and bile ducts relies upon a combination of T2-w and T1-w strategies in order to safely acquire anatomic, cross-sectional and functional information. Tissue-imaging strategies include free breathing T2-w imaging (obtained with echo-train spin-echo sequences with or without fat saturation) and breath-hold 3D-gradient echo T1-w imaging (obtained with fat saturation) without gadolinium and in the capillary phase and in the interstitial phase post-gadolinium. This combination is valuable in the assessment of the full spectrum of pancreatic diseases and malignant bile duct obstruction. Hardware improvements (gradients) and the advent of more sophisticated phased-array coils and parallel imaging capabilities in modern MR scanners allowed to increase the spatial and temporal resolution of "conventional" T2-w and T1-w sequences. Furthermore, it provided the possibility of adding high-b-value diffusion weighted imaging (DWI) to our routine protocol in order to increase the sensitivity of MRI in detecting malignant and inflammatory diseases. To obtain conventional MRCP imaging thick-slab heavily T2-w TSE sequences or 3D heavily T2-w TSE sequences may be used. Advantages and limitations of both sequences will be underlined. Functional bile duct imaging is obtained

using contrast agents that are taken up by hepatocytes and excreted through the biliary system in combination with volumetric T1-w sequences. We use this technique in post-operative complications and to elucidate complex biliary anatomy. Functional imaging of the pancreas is obtained by combining MRCP along with hormonal stimulation with secretin. In addition, secretin improves anatomic delineation and allows MRI quantification of fluid production by the exocrine pancreas.

Learning Objectives:

1. To understand the basic sequences (with technical details) for MRI/MRCP of the pancreas and bile ducts.
2. To learn about the use of optional sequences related to special clinical situations.
3. To learn about advanced imaging protocols for MRI/MRCP of the pancreas and bile ducts concerning functional/structural imaging.

14:00 - 15:30

Room B

Interactive Teaching Session

E³ 1320

Common radiological problems: cardiovascular

A-365 14:00

A. Looking at the heart in chest x-rays

J. Andreu; Barcelona/ES (jandreas@gmail.com)

Despite the advance of cross-sectional techniques, the chest radiograph remains a basic tool for the initial approach to heart diseases. In this lecture we will present our current approach to evaluate cardiac pathology in conventional radiography illustrating it with selected cases. The basic approach consists of seven steps, evaluating the size and shape of the cardiac silhouette, cardiac calcifications, pulmonary circulation and lung changes, great vessels and implanted devices, all of them correlated with the clinical findings.

Learning Objectives:

1. To learn how to detect and characterise cardiac abnormalities in the chest radiograph.
2. To learn how to detect and characterise cardiac abnormalities on chest CT.
3. To learn the limitations of the interpretation of cardiac abnormalities on un-gated chest CT.
4. To learn when further evaluation is required.

A-366 14:45

B. Looking at the heart in chest CT

F. Laurent; Pessac/FR (francois.laurent@chu-bordeaux.fr)

Looking at the heart on a chest film may be considered at a first glance as wasting time since, today, many other techniques are available today to offer an impressive luxury details of the morphological and functional evaluation of heart. Nevertheless, the chest film remains often the first modality performed in many situations in which symptoms can be both from pulmonary or cardiac origin and then, careful analysis of heart may avoid rough mistakes in patient management. Acquired and congenital pericardial or cardiac abnormalities may be responsible for a deformity of the cardiac silhouette and lead to explore the patient by a chest CT. CT with fast scanning capabilities can acquire images of the thorax with reduced cardiac motion artefacts, improving the evaluation of the heart in the course of a thoracic CT. Unexpected findings of cardiac structures on both unenhanced and enhanced acquisition can dramatically influence the patient's clinical management. In many situations, a chest CT is performed without cardiac gating and it may be necessary to complement the initial examination by a gated acquisition to provide a more dedicated analysis. The normal appearance of cardiac structures and the most common cardiac abnormalities should be known by all the radiologists. Various conditions such as idiopathic and acquired cardiomyopathy, ischaemic heart disease, valvular dysfunction can be identified even on non-gated scans. Pulmonary diseases may also involve pericardium and cardiac structures and this should be clearly identified.

Learning Objectives:

1. To learn how to detect and characterise cardiac abnormalities in the chest radiograph.
2. To learn how to detect and characterise cardiac abnormalities on chest CT.
3. To learn the limitations of the interpretation of cardiac abnormalities on un-gated chest CT.
4. To learn when further evaluation is required.

14:00 - 15:30

Room C

CLICK (Clinical Lessons for Imaging Core Knowledge): Common

Clinical Cases

CC 1318

Fever of unknown origin

Moderator:

P.A. Grenier; Paris/FR

A-367 14:00

A. Clinical considerations

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

Patient transport into the radiology department, contact to other potentially infectious persons, and things such as breath-holding are reasonable burdens and dangers to immunocompromised patients. When searching the focus of fever, imaging should help to identify an affected organ system in order to eventually guide invasive procedures to identify underlying micro-organism or non-infectious disease. Equally relevant is the exclusion of its involvement with a reasonable specificity. Depending on local epidemiology, organ system, and the clinical signs and symptoms, suspected differential diagnosis can be derived from image patterns. Some of these diagnoses might be exclusion diagnosis, others might require invasive procedures including time consuming and costly analysis to be verified. Invasive procedures, however, require adequate hemostasis, which is usually not available for a substantial duration due to pancytopenia in patients who underwent chemotherapy. If imaging fails to derive the underlying disease confident and conclusively in a fast way, clinicians might need to treat on an empirical basis. Empirical treatment plays a major role in immunocompromised or severely ill patients at risk, because mortality rises within hours of untreated disease. On the other hand, empiric treatment causes relevant toxicity and substantial costs, while imaging might become cost-effective.

Learning Objectives:

1. To learn more about the clinical conditions causing fever without an apparent origin.
2. To be informed about the clinician's way of thinking in the process of differential diagnosis.
3. To become familiar with the potential role of imaging in the establishment of the final diagnosis and planning of therapy.

A-368 14:30

B. Imaging techniques and typical findings

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

Diagnosis of fever of unknown origin (FUO) is a major challenge for internists. The spectrum of disease includes infections (28%), inflammatory diseases (21%), malignancies (17%), and "no diagnosis" (19%). Deep vein thrombosis (3%) and temporal arteritis in the elderly (16%-17%) are important considerations. Investigation of patients with FUO usually includes clinical and standard biological tests which give numerous clues. Imaging procedures depend on objectives and various imaging investigations should be organised in strategies. Early identification of the best tissue to be the site of biopsy is one of the most decisive procedures. First line imaging studies usually include chest radiography, abdomen ultrasonography and contrast enhanced CT of the thorax abdomen pelvis in order to disclose common etiologies such as infections (tuberculosis, Pneumocystis carinii pneumonia, abdomen abscesses and pelvic abscesses), malignancies (lymphoma, metastatic cancers, renal cell carcinoma and pancreatic carcinoma), autoimmune conditions (Behçet's disease) and miscellaneous (sarcoïdosis). Vein sonography is useful for detecting deep venous thrombosis. Nevertheless, there is a need for more complex techniques if this strategy fails. Second line techniques include MRI and 18-FDG PET scan as (18)F-FDG accumulates in malignant tissues, at the sites of infection and inflammation and in autoimmune and granulomatous diseases. In some studies, the PET scan contributed to the final diagnosis in 25%-69% of the patients.

Learning Objectives:

1. To learn about the available imaging modalities to be used for the evaluation of patients with fever of unknown origin.
2. To become familiar with the technical imaging considerations and the proper diagnostic algorithm.
3. To know more about the typical imaging findings.

A-369 15:00

C. Interactive case discussion

W. Curati-Alasonatti¹, G.H. Mostbeck²; ¹Stammore/UK, ²Vienna/AT

The cases presented during this part of the session illustrate the three principles the clinician and the radiologist should be guided by: 1. Starting with a clinical problem, choose the best imaging modality as part of the investigative process to establish a differential diagnosis. 2. Study the imaging documents acquired and identify the relevant findings leading to the diagnosis or further investigations. 3. Avoid performing multiple imaging modalities, comply with ALARA directives and keep the cost to a minimum: a variation of ALARA. We will illustrate the compliance with these principles as, in the clinical context of a FUO, strategy, individual knowledge and multidisciplinary team-work are critical to the success of the algorithmic approach. Thirty years ago a seminal textbook appeared in the radiological literature: "Critical Diagnostic Pathways in Radiology - An Algorithmic Approach", edited by Ronald Eisenberg and John Amberg and published by J.B. Lippincott (1981). This textbook was published at a time when a spectrum of imaging modalities was becoming well established and critical guidance for their use - and not abuse - was desperately needed by the radiologists of my generation.

Learning Objectives:

1. To introduce typical cases illustrating the role of imaging modalities in the differential diagnosis of patients with fever of unknown origin.
2. To motivate the audience by the use of voting pads to be involved in the diagnostic process.
3. To highlight the conclusion that may be drawn on the basis of the discussed cases.

14:00 - 15:30

Room D1

KISS (Keep It Simple and Straightforward): Musculoskeletal MRI

CC 1316

The lumbar spine

Moderator:

M. Epermane; Riga/LV

A-370 14:00

A. How I do it

P. Richards; Stoke-on-Trent/UK (paula.richards@uhns.nhs.uk)

1. Always report in the same logical manner for each examination, which imprints normal pathology 'jumps out at one'. 2. Evaluate all images before looking at the clinical information to prevent bias and satisfaction of search. 3. Review every scout image. Scoliosis transitional vertebrae and pseudoarthrosis become more obvious on coronals. Single kidneys, hydronephrosis and renal tumours may explain 'back pain', especially if there are mets. 4. Review any x-rays or old IVUs, remembering that abdominal x-rays show the spine. 5. Indications; summarise the reason for the scan. Think of the differential diagnosis to exclude. 6. Technique; allows one to check the levels scanned. Be sure there has been no area missed between 2 studies. 7. Report vertebral alignment and disc height. 8. MRI just like an x-ray, i.e. there is normal alignment from D10 to S3. 9. Start at the far sagittals and look at the nerve roots in the 'key hole', the pars and facets. 10. Determine the worst abnormality on the axial and report the most significant findings first. Check the facets at each level. 11. Have a checklist of normals at the end; 'the bone marrow, cord and CSF return normal signal. The conus ends normally with no pars or metastasis'. 12. Opinion: explain what you think is causing the patient's symptoms. Assume this is the only part read, so if there is only one kidney reiterate here. The lecture will illustrate additional information on scout images and benefits of coronal images.

Learning Objectives:

1. To understand the influences of patient positioning, scan parameters and magnet/coil technology on image quality.
2. To learn how to optimise scan protocols to maximise patient throughput without compromising diagnostic quality.
3. To recognise how and when to modify scan protocols to answer specific clinical questions.

A-371 14:25

B. Normal variants and pitfalls

B. Tins; Oswestry/UK (Bernhard.Tins@rjh.nhs.uk)

The lumbar spine undergoes morphological changes with age. Normal appearances and relevant normal variants will be discussed. In particular, the morphological change from an almost round intervertebral disc in newborns with high water sig-

nal in discs and vertebrae to the adult shape and signal pattern will be reviewed. The normal pattern of unfused bony segments and apophyses in the child and fusion to the mature adult form will be reviewed. Normal variants such as persistent segmentation/non-union leading to limbus vertebrae and dysraphism will be reviewed. Intervertebral discs, vertebral body endplates, posterior elements and bone marrow show a wide degree of variation and the borderland of normal variant versus pathological abnormality is often difficult to navigate. Common borderland findings such as Schmorl's nodes versus Scheuermann's disease will be discussed. Transitional vertebrae as such are normal but incomplete transitional changes are associated with clinical symptoms. Even without associated pathological changes the terminology of transitional vertebrae is a common pitfall. Simple coping strategies will be reviewed. Various imaging artefacts can have an influence on image interpretation though lumbar spine MR imaging is more resistant to these than imaging of the cervical and thoracic spine.

Learning Objectives:

1. To become familiar with the normal anatomy.
2. To be able to identify normal variants.
3. To appreciate the range of pitfalls that may simulate pathology.

A-372 14:50

C. Identifying and reporting abnormal findings

A. Stähler; Munich/DE (info@radiologie-muenchen-harlachung.de)

Most frequent pathologies encountered on lumbar spine examinations are caused by degenerative disc disease and include: Disc herniation with nerve root entrapment, activated erosive intervertebral osteochondrosis from instability, spinal canal stenosis, recess stenosis and neuroforamen stenosis. Disc herniation is defined as dislocation of nucleus pulposus material through a defect of the annulus fibrosus (annular tear) beyond the outer part of the annulus fibrosus. The concept of contained disc versus non-contained disc describes whether there is disc material dislocated into the epidural space or not. The terms intradiscal disc hernia, bulging or protrusion of disc material have to be differentiated. Segmental instability plays a causative role in the development of activated erosive intervertebral osteochondrosis, which is accompanied by band-like/hemispherical bone edema in the adjacent vertebrae and/or band-like vascularity in the disc space at the disco-vertebral junction. Bony changes and spurs at the endplates are absent or only moderately developed. Spinal stenosis may be congenital or acquired by degenerative constriction of the spinal canal leading to spinal cord, nerve root or cauda equina compression. Measurement of the bony spinal does not help in the determination of clinical significance of spinal stenosis. The required space of the nerve roots to pass unaffected through the spinal canal increases when ascending the lumbar spine levels. Severity of spinal canal stenosis is related to the residual subarachnoid space, which is present on axial T2w images. Imaging findings that correlate with the severity and clinical relevance of spinal canal stenosis are cauda redundancy and swelling/edema of nerve roots.

Learning Objectives:

1. To review the imaging appearances of common abnormalities.
2. To understand the use of terminology to describe pathological findings.
3. To learn how to structure a radiological report to ensure clarity and brevity.

14:00 - 15:30

Room D2

Interventional Radiology

RC 1309

Infection and percutaneous drainage

Moderator:

M. Bezzi; Rome/IT

A-373 14:00

A. Empyema

A. Keeling; Dublin/IE (aoifekeeling@hotmail.com)

At the end of this presentation one should be familiar with the: (1) appearances of empyema on each imaging modality, (2) clinical indications for percutaneous drainage, (3) technique and image guidance methods employed for percutaneous chest catheter insertion, (4) potential procedure-related complications and their management, (5) role of urokinase/TPA and (6) existing literature on image-guided chest drainage success rates. Empyema represents a common medical problem with a mortality of up to 20%. Difficulty in differentiating empyema from simple pleural effusion with imaging alone often occurs. Needle aspiration with or without formal chest drainage may be necessary in many circumstances. Traditionally, large bore

chest drains (28-30 Fr) with underwater seals achieved decompression of pleural fluid collections. Recent literature suggests small bore drains may be adequate, with image guidance playing an important role. Pleural space anatomy, including fissural locations will be revised. Aetiology of transudates, exudates and empyemas, along with typical clinical presenting features are outlined. Various examples of plain film, ultrasound, multi-detector computed tomography and MRI appearances of pleural collections and their aetiologies are presented. Selection of patients, image guidance methods, catheter size, insertion technique, pitfalls and procedure complications are discussed. Importance of physician-radiologist liaison with respect to catheter management and catheter dwell times is emphasised. Pleural space fluid collections are common clinical entities that radiologists can accurately diagnose as well as successfully treat. Overview of aetiology, radiological appearances and method of image-guided drainage of infected pleural fluid collections is provided.

Learning Objectives:

1. To learn about imaging strategies and indications for drainage.
2. To review technical aspects of catheter drainage.
3. To understand the use of urokinase.
4. To appreciate the results of percutaneous drainage.

A-374 14:30

B. Abdominal abscess

V. [Válek](mailto:vlvarek@med.muni.cz); Brno/CZ (vlvarek@med.muni.cz)

With new antimicrobial agents, advances in diagnostic imaging and imaging-guided percutaneous procedures, the management of pyogenic liver abscess has significantly improved. The advantages of the percutaneous approach include a marked decrease in the invasiveness and cost of abscess drainage. The classic triad of fever, upper right quadrant pain or fullness, and jaundice is rarely seen nowadays. Possible image-based exclusionary criteria for drainage include abscess size of less than 3 cm in diameter, fluid attenuation of more than 40 HU, absence of contrast material-enhanced margins, absence of trapped air in a fluid collection, absence of free intraperitoneal air, and presence of air without fluid in the abscess cavity. The most important is the size of less than 3 cm. Possible clinical exclusionary criteria include normal white blood cell count, normal temperature, normal blood pressure, absence of peritoneal signs, lack of relevant medical history and a do-not-resuscitate code status. Indications for tacking a percutaneous approach to abdominal abscess drainage are the signs of inflammation and fluid collection (abscess) larger than 3 cm. Contraindications are today only relative. Percutaneous needle aspiration or catheter drainage guided by CT or sonography has become the first line treatment for abdominal abscess.

Learning Objectives:

1. To understand imaging strategies and indications for drainage.
2. To learn about image guidance, route planning and catheter placement.
3. To review follow-up strategies and results.

A-375 15:00

C. Pelvic abscess

M.A. [Funovics](mailto:martin.funovics@meduniwien.ac.at); Vienna/AT (martin.funovics@meduniwien.ac.at)

Pelvic abscess drainage may employ more difficult access routes due to anatomic restrictions. The procedure may carry a higher risk of complications compared to simple abdominal drainage. To optimise patient preparation, correction of coagulation deficits, optimisation of antibiotic treatment, and sedation or anesthesia may be needed. The usual access routes for deep pelvic abscesses are the anterolateral and the posterior transgluteal approach. In selected cases, a transvaginal or transrectal approach may be the safer and more efficient option. Depending on the viscosity of the drained fluid, the presence of necrotic solid tissue and gas, different sizes of drainage material may be needed. Do not hesitate to employ large drainage catheters if indicated. An overview of the available material will be given. Intestinal laceration is a major complication which can be managed percutaneously in selected circumstances. Often, the weakest part of percutaneous drainage is the postinterventional management. It is advocated that the management is actively guided by the interventionalist who ensures that the drainage is properly handled, rinsed, and cleaned, that follow-up imaging is performed at the right intervals, and who is also responsible for indicating drain removal.

Learning Objectives:

1. To understand imaging strategies and indications for drainage.
2. To learn about transgluteal, endocavitary and other routes of drainage.
3. To review results and follow-up strategies.

14:00 - 15:30

Room E1

Musculoskeletal

RC 1310

Postoperative imaging of the lower extremity

Moderator:

F. [Aparisi](mailto:aparisi@valencia.es); Valencia/ES

A-376 14:00

A. Hip

S.J. [Eustace](mailto:seustace@iol.ie); Dublin/IE (seustace@iol.ie)

This talk will review an approach to imaging complications of total hip replacements. The talk will briefly review surgical techniques and types of prostheses. The talk will subsequently review early and late complications of prostheses and focus on the integrated use of all modalities including radiographs, aspiration arthrography, scintigraphy and MRI in achieving a diagnosis.

Learning Objectives:

1. To understand the principles of basic surgical techniques.
2. To review technical aspects of different modalities for imaging post-surgical patients.
3. To recognise normal imaging findings after surgery and how to differentiate them from pathological ones.
4. To become familiar with the main complications after hip surgery.

A-377 14:30

B. Knee

K. [Verstraete](mailto:koenraad.verstraete@ugent.be); Gent/BE (koenraad.verstraete@ugent.be)

There are many surgical techniques to repair meniscal tear, focal cartilage defect, cruciate ligament tear, malalignment, fracture, osteoarthritis, etc. Conventional radiography, CT-scan, CT-arthrography and MRI play an important role in evaluation of the knee after surgery or arthroscopy. Indications for postoperative imaging are infection, persistent pain and dysfunction. Every radiologist should be familiar with "normal" imaging findings after arthroscopy, osteosynthesis, ligament reconstruction, osteotomy, knee prosthesis and meniscal or (osteo)chondral repair, but also recognise the main complications after knee surgery or arthroscopy. Orthopaedic hardware is usually evaluated on plain radiography or CT, and only a relative contraindication for MRI. Microscopic metal artefacts and fibrotic scarring are frequently seen along the course of the instrumentation tract. After partial meniscectomy, an obtuse angle at the apex of the meniscus and increased signal intensity of the remnant part of the meniscus are normal findings, whereas fibrillation and recurrent tear may explain the complaints of the patient. Various intra- and extra-articular reconstructive procedures exist for anterior and posterior cruciate ligament reconstruction. Besides the neoligament, an osseous tunnel, screws and metal artefacts are also visible. Postoperative findings of the extensor apparatus include a thickened patellar tendon, focal myxoid degeneration, fibrosis and focal defects, e.g. after harvesting tendon tissue for ACL reconstruction or after release of the lateral patellar retinaculum for 'unstable' patella. Accelerated osteoarthritis may be a late postoperative finding. MRI very well depicts incorporation and alignment of osteochondral auto- or allografts, and the position, morphology and integrity of the meniscus after repair or transplantation.

Learning Objectives:

1. To understand the principles of basic surgical techniques.
2. To review technical aspects of different modalities for imaging post-surgical patients.
3. To recognise normal imaging findings after surgery and how to differentiate them from pathological ones.
4. To become familiar with the main complications after knee surgery.

A-378 15:00

C. Ankle

C. [Masciocchi](mailto:carlo.masciocchi@cc.univaq.it); L'Aquila/IT (carlo.masciocchi@cc.univaq.it)

To evaluate postsurgical patients it is important to know the primary clinical diagnosis, the surgical treatment, the interval since surgery, and patients' current clinical symptoms. Radiography is the most common imaging modality to evaluate the postoperative ankle, particularly in traumatic cases; after reduction and fixation of a fracture or dislocation it is generally carried out as routine. Ultrasonography is highly sensitive and specific in postoperative tendon assessment, thanks to the superb resolution, and the opportunity for dynamic evaluation of tendon integrity.

MRI has rapidly become important in post-operative assessment of the ankle, because it provides high soft-tissue contrast, multiplanar capability and osseous structures visualisation. It shows signal changes of ligaments and tendons, hypointense subchondral sclerosis, subchondral bone marrow oedema, joint effusion, capsular thickening, fibrosis, and synovitis. MRI has also an important role in the evaluation of post-surgery ankle pain due to impingement syndrome and in the hindfoot chronic instability related to postoperated sinus tarsi syndrome; it demonstrates the anatomy of sinus tarsi, chronic synovitis and nonspecific inflammatory changes, synovial cysts, fibrosis and subtalar joint effusion. It is important also in the follow-up of tumours and tumour-like conditions of bone and soft tissues after surgery. Computed tomography is the most valuable method to define the osseous anatomy of the postoperative ankle, so it is important in the follow-up of the operated osteochondral lesions of the talus. CT allows the evaluation of irregularities or degenerative changes, and progressive degenerative arthritis; however, CT usually fails to evaluate soft tissue's ankle lesion.

Learning Objectives:

1. To understand the principles of basic surgical techniques.
2. To review technical aspects of different modalities for imaging post-surgical patients.
3. To recognise normal imaging findings after surgery and how to differentiate them from pathological ones.
4. To become familiar with the main complications after ankle surgery.

14:00 - 15:30

Room E2

Chest

RC 1304

When CT sees both the heart and the lungs

Moderator:

L. Bonomo; Rome/IT

A-379 14:00

Chairman's introduction

L. Bonomo; Rome/IT (lbonomo@rm.unicatt.it)

The development of subsecond MDCT scanners with high temporal and spatial resolution has significantly reduced scanning times and now it is possible to have very good quality images of the heart during routine chest CT examinations. Therefore, the importance of looking at the heart and pulmonary vessels on a CT scan performed for non-cardiac reasons will be emphasised. Anatomic cardiac details that every radiologist should know will be discussed in the first talk; the presentation is aimed mainly at the non-cardiac radiologist. It will review normal cardiac anatomic details, as routinely encountered on modern multi-detector CT studies. It is now possible to delineate much of the intracardiac anatomy on a contrast enhanced study and significant pathology may also be evident on non-enhanced CT examinations. Important incidental findings and their clinical relevance will be discussed in the second talk. Unexpectedly, cardiac abnormalities may be diagnosed when lung disease is clinically suspected and vice versa; the focus of this presentation will be the comprehensive evaluation of lung and heart/large vessels diseases. The strong correlation existing between pressure in the pulmonary artery system and dilatation of the pulmonary trunk and central branches will be discussed in the last talk. CT is considered more useful than echocardiography because it can depict the cardiac structures in all patients including those with extensive parenchymal abnormalities. At the end of the presentations we should try to answer the question about the routine reporting of cardiovascular findings on CT scan of the chest.

A-380 14:05

A. Anatomic cardiac details that every radiologist should know

S.P.G. Padley; London/UK (s.padley@ic.ac.uk)

This presentation is aimed at the non-cardiac radiologist. It will review normal cardiac anatomic detail, as routinely encountered on modern multi-detector CT studies. It is now possible to delineate much of the intracardiac anatomy on a contrast enhanced study, and significant pathology may also be evident on non-enhanced CT examinations. This study will primarily review normal cardiac anatomy, including cardiac chambers, valves and coronary vessels. The typical radiological appearances of innocent incidental intra-pericardial abnormalities will then be reviewed. Important incidental pathology will be discussed in the next talk.

Learning Objectives:

1. To appreciate the importance of looking at the heart on CT scans of the chest.
2. To review the normal appearance of cardiac structures that can be easily identified on CT scans of the chest.
3. To understand key imaging findings.

A-381 14:28

B. Incidental findings and their clinical relevance

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

Chest CT and MRI are commonly performed to evaluate patients with acute chest pain. A number of imaging techniques are available that may cover the entire chest, including the cardiovascular system. The radiologist will encounter more and more cardiovascular disease that was not visible with ungated CT and MRI techniques. The differential diagnosis of acute chest pain may include over 30 possible diagnoses, a substantial number related to cardiovascular disease. It is important to recognise chronic and acute coronary disease, myocardial infarction and its complications, left ventricular function, pericardial disease, atrial disease and large vessel disease. Case material will be presented and discussed using both CT and MRI techniques to illustrate the spectrum of usual and more unusual cardiovascular pathology that should be considered in the differential diagnosis of unexplained chest pain.

Learning Objectives:

1. To become familiar with cardiac anomalies that can be identified on CT scans of the chest.
2. To understand the clinical value of cardiac anomalies incidentally detected on CT scans of the chest.
3. To learn how to manage and report incidental cardiac findings to the referring clinician.

A-382 14:51

C. Pulmonary hypertension and right ventricle function

M. Rémy-Jardin, F. Pontana, A.-L. Hachulla, J. Rémy; Lille/FR (martine.remy@chru-lille.fr)

Pulmonary hypertension (PHT) remains a disease difficult to diagnose because the clinical findings are nonspecific, often leading to a delayed diagnosis. Once recognised, it is necessary to determine the underlying cause and to estimate the severity of pulmonary hypertension. Among the noninvasive methods of assessment of PHT, CT angiography (CTA) now plays an important role in the diagnosis and post-therapeutic management of PHT. Numerous recent technological advances of multidetector-row CT technology (MDCT) have reinforced the clinical impact of this technology by introducing new tools for the morphological evaluation of small-sized pulmonary arteries and pulmonary capillaries, the latter being accessible with dual energy CT and often referred to as pulmonary "perfusion". The role of CT now also includes the possibility to investigate the presence of PHT on the basis of functional parameters, such as the distensibility of the pulmonary arterial wall, and to integrate cardiac functional information, with great interest towards right ventricular function. The major clinical impact of these new scanning modes is that morphology and function can be obtained from the same data set, with no restriction on the diagnostic performance of high-resolution CT angiographic images. The purpose of this lecture is to review these new trends in imaging of PHT and estimating right ventricular function through practical clinical situations, including the most common causes of PHT.

Learning Objectives:

1. To review the normal appearance of pulmonary vessels and right ventricle on CT scans of the chest.
2. To learn about CT findings indicative of pulmonary hypertension in comparison with other imaging modalities.
3. To understand how to evaluate the right ventricle function.

Panel discussion:

Ready for routine reporting of cardiovascular findings on CT scans of the chest? 15:14

CT scans of the chest are usually performed and reported as if the lungs were the only organs in the thoracic cage. However, the heart and pulmonary arteries can show significant abnormalities either as associated findings of the parenchymal disease or as incidental findings. So the recommendation is: do not forget the heart and pulmonary vessels when reporting a CT scan of the chest.

14:00 - 15:30

Room F1

Special Focus Session

SF 13

Quantifying liver fat, inflammation and fibrosis: routine or research?

Moderator:

C.B. Sirlin; San Diego, CA/US

A-383 14:00

Chairman's introduction

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

Liver fat, inflammation, and fibrosis are important pathological features in patients with diffuse liver disease. The clinical gold standard for assessing these features is liver biopsy. Due to its invasiveness and sampling variability, however, liver biopsy is suboptimal for screening, monitoring, and clinical research. There is, therefore, a need to develop biomarkers to assess liver fat, inflammation, and fibrosis non-invasively. In recent years, many quantitative imaging techniques have been developed, refined, tested, and made available. The question becomes: are these techniques ready for routine clinical use or are they most appropriate for research? In this special focus question, we will begin with a brief overview of diffuse liver disease and discuss basic concepts of biomarker validation and qualification. Dr. Reeder then will discuss conventional and state-of-the-art imaging-based biomarkers of liver fat. Dr. Cobbold will discuss the current status of non-invasive biomarkers for liver inflammation. Dr. Van Beers will discuss ultrasound- and MR-based biomarkers of liver fibrosis, with emphasis on techniques such as transient elastography and MR elastography that measure visco-elastic properties of liver tissue. We will conclude with a panel discussion asking the question: are the repeatability, reproducibility, and robustness of the non-invasive biomarkers presented in this session adequate for routine clinical implementation?

Session Objectives:

1. To review the clinical importance of diffuse liver disease.
2. To understand that key features of diffuse liver disease include fat accumulation, inflammation, and fibrosis.
3. To understand the need for non-invasive biomarkers to assess fat, inflammation, and fibrosis.
4. To review basic concepts in biomarker validation and qualification.

A-384 14:10

Quantification of liver fat

S.B. Reeder; Madison, WI/US (sreeder@wisc.edu)

Intracellular deposition of fat within hepatocytes (steatosis) is a common condition of the liver. Fat is the histological hallmark of non-alcoholic fatty liver disease (NAFLD) but also may occur with alcohol abuse, viral hepatitis, HIV and genetic lipodystrophies, and chemotherapy. NAFLD alone afflicts an estimated 20-80 million in the US and is a rapidly growing condition in other Western societies, paralleling the expanding epidemics of obesity and diabetes type II. This talk will review the clinical, pathogenic and histological features of liver fat, including an overview of fatty liver disease and diseases where fat is an important disease feature. Next, it will review the current use and limitations of non-targeted biopsy in diffuse liver disease, and why quantitative non-invasive biomarkers of liver fat and iron would be beneficial. Currently available conventional magnetic resonance imaging techniques that attempt to detect and quantify liver fat will then be discussed, as well as known confounding factors that corrupt the ability of conventional methods to quantify fat. This lecture will then describe emerging quantitative imaging methods for accurate and precise quantification of liver fat, and the advantages offered by these methods address in comparison with conventional methods. Finally, remaining challenges and unsolved problems for quantifying liver fat will be discussed.

Learning Objectives:

1. To review clinical, histological, and pathogenic features of liver fat.
2. To review conventional techniques for detecting and qualitatively assessing liver fat.
3. To consolidate knowledge of advanced techniques for quantifying liver fat.
4. To be aware of current gaps in knowledge about quantification of liver fat and learn about future directions.

A-385 14:32

Quantification of liver inflammation

J.F.L. Cobbold; London/UK (j.cobbold@imperial.ac.uk)

Liver inflammation, or hepatitis, may be acute or chronic and occurs as a result of one or more hepatocellular insults (including viral, metabolic and toxic causes) leading to a pro-inflammatory cytokine response, oxidative stress, hepatocellular damage, necrosis, apoptosis and inflammatory cell infiltration. Hepatic stellate cell activation and net deposition of disordered extracellular matrix (fibrosis) may occur in chronic liver disease. Histological scoring systems for the assessment of chronic liver disease include the assessment of inflammation, while in acute hepatitis, liver biopsy is rarely indicated. Histological scoring systems rely on identification of features producing scores which are categorical in nature and cannot be considered truly quantitative. Serum aminotransferase values are conventionally used for the routine assessment of hepatic inflammation with limitations. Conventional ultrasound demonstrates characteristic appearances in acute and chronic hepatitis, but is unable to quantify inflammation. When considering the non-invasive assessment of chronic liver disease, interpretation of aminotransferase values is less clear and conventional imaging techniques (MRI, CT and ultrasound) are poor discriminators of hepatic inflammation. Liver stiffness, measured by transient elastography, is predominantly influenced by fibrosis, but the effect of inflammation may substantially affect values, with implications for clinical practice. Predominantly research-based techniques show promise, including contrast-enhanced ultrasound, proton and phosphorus-31 MR spectroscopy and diffusion-weighted imaging. Serum aminotransferase values are a useful and sensitive tool in clinical practice with well-described limitations. Radiological-pathological correlations have demonstrated that inflammatory processes affect the output from a number of techniques, yet the challenge remains to find clinically relevant and specific markers of liver inflammation.

Learning Objectives:

1. To review clinical, histological, and pathogenic features of liver inflammation.
2. To review conventional techniques for detecting and qualitatively assessing liver inflammation.
3. To consolidate knowledge of advanced techniques for quantifying liver inflammation.
4. To be aware of current gaps in knowledge about non-invasive quantification of liver inflammation and learn about future directions.

A-386 14:54

Quantification of liver fibrosis

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

Fibrosis is a non-specific healing process that occurs in all chronic insults of the liver. Fibrosis staging is based on semi-quantitative histopathological scores obtained at liver biopsy. However, biopsy is invasive and the results are limited by sampling. Non-invasive assessment of liver fibrosis can be based on serum biomarkers or liver imaging. Composite scores of biomarkers, such as the fibrotest, have a reasonable accuracy for detecting liver cirrhosis but are unable to discriminate between intermediate stages of fibrosis. Dynamic elastography is a quantitative functional imaging method that measures the visco-elastic parameters of tissues by analysing the propagation of transmitted mechanical waves elasticity of the liver is observed in liver fibrosis. Transient ultrasound elastography is increasingly used as first-line examination to stage liver fibrosis. However, this method remains limited for staging intermediate fibrosis, and often fails in obese patients and patients with ascites. It has been shown that more robust, reproducible and accurate assessment of liver fibrosis can be obtained with MR elastography. MR elastography holds the promise of complementing ultrasound elastography and serum biomarkers for quantifying liver fibrosis and monitoring the response to treatment. However, elastography is not a specific method for assessing liver fibrosis because it measures liver stiffness that is influenced by other abnormalities including oedema, inflammation, cholestasis, congestion and activation of the stellate cells. The precise role of other functional imaging methods, including perfusion imaging in cirrhosis and diffusion MRI in liver fibrosis remains to be determined.

Learning Objectives:

1. To review clinical, histological, and pathogenic features of liver fibrosis.
2. To review conventional techniques for detecting and qualitatively assessing liver fibrosis.
3. To consolidate knowledge of advanced techniques for quantifying liver fibrosis.
4. To be aware of current gaps in knowledge about non-invasive quantification of liver fibrosis and learn about future directions.

Summary of presentations 15:16

C.B. Sirlin; San Diego, CA/US

Panel discussion:

Routine or research? 15:21

Is non-invasive image-based quantification of liver fat, inflammation, and fibrosis ready for routine clinical use? Validation of biomarkers requires demonstration not only of accuracy but also of repeatability, reproducibility, and robustness. For emerging technology, initial research usually focuses on accuracy but not on the other parameters. So the question is: are the repeatability, reproducibility, and robustness of the non-invasive biomarkers presented in this session adequate for routine clinical implementation?

14:00 - 15:30

Room F2

Breast

RC 1302

Update in BI-RADS

Moderator:

G. Forrai; Budapest/HU

A-387 14:00

A. Mammography

E. Aribal; Istanbul/TR (earibal@marmara.edu.tr)

Breast imaging reporting and data system (BI-RADS) was developed by American College of Radiology in order to set standards for mammography reporting, common terminology and data collection. BI-RADS is being used widely for over a decade and many studies have assessed the validity of the system. An important component of BI-RADS is the lexicon which gives descriptors of specific imaging features that facilitate image interpretation and unify the reports. Two main titles for these descriptors are about masses and calcifications. An asymmetry is called a mass when it is seen in two projections. A mass is defined with its shape, margin and density. Definition of a mass with these three modifiers would help the radiologist to determine the type of the mass and probability of its malignancy. Calcifications are divided into three categories by their shapes and another descriptor is defined for their distribution. The first category is for typically benign calcifications. The other two are for probably malign calcifications where biopsy should be suggested. The distribution modifiers for calcifications can also play an important role in assessing the probability of malignancy. BI-RADS defines 7 assessment categories from 0 to 6 for the final report that facilitate data management for yearly audits. Category 3 is the transition zone between malignant and benign lesions where the suspicion for malignancy should be less than 2% and requires short-term follow-up. BI-RADS morphology and distribution descriptors are effective in assessing the risk of malignancy with a reasonable positive predictive value.

Learning Objectives:

1. To review the outline of BI-RADS mammography and its updates.
2. To review literature on the applicability of BI-RADS.
3. To review BI-RADS categorisation with case illustrations.

A-388 14:30

B. US

G. Rizzato; Udine/IT (grizzatto@libero.it)

The breast imaging reporting and data system (BI-RADS®) for ultrasound (US) was developed by the American College of Radiology (ACR) and published in 2003. Although this lexicon was created to achieve a consensus among radiologists when describing breast abnormalities, clinical practice shows substantial intraobserver agreement but only moderate interobserver agreement. Most problems are reported for descriptors related to shape (when trying to classify abnormalities containing lobulations and/or elliptical with not-parallel orientation), echo pattern and margin. Especially mass margin is a critical feature for determining whether a lesion should be biopsied or not. Other problems are related to the final assessment, including difficulties in applying the subcategories and the relatively high percentage of false negative cases for lesions interpreted as category 3. Many computer-aided diagnosis software have shown the potential to improve performance amongst less experienced readers and decrease interobserver variability; still they do not solve all the problems. The BI-RADS® lexicon is actually under advanced revision by an international panel and Ellen B. Mendelson chairs the US subcommittee. Revision is reviewing both descriptors and categories; it will include also new parameters linked to the evolution of US technology as colour flow mapping and elastography.

Learning Objectives:

1. To understand the advantages and limitations of BI-RADS in clinical practice.
2. To appreciate the potential of an automated analysis of the descriptors.
3. To trace continuous modifications required by technological advancements.
4. To review BI-RADS categorisation with case illustrations.

A-389 15:00

C. MRI

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

The breast imaging reporting and data system (BI-RADS) for MRI has been the first effort to standardise terminology in breast MRI. The system lists a number of descriptors for all sorts of breast MR imaging findings. Its main feature is that it distinguishes between "type of enhancement": mass-like and non-mass-like enhancement. This distinction is important because it marks a crossroad of differential diagnosis: whereas the descriptors for mass-like enhancement serve to help distinguish benign and malignant solid tumours, e.g. fibroadenomas from breast cancer, the descriptors for non-mass-like enhancement can be used to distinguish DCIS or diffusely infiltration cancer from benign changes such as adenosis, hormonal stimulation, mastitis. So far, the PPV and NPV of the different descriptors are not yet established, such that the current BI-RADS lexicon helps describe, but not necessarily interpret breast MR images. The lecture is meant to help fill this gap by presenting the newest revisions and amendments of the BI-RADS MRI lexicon, and by a systematic review of BI-RADS descriptors in benign and malignant breast lesions.

Learning Objectives:

1. To review BI-RADS descriptors for MRI.
2. To understand the differences in the final version of BI-RADS.
3. To review BI-RADS categorisation with case illustrations.

14:00 - 15:30

Room G/H

Neuro

RC 1311

Focal brain lesions

Moderator:

M. Golebiowski; Warsaw/PL

A-390 14:00

A. Differential diagnosis of T2 hyperintense lesions

A. Rovira-Cañellas; Barcelona/ES (alex.rovira@idi-cat.org)

Conventional MRI techniques, such as T2W and gadolinium-enhanced T1W sequences, which are highly sensitive for detecting demyelinating plaques, are recognised as the most important paraclinical tool for diagnosing multiple sclerosis (MS). However, the changes seen on MRI in patients with MS are not disease-specific, as focal white matter T2 hyperintense lesions (THL) are also commonly observed not only in the elderly but also in middle age and young patients, and in a large list of different disorders such as hypoxic-ischaemic vasculopathies (atherosclerotic and hypertensive small vessel disease, CADASIL, Fabry's disease and Susac's syndrome), CNS vasculitis, sarcoidosis, adult forms of leucoencephalopathies, 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 THLs, 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, ...). In addition to these conventional MRI-based features, non-conventional MR techniques (diffusion, MRS 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 THLs, 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 be aware of the limited specificity of brain multifocal T2 abnormalities.
2. To learn about recognition patterns that might be helpful in suggesting the most likely etiology of brain multifocal T2 lesions.
3. To learn about the role of spinal cord imaging and advanced neuroimaging techniques for the differential diagnosis of brain T2 hyperintense lesions.
4. To be able to establish a neuroimaging diagnostic strategy in patients with multiple brain T2 lesions of unknown origin.

A-391 14:30

B. Neoplasm or non-neoplasm

Z. Rumboldt; Charleston, SC/US (rumbolz@muscc.edu)

A variety of diseases including neoplasms, but also infectious, inflammatory, vascular and traumatic processes, may present as focal intracranial mass lesions. Modern neuroimaging, primarily with MRI, enables differentiation of these entities allowing for accurate diagnosis in almost all cases. The requirements are appropriate image acquisition and detailed analysis of imaging findings, while pertinent clinical information may be very helpful in certain cases. The distinction is frequently broad, between different disease processes, such as with tumefactive demyelination versus neoplasm, which is often sufficient for clinical decision making and patient management; at times this may be more specific, approaching histological diagnosis, such as with pilocytic astrocytoma versus medulloblastoma. This presentation will go briefly over the imaging techniques and various disease processes, while heavily concentrating on the differentiating features of intra-axial primarily non-haemorrhagic mass lesions. The emphasis will be on the key distinguishing imaging features, such as presence or absence of mass effect or vasogenic oedema, signal intensity characteristics, presence and pattern of contrast enhancement, as well as diffusion and perfusion features. Decision making process will be discussed. A number of cases with intracranial masses will then be reviewed and analysed, using a step by step approach, accentuating the most reliable distinguishing findings.

Learning Objectives:

1. To list various pathologic processes that present as focal brain masses.
2. To define the differentiating imaging and clinical features of those processes.
3. To recapitulate the role of imaging techniques for differentiation of brain mass lesions.

A-392 15:00

C. Adult glioma: advanced neuroimaging for treatment planning

C. Calli; Izmir/TR (cem.calli@gmail.com)

The role of MR imaging in adult gliomas consists of many steps. (1) Is there a lesion in the brain? (2) Is the lesion a tumour? (3) Is the tumour a glioma? (4) Is it a high- or low-grade glioma? (5) If there is a suspicion and a biopsy is planned, which part of the tumour should be targeted at biopsy. (6) How the surgery should be performed to avoid injury to functional areas of the brain (e.g. motor cortex). (7) If there is need for adjunctive radiotherapy, how the extent of the tumour should be defined? (8) After radiotherapy, if a new enhancing lesion occurs, is it a recurrent neoplasm or radiation necrosis? Conventional anatomical MR imaging is not always powerful enough to answer these questions. However, with advanced MR imaging techniques such as diffusion MR (including tractography), perfusion MR, MR spectroscopy and functional MRI (fMRI) we can answer the above questions reliably in most cases.

Learning Objectives:

1. To recognise different treatment protocols for different types of adult gliomas.
2. To get an overview of the advanced neuroimaging techniques that may aid in the pre-operative characterisation of adult gliomas.
3. To discuss the roles of various advanced neuroimaging techniques for glioma treatment planning.

14:00 - 15:30

Room I/K

Genitourinary

RC 1307

Kidney: imaging and intervention

Moderator:

M.N. Özmen; Ankara/TR

A-393 14:00

A. Angiomyolipoma: a review

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

Angiomyolipomas (AML) are benign tumours derived from the perivascular epithelioid cell (PEC) characterised at pathological examination by the expression of the melanocytic marker HMB-45. They contain various proportions of the three components: vascular, fatty and muscular. An epithelioid variant with a malignant potential is exceptional. 80% are sporadic and 20% integrated to tuberous sclerosis. The association with a lymphangiomyomatosis is always possible: chest CT will be performed in TS and sporadic AML if large or associated with respiratory

troubles. Characterisation of AML is possible, based on identification of its fatty content mainly using CT. When microscopic, this component may be missed and biopsy is required with immunostaining. MR imaging may be helpful using chemical-shift sequences but thresholds, to rule-out clear cell carcinoma, have to be better defined. Presence of necrosis or calcifications rules-out diagnosis of AML. AMLs must be treated if haemorrhagic, painful or if diameter exceeds 4cm. Embolisation is the main nonsurgical method, using microparticles, alcohol and/or coils but postembolisation syndrome must be prevented. Volume regression may require all agents whereas aneurysm occlusion requires coiling. The effect on volume and on haemorrhagic risk is substantial making surgery as an alternative method for nephron sparing purposes. Secondary surgery is required in less than 10% of embolisation. RF ablation is also possible but its efficacy is still under evaluation.

Learning Objectives:

1. To learn the high frequency of angiomyolipoma, and the possibility of complication.
2. To review the imaging appearance of typical and atypical angiomyolipoma.
3. To understand the higher incidence of angiomyolipoma in certain phakomatoses.
4. To learn about the possibilities of intervention and to discuss the indications and results.

A-394 14:30

B. The (not so) rare malignant tumours of the kidney

P. Hallscheidt; Heidelberg/DE (Peter.Hallscheidt@med.uni-heidelberg.de)

Today, an increasing number of renal cell carcinomas is detected in a very early stage. These incidentally detected carcinomas must be differentiated from benign tumour. The role of the radiologist is to differentiate renal lesions and to diagnose malign tumours in adults and children. With the individual therapy for each tumour and patient, a better knowledge of different gradings and entities is demanded. Modern imaging modalities such as CT and MRI have the capability to differentiate renal tumours because of different attributes. Besides the benign tumours, the malign tumours such as renal cell carcinoma, complex cysts, metastasis of other malignomas and lymphomas of the kidneys have to be differentiated. Whereas CT remains the standard tool for staging RCC, the differentiation of different tumours is a field increasingly pre-operatively worked up by MRI with dynamic and diffusion imaging. The most common and not so common renal tumours are demonstrated and typical findings are discussed.

Learning Objectives:

1. To know the rare malignant tumours of the kidney: Bellini duct carcinoma, chromophobe renal cell carcinoma, lymphoma, sarcoma, renal medullary carcinoma and metastases.
2. To learn capabilities and limitations of MRI and CT.

A-395 15:00

C. Radiofrequency and cryotherapy of renal tumours: techniques, results and complications

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

The number of small renal tumours is increasing due to the large amount of imaging examinations of the kidneys performed with various modalities and the true increasing incidence of renal cancer. Conservative therapy of small renal tumours is now widely recognised as the reference technique for the treatment of these small lesions. The increasing rate of chronic renal failure in the elderly and the efficacy of conservative therapy to treat cancer as demonstrated by the urologists performing partial nephrectomy and tumourectomy emphasise the role of percutaneous minimally invasive ablative procedures, particularly in patients with surgical contraindications. Radiofrequency ablation and cryotherapy are the two most developed techniques, but new technical approaches are under development such as microwave ablation, electroporation, etc. The evaluation of the success of the procedure relies on imaging techniques showing the lack of enhancement within the lesion and the size and shape of the necrotic covering the entire tumour area. The techniques, indications, results, and complications of both radiofrequency ablation and cryotherapy will be discussed.

Learning Objectives:

1. To learn the technique and results of radiofrequency ablation of renal tumours.
2. To learn principles, indications and results of cryotherapy, microwave ablation and high-intensity focused US (HIFU).

14:00 - 15:30

Room L/M

Radiographers

RC 1314

Radiotherapy and integration with a diagnostic-therapeutic path

Moderators:

S. Geers-van Gemeren; Utrecht/NL

C. Hohl; Siegburg/DE

A-396 14:00

A. Electronic portal imaging used for the development and improvements in radiation therapy for prostate cancer

A. Thorolfsson, A. Einarsdóttir, G. Mýrdal; Reykjavik/IS (agnest@landspitali.is)

The purpose is to gain numerical information of accuracy in the treatment of localised prostate cancer and calculate the necessary size of the safety margin around the clinical target volume (CTV-PTV). In addition, the purpose was to evaluate the accuracy in treatment set up with patients with high BMI to find out whether patients with high BMI need a larger safety margin. Portal imaging was used to measure off-line random set-up error from bony structure. The sample size was 40, i.e. all the patients who received radiation treatment for localised prostate cancer in Landspítali - University Hospital (LSH) 2006. A total of 3032 portal images were acquired. In 2010, the task was repeated for 38 patients having gold fiducial markers in the prostate. The calculated 3-D IMRT safety margins in LSH 2006 was to be 15.8 mm. Correlation is with high BMI and set-up errors in medio lateralis (M-L) direction ($r=0.21$). This indicates that a patient with an increased pelvic circumference has a tendency to have more set-up errors. Reformed procedural workflow resulted in more acceptable calculated margins in 2010. When corrected on line 3 times per week the margin is to be 7.2 mm and 3.0 mm if corrected 5 times per week. In conclusion, for delivery of 76-78 Gy to the prostate with IMRT and spare surrounding healthy tissue effort is needed to secure the accuracy in the overall procedure of treatment planning and delivery.

Learning Objectives:

1. To gain knowledge on how to improve the target accuracy in treating prostate cancer with radiation therapy using Electronic Portal Imaging.
2. To understand the importance of gaining numerical information of accuracy in the treatment of clinically localised prostate cancer and how to use the information to calculate the necessary size of the safety margin around the clinical target volume.
3. To become familiar with the preparation needed before starting treatment with IMRT and be aware that there is a need to look at all the treatment elements including the technical side, quality, education, staff and patients.
4. To consolidate knowledge of radiation therapy for prostate cancer and the meaning of giving high dose to the target while minimising radiation dose to healthy tissue.

A-397 14:30

B. Image-guided radiation therapy: when imaging meets therapy

A. Sarchosoglou; Athens/GR (anastasia71@hotmail.com)

The aim of this presentation is: to understand the necessity of imaging in the delivery of external radiotherapy; to be familiar with the technology of image-guided radiation therapy and to gain knowledge about the implementation of 3D IGRT. The aim of radiotherapy is to deliver high dose to target volume while minimising the dose to surrounding healthy tissues. However, during treatment delivery many uncertainties may arise that can result in higher toxicity and poor local control. Thus, it is crucial to monitor and adjust if necessary, the actual treatment. Image-guided radiation therapy is the process where images are taken immediately prior or during a course of radiation treatment, to assess and improve the accuracy of therapy. Manufacturers have developed a number of systems to perform IGRT providing the options of ionising radiation images/non-ionising imaging technology and gantry mounted/room mounted equipment. 3D IGRT can be performed by acquiring computed tomography images on the treatment unit. These images are matched with reference images from planning CT and potential discrepancies are recognised, calculated and corrected by couch shifts giving optimal results. Such advanced technologies require quality assurance systems to be in place and high trained personnel. When properly implemented, IGRT meets the aim of radiation therapy. Imaging provides confidence to radiation therapy to be aggressive, to fight cancer. Imaging promises radiation therapy a great future with improvements in clinical outcomes and patient survival!

Learning Objectives:

1. To understand the necessity of imaging in the delivery of external radiotherapy.
2. To be familiar with the technology of image-guided radiation therapy (IGRT).
3. To gain knowledge about the implementation of 3D IGRT.

A-398 15:00

C. Bridges between radiotherapy and radiography from a European perspective

K. Sjövall; Lund/SE (Katarina.sjovall@skane.se)

Radiotherapy is an area with a rapidly improving development of new techniques and improved possibilities for accuracy. This lecture aims to illustrate and discuss points of contact and the need for collaboration between radiotherapy and radiography. European educational programmes and working fields for radiotherapy nurses and radiotherapy technicians are compared. Radiotherapy nurses and radiotherapy technicians are responsible for the administration of radiotherapy to cancer patients and for the clinical care related to the treatment. Apart from prevention and treatment of side effects and psychosocial support during the treatment, it encompasses preparations, delivery and verification of the radiation dose. Educational programmes differ in terms of academic level and target groups, whether it is nurses or technicians in radiology or radiotherapy exclusively. Areas in the radiotherapy process where competences from radiography are needed are discussed, considering both technical development and research progresses.

Learning Objectives:

1. To gain knowledge about the differences and similarities between the areas of education and profession in radiography and radiotherapy from a historical perspective.
2. To gain knowledge about national differences and similarities from a European perspective.
3. To consolidate knowledge about what competences are needed in the area of radiotherapy, and to define common ground with radiography.
4. To consolidate knowledge about present and future needs of research and development in radiotherapy, how radiotherapy can apply competences from radiography.

14:00 - 15:30

Room N/O

Joint Course of ESR and RSNA

(Radiological Society of North America)

MC 1325

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

Moderator:

H.-U. Kauczor; Heidelberg/DE

A-399 14:00

A. Oncologic imaging: terminology, definitions and buzzwords

Y. Menu; Paris/FR

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-400 14:20

B. Liver cancers (primary, metastases)

R.L. Baron; Chicago, IL/US

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-401 14:55

C. Prostate cancer

J.O. Barentsz; Nijmegen/NL

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

14:00 - 15:30

Room P

Physics in Radiology

RC 1313

Clinical audit, accreditation and the role of the medical physicist

Moderators:

W.J.M. van der Putten; Galway/IE
M. Wucherer; Nürnberg/DE

A-402 14:00

A. European-wide perspective on clinical audit

H. Jarvinen; Helsinki/FI (hannu.jarvinen@stuk.fi)

The Council Directive 97/43/EURATOM introduced the concept of clinical audit to medical radiological (diagnostic radiology, nuclear medicine and radiotherapy) procedures. Clinical audit is a systematic review of the procedures in order to improve the quality and the outcome of patient care. According to the directive, clinical audits shall be implemented in accordance with national procedures. The review of its implementation in Europe has revealed a high variation of approaches and many practical problems. Therefore, the European Commission has published further guidelines on clinical audits in its report Radiation Protection No. 159 (2009). The purpose is to improve the implementation of clinical audits and to enable the Member States to adopt the model of clinical audit with respect to their national legislation and administrative provisions. The guideline points out the importance of both internal and external assessments for clinical audit. It deals with all types and levels of clinical audit and gives practical guidance for application. It defines the list of topics which should be covered, while the actual criteria of good practice are discussed on generic levels only. The borderline between clinical audit and other quality assessments (accreditations, certifications, peer reviews) and regulatory inspections is also discussed. The guideline is addressed to all professional groups, hospital management, auditing organisations and regulatory bodies. It is important to recognise that the guideline is not a legal requirement. This refresher course lecture will give a summary of the EC guidelines and discuss briefly the implementation of clinical audits in Europe.

Learning Objectives:

1. To understand the purpose and essential contents of the European commission guideline on clinical audit.
2. To learn about a review of clinical audits in Europe.

A-403 14:30

B. National perspective: clinical audit inspections

S. Ebdon-Jackson; Didcot/UK (steve.ebdon-jackson@hpa.org.uk)

European Council Directive 97/43/Euratom requires under Article 6 (4) that "clinical audits are carried out in accordance with national procedures". Implementation of this requirement across Europe has been varied. This paper will reflect on the experience in the UK and will consider examples of the various initiatives undertaken in the UK by professional bodies and organisations. This will be contrasted with the role of the regulator and the aims of the inspection process with regard to compliance with the specific regulation addressing clinical audit and the remaining regulations addressing justification, optimisation, etc. Examples will be provided of the type of audits undertaken within UK hospitals. A UK perspective of EC and IAEA initiatives in clinical audit will be provided.

Learning Objectives:

1. To understand the approach taken by a national body towards performing clinical audit.
2. To understand practical aspects of clinical audit inspections.
3. To understand the lessons learned from inspection and suggestions for improvement.

A-404 15:00

C. Hospital perspective on clinical audit

P. Gilligan; Dublin/IE (P.Gilligan@materprivate.ie)

The demand from the public for greater accountability and standards has increased the importance of audit and accreditation in modern healthcare delivery. Specifically radiology departments participate in audit and accreditation by a number of entities. These include: 1. National bodies concerned with improving radiation safety particularly originating from EU 97/43 directives. 2. Hospital wide accreditation surveys from state and private accrediting organisations. 3. Auditing of standards from within professional bodies. 4. Following from investigation of specific incidents such as misdiagnosis or radiation concerns. 5. Modality-specific standards. Although the specific requirements of the accrediting or auditing body may differ, the processes and practical aspects in demonstrating compliance with standards and quality improvement are generally similar. Mechanisms such as outcomes, quality cycles, and performance indicators are critical in the success of any accreditation or audit program. In addition to fulfilling basic regulatory requirements, the medical physicist is playing an increasing role in developing performance indices particularly in radiation safety, clinical image quality and equipment management. The increasing role of the medical physicist in audit underpins the requirement for inclusion of audit and accreditation as part of their education. Recent experience of setting up and participating in EU 97/43 directive-based clinical audit in Ireland highlighted the critical need for clarity of roles and ownerships of processes to be communicated to those who are carrying out audit and those who are being audited in hospitals and dental practices.

Learning Objectives:

1. To understand practical aspects of complying with standards and undergoing audit.
2. To understand the outcomes of the audit.
3. To understand how to implement the results of the clinical audit.

14:00 - 15:30

Room Q

Paediatric

RC 1312

Safety first

Moderator:

R. Fotter; Graz/AT

A-405 14:00

A. Security and dose with conventional radiology

J.-F. Chateil; Bordeaux/FR (jean-francois.chateil@chu-bordeaux.fr)

Performing imaging studies in a child requires basic knowledge. The first point is to reassure and to avoid stressful/painful procedure. Training of radiographer and radiologist is fundamental. Explanations, presence of a parent (if not pregnant...), are preferable. Specific devices may be useful for immobilisation and to avoid repeated exposures. Antalgic drugs (traumatic circumstances) or sedative nitrous oxide inhalation (MCUG) may be useful. X-rays exposition in relation with conventional radiology is lower than the one encountered with CT. But dose depends on type of examination and also on imaging equipment. New devices, such digital fluoroscopy with x-rays pulsed emission, flat-panel detector, slot-scanning x-ray imager need less ionising radiation than conventional screen-films devices or even photostimulable phosphor imaging plates. The scale between the higher and the lower dose for the same examination can be from ten to one. Common principles of protection that apply to all x-ray imaging procedures, known as ALARA concept (as low as reasonably achievable), have to be used daily. Act in accordance of the medical justification of the examination, without any non-ionising alternative method, remains the first step. The second one is the optimisation of each procedure, the limitation of expositions, with control of the x-ray beam adjusted to optimise the critical balance between image quality and exposure to the child. Measure of the dose is mandatory to demonstrate appropriate levels on child exposure and to be sure in the future that very low radiation doses received during conventional imaging procedures will not produce adverse effects.

Learning Objectives:

1. To learn about management of children in the radiology unit.
2. To understand how technology affects dose delivery.
3. To recognise the necessity for the application of the ALARA principles in paediatric radiology.

A-406 14:30

B. CT in children: dose reduction strategies

R.A.J. [Nievelstein](mailto:R.A.J.Nievelstein@umcutrecht.nl); Utrecht/NL (R.A.J.Nievelstein@umcutrecht.nl)

The revolutionary development in multidetector CT (MDCT) technology during the past decade has contributed to a substantial increase in its diagnostic applications and accuracy in children. A major drawback of MDCT is the use of ionising radiation with the risks of radiation-induced side effects, of which the induction of secondary cancer is the most important. Therefore, justification and optimisation of paediatric MDCT is of great importance in order to reduce these risks as much as possible (as low as reasonably achievable principle). Optimisation of paediatric MDCT starts with a solid understanding of all technical aspects of CT, including the most relevant scan parameters, dose reduction techniques and technique of IV contrast material administration. Furthermore, due to the smaller size and lack of visceral fat in young children the interaction and absorption of radiation will be different which will influence the choice of the various technique and scan parameters. Although all these issues are pivotal for a successful CT examination, it may become worthless if the importance of pre-scan issues such as justification and patient preparation are ignored. After a short overview concerning the current knowledge on radiation-related risks in children, this lecture will focus on several aspects relevant for MDCT optimisation in children. Issues such as justification, patient preparation, technique and scan parameters will be addressed. Finally, some guidelines for radiation dose level-based CT protocols will be given.

Learning Objectives:

1. To get an overview of current knowledge on radiation risks in children.
2. To understand the CT scan and technique parameters that influence radiation dose.
3. To learn about dose reduction strategies in order to optimise CT in children.

A-407 15:00

C. Ensuring safety for infants undergoing MRI

T.G. [Maris](mailto:tmarris@med.uoc.gr); Iraklion/GR (tmarris@med.uoc.gr)

The purpose is to present an overview of the safety hazards and safety protocols related to infants undergoing MRI examinations. MRI infrastructure-dependent safety hazards originating from: (a) static and fringe magnetic fields, (b) gradient subsystems, (c) radiofrequency subsystems and (d) acoustic noise sound pressure will be reviewed and discussed. Safety hazards related to upcoming technological issues and future trends concerning MRI will be presented. The current status of the organisations responsible to the problems of MR safety will be reviewed. Which authority is responsible and where the responsibility is addressed to (Directives, Legislation policies, etc). An optimised protocol related to a variety of clinical MR sequences in reference to temperature measurements, EMF measurements, SAR and acoustic noise figures using basic commercially available infrastructure will be presented. 2D/3D TSE sequences with different ETL's, 2D/3D GRE, 2D/3D SSFP and SE/GRE EPI sequences with multi-(b) diffusion gradients and 3D TOF MR angiography sequences will be examined. In vitro measurements of SNR, spatial resolution and scan times will be performed for each clinical MR sequence. A comprehensive MRI equipment operational policy (optima: (ETL, TR, TE, b-value, EPI factor etc).) for a safety protocol for infants undergoing MRI is proposed. Recommendations for safe infant MRI examinations will be summarised and presented. Conclusion: MRI equipment can operate safely for infant imaging but require policies and procedures beyond those required for standard diagnostic MRI examinations.

Learning Objectives:

1. To get an overview of the three basic safety hazards related to infants undergoing MRI examinations.
2. To become familiar with safety hazards related to upcoming technological issues and future trends.
3. To learn about a safety protocol that could be applied in MRI examinations for infants.

16:00 - 17:30

Room A

Abdominal and Gastrointestinal

RC 1401

CT colonography: the big picture

Moderator:

S.A. Taylor; London/UK

A-408 16:00

A. Optimised techniques for best results

D. [Regge](mailto:daniele.regge@ircc.it); Turin/IT (daniele.regge@ircc.it)

Multicentre trials have shown that CT colonography is ready for widespread clinical use. However, these studies have also highlighted the inconsistent performances of CT colonography, with divergent results being recorded in different centres and between readers. Inter-observer and inter-centre variability may be related to reader experience but it is also affected by how CT colonography is performed. While faecal tagging has been accepted universally as the proper way to prepare patients for CT colonography, there is no consensus on which tagging agent is better, on the timing of contrast agent administration and on whether laxatives should be administered and in what dosage. In a similar way it is not yet clear which is the best way to obtain colon distension, whether by administering spasmolytic agents routinely or by changing patient's decubitus. Standardising bowel preparation and technique is one of the most important goals that need to be achieved for CT colonography to be universally accepted and this presentation will attempt to deal with the issue using an evidence-based approach.

Learning Objectives:

1. To review bowel preparation techniques for CT colonography.
2. To learn about the possible options in terms of technique used (method of colonic distention, use of spasmolytic agents, use of IV contrast material, dual positioning etc).
3. To learn about optimal data acquisition parameters for CT colonography.
4. To become familiar with published results with emphasis on techniques used.

A-409 16:30

B. Guide to interpretation and generating a useful report

T. [Mang](mailto:thomas.mang@meduniwien.ac.at); Vienna/AT (thomas.mang@meduniwien.ac.at)

The evaluation of CT colonography (CTC) studies is based on detection, interpretation and reporting of colonic findings. It is performed on a computer workstation equipped with dedicated CTC software by a primary 2D or a primary 3D approach. In either case, the alternative viewing technique must be available for rapid correlation and characterisation of suspicious findings. Primary 2D evaluation is based on "lumen tracking" by interactively scrolling through the axial slices and multiplanar reformatted images, focusing only on the air-distended colonic lumen from one end to the other one. Primary 2D evaluation provides information about the attenuation of findings during the search process and is time-efficient. Primary 3D evaluation is based on 3D virtual endoscopy in an antegrade and retrograde fashion and increases both, the conspicuity, especially of small and medium-sized polyps, and the duration of visualisation. The use of advanced 3D displays like virtual dissection or unfolding techniques may reduce the interpretation time for primary 3D evaluation. Computer-aided detection (CAD) algorithms used as a 2nd reader were shown to reduce the number of perceptual errors by pointing out possible abnormalities that might otherwise be missed. Colonic findings are characterised by their morphology, their attenuation characteristics, and by their mobility. Knowledge of CTC imaging features of common colonic lesions and artefacts is necessary for characterisation of findings and differentiation between definite colonic lesions and pseudo-lesions. Standardisation of CTC reporting facilitates classification and communication of findings and the comparison with previous studies, thereby better assisting physicians in making appropriate management decisions.

Learning Objectives:

1. To understand what the radiologist needs to know to accurately interpret CT colonography examinations.
2. To recognise the relative merits of different interpretation techniques.
3. To learn about a standardised method for generating a CT colonography report.
4. To briefly summarise the current status of CAD and its potential use in CT colonography.

A-410 17:00

C. Dose, risk and relevance in a screening population

A. Graser; Munich/DE (Anno.Graser@med.uni-muenchen.de)

While CTC has achieved excellent results in average risk individuals with regard to detection of clinically relevant polyps, it has not yet been implemented on a large scale in colorectal cancer (CRC) screening programmes. This is mainly due to the fact that it uses ionising radiation. There is uncertainty about adequate screening strategies and the risk of radiation-induced malignancy. This presentation will summarise recent results of CTC in a screening setting, will look at the dose associated with CTC, and summarise calculations of radiation-associated risk of malignancy. The key question is whether low doses from CTC will cause relevant negative effects in the screening population. The lecture will also feature a comparison between CT and MR colonography, an imaging test that might be able to provide high sensitivity CRC screening without ionising radiation.

Learning Objectives:

1. To understand the radiation dose imparted to patients undergoing CT colonography.
2. To understand the use of dose reducing techniques and their effect on diagnostic performance.
3. To consider the risk of radiation-induced malignancy versus potential benefits of CT colonography in the context of population screening for colorectal cancer.

16:00 - 17:30

Room C

CLICK (Clinical Lessons for Imaging Core Knowledge): Common

Clinical Cases

CC 1418

Focal neurological disorders

Moderator:

M. Sasiadek; Wroclaw/PL

A-411 16:00

A. Clinical considerations

D. Balériaux; Brussels/BE (dbaleri@ulb.ac.be)

From headache to epilepsy... or from "normal", physiological "headache" to life threatening pathological conditions. When do we need "neuroimaging" and what is the optimal diagnostic work-up? The radiologist must and should remain first of all a Medical Doctor: he/she should keep close contact with the clinical world and always keep an active dialogue with the referring clinician. Indeed, medical imaging has become more and more sophisticated but also more expensive. Imaging is not a "screening procedure" in brain pathology but should be performed in order to confirm a clinical, suspected diagnosis keeping still in mind that differential diagnosis must be considered as well. Imaging plays also a unique role in lesion evaluation and treatment monitoring. The radiologist must answer precise questions about the patient's suspected pathological condition and if necessary, discuss the imaging findings with the clinician in order to narrow the differential diagnosis. Each MRI or CT must be performed with a clear knowledge of the clinical question and the suspected pathology. Therefore, the radiologist will make the proper choices of imaging techniques especially with MRI where imaging sequences have become numerous. Headaches and seizures are symptoms only and may be present in multiple and very diverse pathological conditions as infectious, neoplastic, haemorrhagic, vascular diseases: by knowing the clinical history a good "clinically conscious" radiologist will undoubtedly be of greater "added value"!

Learning Objectives:

1. To learn more about the clinical conditions causing focal neurological symptoms.
2. To be informed about the clinician's way of thinking in the process of differential diagnosis.
3. To become familiar with the potential role of imaging in the establishment of the final diagnosis and planning of therapy.

A-412 16:30

B. Imaging techniques and typical findings

P. Barsi; Budapest/HU (barsipeterdr@gmail.com)

Neuroradiology has a continuously changing and developing array of modalities. Conventional radiography has lost its importance. Angiographic practice has shifted from diagnostics to therapy. MS-MD CT scanners provide high-quality CT angiography and

perfusion imaging. New possibilities arise in MRI almost every day. Imaging algorithms are to provide the correct diagnosis in the shortest time with the lowest expenses and harm to the patient. MRI is the first method of choice in neurological diseases with two exceptions: acute stroke and acute trauma, CT providing the necessary information, more available and with easier patient care. Adequate imaging protocols optimally visualise the anatomical region of interest and pathological processes, optimise the comparison between serial examinations and provide the information in reasonable examination time. Appropriate and well understood clinical information is indispensable (neuroradiology means good clinical knowledge combined with expertise in imaging methods and their evaluation). Complicated protocols are superfluous without competent clinical background but adequate information must be provided to experienced clinicians. Basic protocols help to gather important information but do not exclude additional necessary methods. Examples to be demonstrated are MRI protocol for the pituitary, epilepsy, multiple sclerosis and spine. The up-to-date concepts of image evaluation and interpretation will be demonstrated for brain CT, brain MRI and spinal MRI, including the importance of follow-up. The body and conclusion part of the structured neuroradiological report will be discussed. Consultation with other neuroradiologists and with clinicians is the final tool to reach the goal: to help in recovering the patients' health.

Learning Objectives:

1. To learn about the available imaging modalities to be used for the evaluation of patients with a focal neurological disorders.
2. To become familiar with the technical imaging considerations and the proper diagnostic algorithm.
3. To know more about the typical imaging findings.

A-413 17:00

C. Interactive case discussion

G. Krumina; Riga/LV (gaida.krumina@apollo.lv)

Ten authentic and original typical clinical cases illustrating the importance of imaging modalities in the differential diagnosis of focal neurological symptoms from headache to epilepsy will be presented while respecting the privacy of the patient. The spectrum of pathologies includes vascular, inflammation, metabolic, degenerative diseases, congenital malformations and neoplasms of the central nervous system. Each case story will be described shortly in a standard form followed by demonstration of typical CT and/or MRI images. In some cases, conventional MRI will be supplemented by multi-voxel MR spectroscopy, DTI, MR tractography images, and morphological pictures. Follow-up images will be presented where appropriate. Several diagnostic options will be offered for attendants. The audience will be asked to participate in the diagnostic process by the use of voting pads. After highlighting of final diagnosis the basic differential diagnostic considerations will be briefly summarised and emphasised from the clinical and imaging point of view for each presented case.

Learning Objectives:

1. To introduce typical cases illustrating the role of imaging modalities in the differential diagnosis of focal neurological symptoms.
2. To motivate the audience by the use of voting pads to be involved in the diagnostic process.
3. To highlight the conclusion that may be drawn on the basis of the discussed cases.

16:00 - 17:30

Room D1

KISS (Keep It Simple and Straightforward): Musculoskeletal MRI

CC 1416

Soft tissue extremity masses

Moderator:

A.R. Mester; Budapest/HU

A-414 16:00

A. How I do it

J.C. Vilanova; Girona/ES (kvilanova@comg.cat)

Diagnostic quality MRI of soft tissue masses can be performed using a variety of magnetic equipments and a variety of field strengths. Regardless of system design, efforts should be made to maximise signal-to-noise ratios (SNR) using the most appropriate coil to include the lesion and associated oedema. FOV should be tailored to the size of the patient and the size of the mass. It is important to obtain images in at least two planes through the lesion. Slice thickness vary depending on the size of the lesion and interslice should be not more than one-half of the slice width. Imaging matrix should be balanced to in-plane spatial resolution. Parallel



imaging techniques allow to reduce scan time or improve SNR. Fat suppression techniques are mandatory, and Dixon or STIR techniques should be used for low-field systems. Spin and gradient echo sequences should be used including at least T1 and T2 WI. Intravenous gadolinium may be helpful especially using multiphase dynamic contrast on fast gradient echo sequence depending on medical appropriateness. Emerging MR imaging techniques may be useful, including diffusion-WI and spectroscopy.

Learning Objectives:

1. To understand the influences of patient positioning, scan parameters and magnet/coil technology on image quality.
2. To learn how to optimise scan protocols to maximise patient throughput without compromising diagnostic quality.
3. To recognise how and when to modify scan protocols to answer specific clinical questions.

A-415 16:25

B. Normal variants and pitfalls

F.M.H.M. Vanhoenacker; Antwerp/BE (filip.vanhoenacker@pandora.be)

Mimickers of the soft tissue tumours belong to a large and heterogeneous group of disorders, varying from normal anatomic variants, and other pitfalls such as inflammatory and infectious lesions, post-traumatic lesions, skin lesions, nonneoplastic vascular lesions, metabolic disorders (crystal deposition disease, amyloidosis) and miscellaneous disorders (Geyser phenomenon in longstanding rotator cuff disease, Baker's cyst, elastofibroma dorsi, pseudohypertrophy of the lower leg due to neurogenic compression...). Classification of these pseudotumours remains still a matter of debate. Many of these lesions are reactive or self-limiting without the need for further investigation or significant intervention. The imaging approach is often very similar to the approach of "true" soft tissue tumoural counterparts. Knowledge of the normal anatomy and existence and common presentation of these diseases, in combination with the relevant clinical findings (clinical history, location, skin changes), enables the correct diagnosis in most cases, thereby limiting the need for invasive procedures. Biopsy should be performed in doubtful cases.

Learning Objectives:

1. To become familiar with the normal anatomy.
2. To be able to identify normal variants.
3. To appreciate the range of pitfalls that may simulate pathology.

A-416 16:50

C. Identifying and reporting abnormal findings

J.L.M.A. Gielen; Edegem/BE (jan.gielen@uza.be)

Accurate identification and reporting on soft tissue extremity masses is essential for correct diagnosis and optimal treatment planning. This lecture focuses on the MRI signs to stage and grade-characterise soft tissue mass lesions. These two objectives are the major structural components of the MRI report and fit the request of the referring clinician. This implies an accurate description of these signs with appropriate terminology in the report. Local staging is essential for the preoperative work up. Important staging parameters are size, compartmental location, skip lesions and relationship to neurovascular structures and joints, as well as distance to the nearest joint space. Grading and characterisation is complex and multifactorial and classifies the lesions as „certainly benign“ (no biopsy needed) and „possibly „ or „certainly malignant“ (biopsy needed). Grading parameters are homogeneity, (changing) signal intensities in multiple acquisition techniques and static and dynamic gadolinium enhancement pattern. These are used to define the composition of the lesion, i.e. fat, met-Hb, hemosiderin, myxoid tissue, collagen, viable, cystic or necrotic components. Other important grading and parameters are lesion margin, shape, perilesional invasion or destruction, multiplicity, specific location and associated findings but also age and gender of the patient. Benign lesions often have characteristic presentations. This is the case in arthrosynovial cysts, myxomas, lipomas, giant cell tumour of tendon sheath, hamartoma of nerve, elastofibroma dorsi, fibromatosis, neurinoma, etc. In the suspicion of tumour recurrence, a comparison of these grading parameters with the primary tumour result in a high specificity. Typical examples are used to illustrate „state-of-the-art“ reporting.

Learning Objectives:

1. To review the imaging appearances of common abnormalities.
2. To understand the use of terminology to describe pathological findings.
3. To learn how to structure a radiological report to ensure clarity and brevity.

16:00 - 17:30

Room D2

Interventional Radiology

RC 1409

Oncologic interventions in the liver

Moderator:

M. Glynos; Athens/GR

A-417 16:00

A. RF ablation

F. Deschamps; Villejuif/FR (Frederic.Deschamps@igr.fr)

Percutaneous radiofrequency ablation (RFA) is a safe and effective treatment for well selected patient with hepatic tumours such as hepatocellular carcinoma (HCC) and liver colorectal metastases (LCM). An appropriate selection is crucial. It is based on clinical and technical arguments. Clinically, surgical resection of the hepatic tumours remains the gold standard. Indeed, survival data following RFA are not as good as surgical resection. The only exception seems to be the RFA of the very early HCC (≤ 3.0 cm) in cirrhosis that is not candidate for liver transplantation. Most often, the RFA offers an alternative for patients with medical comorbidities, poor liver function or prior hepatectomy. Technically, there are three decisive points for complete ablation. The first point is the good visualisation of the tumour either under ultrasound or un-enhanced computed-tomography (CT) examination. Metallic coil placement, lipiodol tattoo and virtual CT sonography with magnetic navigation are technical tricks that allow the RF ablation of "invisible" tumour. The second point is the tumour size: in most series, a diameter less than 25-35 mm is commonly admitted as a prognostic factor. This is probably because the maximal ablation diameter is slightly larger than 40 mm with the electrode needles available now. Micro-waves ablation might improve the local control by increasing the ablation diameter. The last point is the "heat-sink effect" that requires a temporary occlusion of a large vessel close to the tumour. The quality of follow-up imaging is a key factor for evaluation of tumour destruction.

Learning Objectives:

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

A-418 16:30

B. Portal embolisation

O.M. van Delden; Amsterdam/NL (o.m.vandelden@amc.uva.nl)

Partial hepatectomy for liver metastases or primary liver tumours can only be performed when the future remnant liver volume (FRLV) is considered large enough to avoid the risk of post-operative liver failure. In normal livers a FRLV of 25-30% is considered safe whereas in compromised livers a FRLV of at least 40% is required. In patients whom the FLRV is considered to small, PVE may be performed pre-operatively to increase the FRLV. PVE involves percutaneous selective embolisation of the portal venous (PV) system, usually of the right liver lobe, which leads to atrophy of the embolised lobe. This, in turn, leads to hypertrophy of the FRLV. Because of the dual vascular supply to the liver (arterial and portal venous), necrosis of the embolised lobe does not occur. This compensatory hypertrophy of the left lobe facilitates resection in patients in whom the FRLV would otherwise have been too small to allow resection. PVE is most often performed percutaneously under conscious sedation and local anaesthesia through an ipsilateral approach, using a combination of particles, such as polyvinyl-alcohol (PVA) and embolisation coils. Potential complications of PVE include thrombosis of the contralateral PV, liver abscess formation or cholangitis and are rare. Most of the hypertrophy occurs in the first 3-4 weeks after PVE and increase in volume of the FRLV averages 12% after this time period. CT-volumetry should be performed both before PVE and after 3-4 weeks to measure increase in FRLV.

Learning Objectives:

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

A-419 17:00

C. Future directions

J. Kettenbach; Berne/CH (joachim.kettenbach@insel.ch)

Image guidance and imaging fusion techniques represent an integral element in oncologic interventions and liver surgery. In addition, several liver planning techniques such as the virtual liver surgery planer enhance simulation of a proposed liver resection. Using roboter-assistance or navigational guidance combined with thermal ablation techniques such as radiofrequency ablation, significantly enhances accuracy of ablation probe placement and efficacy of ablation necrosis. Furthermore, the local recurrence rate can be considerably reduced, and the amount of complete tumour ablation is significantly more likely. Integrating magnetic resonance imaging, and focused ultrasound to deliver and activate nano-capsules carrying anti-cancer drugs to effectively target tumours will be another task. This will involve drugs being injected into the body in the form of tiny capsules, which are harmless until they are activated by a concentrated focused ultrasound 'blast'. The MRI scanner will then be used to track the passage of the drugs, visualise the target and monitor the delivery of the drug treatment.

Learning Objectives:

1. To review new ablation modalities.
2. To review research on targeted embolotherapy.
3. To understand the use of combined therapies.

16:00 - 17:30

Room E1

Genitourinary

RC 1407

MRI in prostate cancer

Moderator:

J. Venancio; Lisbon/PT

A-420 16:00

Chairman's introduction

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

MRI is used in the detection of prostate cancer (PCa) in several circumstances highlighting: A. Patients with previous series of negative ultrasound-guided biopsies and clinical or biochemical suspicion of PCa. B. Patients already treated for PCa, with rising PSA. Functional multiparametric MRI including: dynamic contrast enhanced MRI (DCE-MRI), diffusion-weighted MRI (DW-MRI), and spectroscopic MRI (S-MRI) is useful to detect suspect areas, mainly in peripheral zone and direct TRUS or MRI-guided biopsies. Nowadays 3 T MRI can improve PCa detection due to higher multiparametric capabilities and more precise staging. It is very important precise localisation of tumour in some kind of patients indicated for focal treatment: HIFU, brachytherapy, cryotherapy... In the follow-up after treatment, with a biological or clinical suspicion of relapsing, it is very important to detect peri-anastomotic or pelvic recurrences, and MRI (combining the use of endorectal and pelvic phased array coils) is better than US or CT. Particular conditions concerning this matter will be discussed. Present and future clinical needs on imaging PCa. New developments in MRI of PCa will be presented, emphasising local staging, recurrences perianastomotic and the evaluation of lymph nodes (Fe-nanoparticles?).

Session Objectives:

1. To review and compare the most important MRI developments.
2. To evaluate prostate after treatment for cancer, and signal intensity changes to detect local recurrences.
3. To learn about future trends of MRI in prostate cancer, answering future clinical needs, namely in the evaluation of lymph nodes.

A-421 16:05

A. MRI in detection of prostatic cancer

F. Comud; Paris/FR (francois.comud@imagerie-tourville.com)

MRI is more and more used for PCa detection in patients with a negative series of TRUS-guided biopsies and a persistent biological suspicion of PCa. Functional MRI increases the accuracy of T2W-Imaging to localise PCa. It includes dynamic contrast enhanced MRI (DCE-MRI), diffusion-weighted MRI (DW-MRI) and spectroscopic MRI (S-MRI). Sensitivity and specificity of DCE-MRI are significantly higher than that of T2W-MRI to detect P-Zone cancers with a tumour volume > 0.2-0.5 cc. Limitations of DCE-MRI include the frequent enhancement of benign P-Zone sextants and T-Zone BPH nodules. With DW-MRI, PCa shows a significantly lower apparent diffusion coefficient (ADC) value than that of benign prostate tissue which increases the accuracy of

T2W-MRI to localise PZ-Zone PCa. In the T-Zone, stromal nodules commonly have a low ADC value simulating PCa. Significant differences in tumour ADC values existed between patients with low-risk, and those with higher risk localised P-Zone PCa. With S-MRI, the best accuracy for diagnosing PCa is obtained by combining a positive T2W-MRI and a choline+creatine/citrate ratio > 0.75. In the T-Zone, S-MRI has the same limitations than DCE and DW-MRI. Multiparametric functional MRI accuracy of MRI to detect PCa can be improved by combining different functional sequences. At the moment, it seems that the most widespread used protocol is a combination of DW and DCE-MRI for detection of P-Zone tumours. Performance of functional MRI to detect T-Zone PCa is less well established. Multiparametric MRI can now be used to perform stereotaxic TRUS-guided biopsies after TRUS-MRI image fusion.

Learning Objectives:

1. To understand the role of MRI in diagnosis of prostatic cancer.
2. To understand the key MRI findings in prostatic cancer.
3. To learn about the role of MR spectroscopy in diagnosis of prostatic cancer.

A-422 16:28

B. MRI in the post-treatment follow-up

A.T. Turgut; Ankara/TR (ahmettuncayturgut@yahoo.com)

The role of imaging in patients with increased PSA level after radical prostatectomy or radiation therapy is to aid in differentiating locally recurrent disease which can be managed with local therapy from distant metastatic disease requiring systemic therapy. Although the majority of local recurrences in post-surgical patients can be detected by MRI in the perianastomotic region which can also be evaluated with TRUS and TRUS-guided biopsy, some recurrences can occur at pelvic sites that are beyond the range of TRUS; MRI has a role of labelling these sites for TRUS-guided biopsy. The combination of an external phased-array coil and endorectal coil is recommended for detecting local recurrent cancer. Current protocols involve T2-weighted MRI combined with functional techniques such as dynamic contrast-enhanced MRI (DCE-MRI), magnetic resonance spectroscopy and diffusion-weighted MRI. In the post-prostatectomy bed, recurrences present as lobulated masses having low to intermediate signal intensity on T2-weighted images and showing early, nodular enhancement with early washout of gadolinium on DCE-MRI. The predominant finding after radiotherapy is a diffusely low signal intensity with an indistinct zonal anatomy where the contrast between a hypointense recurrence and benign irradiated tissue decreases. On DCE-MRI, peripheral zone enhancement is lower after radiotherapy and any focal enhancement should be regarded as suspicious. The overall diagnostic efficacy of DCE-MRI for detecting recurrent prostate cancer is better than T2-weighted MRI alone. On MRI, bone metastases have low and high signal intensity on T1- and T2-weighted images, respectively, and enhance after intravenous gadolinium administration.

Learning Objectives:

1. To understand the role of MRI in the follow-up of the patients with prostate cancer after radical prostatectomy or radiotherapy.
2. To learn about the MRI findings for local or distant metastasis in the post-treatment follow-up of prostate cancer.
3. To learn about the post-radiotherapy signal intensity changes on the detectability of recurrent prostate cancer after radiotherapy.

A-423 16:51

C. New frontiers in imaging of the prostate

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

In this presentation new techniques with potential clinical value will be described with a focus on prostate cancer multi-modality MR imaging. Techniques such as T2W, DWI, DCE and MRSI will be addressed, and their role in screening, determination of tumour aggression and localisation, MR-guided biopsy, MR-guided minimal invasive focal therapy (laser, cryo, HiFu), and MR-guided radiotherapy will be discussed. Examples will be shown.

Learning Objectives:

1. To become familiar with new developments in MRI of prostate cancer.
2. To understand the future clinical needs, and how MRI can solve them.

Panel discussion:

What is the most appropriate radiological approach in patients with rising PSA levels, and when? 17:14

The major area of debate is how to approach patients with increased PSA levels. The discussion has two parts: one is the patient who has not had a prior cancer diagnosis and the other one is the patient who has already been treated for prostate cancer. What is the role of MR (as well as MRS, DW MR and dynamic MR) in precluding the need for multiple biopsies? When should we stop in cases with high or increasing levels of PSA despite consecutive negative biopsy outcomes?

16:00 - 17:30

Room E2

Special Focus Session

SF 14

Thoracic emergencies: triage with MDCT

Moderator:

D.R. Kool; Nijmegen/NL

A-424 16:00

Chairman's introduction

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

Because of advancing technical developments and increasing diagnostic utility of MDCT in emergency care, its use has expanded significantly and has changed patient care, especially in chest emergencies. However, MDCT has important drawbacks in cost and radiation exposure. The first presentation will discuss MDCT in acute chest pain (ACP). Scan techniques in different scanners will be addressed. The reasons why CTA/CTCA can be a viable application for ACP and the current evidence for CTA in ACP will be discussed followed by an update on indications. The next presentation will address MDCT in chest trauma. Its significance, the utility of this imaging method and its advantage compared to other modalities will be discussed. The examination protocol and the role of post-processing methods will be addressed. The interpretation of MDCT, findings, benefits, limitations and pitfalls will be shown. The utility of chest x-ray and ultrasound as primary examinations and the indication for MDCT, routine or selective, will be discussed. Our last speaker will familiarise us with procedures to measure radiation dose in thoracic MDCT, followed by an update of radiation exposure associated with the protocols for the different clinical indications. Finally, available techniques for radiation dose reduction in ECG-gated and non-gated MDCT and their effectiveness in radiation dose reduction will be demonstrated. However, the best way to reduce radiation is to perform MDCT only when there is an appropriate indication and this will be the focus of the concluding panel discussion of this session.

Session Objectives:

1. To learn about the benefits of MDCT in traumatic and non-traumatic emergencies of the chest.
2. To learn about the disadvantages of MDCT in emergency care.
3. To learn about ways to reduce the disadvantages of MDCT and improve appropriate use of MDCT.

A-425 16:05

MDCT in acute chest pain

F. Cademartiri, E. Maffei; Parma/IT (filippocademartiri@hotmail.com)

MDCT in acute chest pain has been performed for several years. However, one of the major missing pieces of the puzzle in this field was the heart and the coronary arteries. Major life-threatening causes of chest pain such as acute aortic dissection and pulmonary embolism are part of our daily practice in emergency radiology care. Coronary arteries and cardiac assessment are, instead, a new and challenging application. CT scan technique has several and demanding requirements as well as training for proper reporting. Current state-of-the-art CT scanner can perform a complete chest CT with ECG synchronisation in few seconds with a reasonable, if not low, radiation dose. Technique has to be optimised depending on patients' features, and clinical indications.

Learning Objectives:

1. To become familiar with the CT scan technique for non-traumatic thoracic emergencies.
2. To learn about the rationale of triple rule-out with CT.
3. To learn about the indications of CT in settings of acute chest pain.

A-426 16:28

MDCT in chest trauma: indications, technique and interpretation

H. Mirka; Plzen/CZ (mirka@fnplzen.cz)

Chest trauma is, particularly in younger population, a significant cause of morbidity and mortality. It is directly responsible for 20-25% of trauma-related deaths and in other 50% of deaths it is an important contributing factor. Imaging methods play the key role in management of this group of patients. Introduction of MDCT in the last decade of the 20th century markedly changed the diagnostic approach to the thoracic trauma. Fast data acquisition and increased resolution in the z-axis enabled reliable assessment of all chest anatomical components (often together with other parts of the body) in one examination. Compared to x-ray MDCT defines more accurately the extent and severity of traumatic changes and may detect serious

ocult injuries of the large vessels, heart, tracheobronchial tree, diaphragm or spine. Despite significant merits of MDCT the chest x-ray together with ultrasound still serves as a tool for fast orientation and detection of traumatic changes requiring urgent intervention (e.g. tension pneumothorax, large haemothorax and pericardial tamponade). MDCT is currently accessible in practically all trauma centers and it is considered to be the gold standard of the imaging of trauma. This fact results in a tendency to perform MDCT in patients with high-energy injury as a routine examination without selection according to the clinical and x-ray finding. The disadvantages of this approach are increased costs and higher radiation exposure, but on the other hand it increases the number of relevant additional findings (in 7-40%) leading to the modification of the therapeutic strategy.

Learning Objectives:

1. To learn about imaging algorithm in chest trauma: the value of CT.
2. To understand the benefits of MDCT.
3. To learn about examination protocols.
4. To learn about post-processing methods.
5. To learn about imaging findings focused on merits of MDCT.

A-427 16:51

Radiation in emergency thoracic CT: can it be reduced?

S. Leschka; St. Gallen/CH (sebastian.leschka@kssg.ch)

The risks associated with radiation exposure in CT is of concern to radiologists, medical physicists, government regulators, and the media. Thoracic CT is a technically robust, non-invasive imaging technique for the evaluation of several traumatic and non-traumatic thoracic emergencies. Technical advances in the past years have resulted in improvements in image acquisition speed, spatial resolution, and the temporal resolution. Consequently, thoracic CT can now be performed rapidly in emergency conditions without substantial delay in treatment. State-of-the-art CT systems are now capable of imaging the entire thorax within a few seconds. However, radiation exposure associated with thoracic CT have been increased with the advantages of modern CT systems particularly in the evaluation of chest pain syndrome. Thoracic aortic CT angiography with cardiac gating may now be considered the preferred technique for the evaluation of chest pain syndrome in selected patients but is associated with a substantial higher radiation dose than routine non-gated thoracic CT. Several effective strategies have been developed to limit the radiation exposure in cardiac gated thoracic CT including prospective ECG gating techniques, anatomy and ECG-based tube current modulation, high pitch acquisition, and adaptation of the CT scanning parameters to the body habitus. In addition, several techniques are available to reduce the radiation exposure in non-gated thoracic CT depending on the patient's body habitus and the clinical indication.

Learning Objectives:

1. To become familiar with radiation dose values associated with current CT protocols used in thoracic emergencies.
2. To learn which factors influence the radiation dose in thoracic CT.
3. To learn how radiation dose can be reduced in clinical practice.

Panel discussion:

Increasing use of MDCT in emergency radiology of the chest: is it appropriate? Can we stop it? Do we want to? 17:14

In many countries imaging in the emergency department is only partly based on appropriateness but also on defensive medicine, finances or politics. The number of procedures increases with decreasing positive rates. Furthermore, especially with the use of MDCT, radiation exposure is increasing. If radiologists want to reduce inappropriate use of MDCT, the questions arise of whether we are able to do it and how it can be achieved. Are there alternative diagnostic strategies?

16:00 - 17:30

Room F1

Radiology in Abdominal Emergencies

CC 1417

Inflammation and oedema

Moderator:

N. Elmas; Izmir/TR

A-428 16:00

A. The three musketeers: appendicitis, diverticulitis, colitis

J. Stoker; Amsterdam/NL (j.stoker@amc.uva.nl)

Appendicitis, diverticulitis and colitis are frequent causes of acute inflammatory bowel emergencies. In many patients, suspected for these conditions the diagnosis is not clear upfront. Imaging plays an important role in identifying the underlying

cause. Ultrasound (US) and computed tomography (CT) are readily available and widely used imaging techniques for this work up. US comprises an examination of the abdomen with the graded compression technique. A transducer should be used optimised for the visualisation of the bowel. The CT protocol includes the use of intravenous contrast medium, while oral contrast medium will not be routine in many institutions. Findings are bowel wall thickening (or enlarged appendiceal diameter), fat infiltration, free air and fluid collections. The present evidence on the role of imaging in appendicitis and diverticulitis is substantial and has been summarised in systematic reviews. Although US is accurate in diagnosing appendicitis and diverticulitis, CT is more accurate than US. Further advantages of CT are better identification of alternative diagnoses and better comparison between consecutive examinations. Thereby, CT is more helpful in communicating the diagnosis to the referring physician. Cost effectiveness of CT in acute appendicitis has been demonstrated as well as the positive impact on management. For colitis, the evidence is more limited and imaging has more limitations here. Drawback of CT is ionising radiation exposure. An imaging strategy with initial US and CT only in inconclusive or negative US cases results in the highest sensitivity, reduces ionising radiation exposure and is cost effective.

Learning Objectives:

1. To know the pros and cons of ultrasound and computer tomography in appendicitis, diverticulitis and colitis.
2. To understand the imaging findings and results in appendicitis, diverticulitis and colitis.
3. To learn the role of imaging in acute inflammatory bowel emergencies.

A-429 16:30

B. Liver and biliary tree

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

Accurate and rapid diagnostic imaging is essential for the appropriate management of acute biliary tract disorders. Ultrasonography (US) continues to be the first and often the only test needed to confirm suspected diagnoses affecting the ducts and gallbladder. However, there has been an increase in the overall use of computed tomography (CT) in the emergency room setting, mostly because for its widespread availability and the relative speed, ease and uniformity with which evaluations can be performed. Thus, CT may be the first imaging examination performed on patients presenting with signs and symptoms that are less specific for biliary diseases. Magnetic resonance (MR) imaging has similarly robust potential as CT, although its integration into the acute care setting requires greater technical and logistical effort. Improved MR imaging sequences, advances in coil technology, streamlined imaging protocols, and increased technical and professional familiarity with the modality make it an increasingly attractive option when there is concern about patient radiation exposure or allergy to iodinated contrast material, as in pregnant patients with acute abdominal symptoms. MR can also be used as a problem-solving modality. In this presentation, the common and uncommon imaging appearances on US, CT and MR of acute diseases of the biliary tract and gallbladder will be reviewed. Potential pitfalls to be avoided with the three modalities are also illustrated.

Learning Objectives:

1. To learn the etiology and clinical presentation of acute inflammatory liver diseases.
2. To understand imaging strategies using US, CT and MRI.
3. To know typical findings and the spectrum of differential diagnoses.

A-430 17:00

C. Pancreatitis: common and critical

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

Pancreatitis is an abdominal condition potentially life threatening. Imaging plays a key role not only in the diagnosis but also in the staging and patient management of acute and chronic pancreatitis. Pancreatic inflammation and necrosis can be easily identified by imaging methods and has prognostic implications. The clinical prognostic criteria in acute pancreatitis are currently coupled with imaging criteria. CT plays a central role in the evaluation of patients with known or suspected pancreatitis. A CT-based severity index is the main prognostic method to predict outcomes. In addition, MRI and MRCP play increasingly important roles in pancreatitis evaluation. Integrity of the pancreatic duct can be easily evaluated by this last method, particularly if enhanced with the use of secretin. Imaging appropriateness criteria determine the value of distinct imaging modalities with regard to the stage of disease. We review the modern imaging criteria for the diagnoses, staging and patient management in acute and chronic pancreatitis. We also discuss current severity indices and imaging appropriateness criteria.

Learning Objectives:

1. To learn epidemiology and clinical outcome of patients with pancreatitis.
2. To understand typical findings and diagnostic pitfalls.
3. To know the role of radiology in patients with acute and chronic pancreatitis.

16:00 - 17:30

Room F2

Breast

RC 1402

Evaluation of the treated breast and follow-up

Moderator:

A. Tardivon; Paris/FR

A-431 16:00

Chairman's introduction

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

The topics of this refresher course cover very interesting fields in patients with a breast cancer. How to evaluate residual disease after surgical biopsy? How to evaluate tumour response to neoadjuvant therapies and what about surveillance after treatment? In all these fields, many questions remain without clear answers and univocal recommendations especially about the timing of imaging after surgery, under treatment and during follow-up. If MRI is the most sensitive imaging technique for detecting cancer (residual disease, new cancer event and local relapse), we have to keep in mind that it is not perfect (calcifications, low grade DCIS detection) and that radiation therapy and systemic treatments play a major role for curing minimal residual disease. For evaluating and predicting response to neo-adjuvant treatments, the major question is the debate between morphology (size and volume) and function (perfusion, spectroscopy and diffusion). For follow-up after treatment, considering the number of women concerned, cost benefit analyses are mandatory to offer the most efficient imaging strategies based not only on defined subgroups (risk factors of local relapse) but also over time. One of the first take home messages of this course is the multidisciplinary approach of this disease or in another way: we do not treat images but patients!

A-432 16:05

A. Evaluation of residual disease after excisional biopsy

C. Boetes; Maastricht/NL (c.boetes@mumc.nl)

Mammography can have an additional value in evaluating if microcalcifications are left behind in the case of DCIS and irradical operation. Ultrasonography has proven to have no additional value in evaluating the postoperative breast, because of haematoma and scar tissue. MR imaging of the breast can of all imaging techniques predict residual disease in the most accurate way. However, false positive results can exist because of enhancing scar tissue. Also, false-negative results exist, especially owing to residual low and intermediate grade DCIS. It is recommended to perform postoperative breast MRI in premenopausal women in the right time of the menstrual cycle, that means between the 5th and 12th day after the start of the menstrual cycle. Unclear is how soon after the operation one should perform breast MRI. If a large mass of residual disease is suspected, MRI is an excellent tool to confirm this fact. But, if a mastectomy is considered, pathological confirmation before the re-operation is recommended. Another imaging technique is TC-99m-MIBI scintimammography. This seems a promising technique with a high sensitivity and specificity.

Learning Objectives:

1. To review indications for imaging after excisional biopsy.
2. To understand imaging findings in the treated breast.
3. To understand the role of MRI in detection of residual disease.

A-433 16:28

B. Evaluation of response to neoadjuvant chemotherapy

P.A.T. Baltzer, M. Dietzel, W.A. Kaiser;

Jena/DE (pascal.baltzer@med.uni-jena.de)

Neoadjuvant chemotherapy is regularly used for downstaging of locally advanced breast cancer. While it is equivalent to adjuvant therapy regarding overall survival and occurrence of distant metastasis, more patients are eligible for surgical treatment by less aggressive breast conservative therapy. Neoplastic growth depends on blood supply with nutrients and oxygen. Hypoxia-induced angiogenesis is an early step in tumour progression. MRI is the imaging modality providing highest sensitivity for detection of breast cancer, highlighting tumour vascularisation by injection of T1-shortening contrast agents. Characteristic differences between benign and malignant lesions are

best identified by dynamic repetitive T1w imaging which is referred to as DCE-MRI. Chemotherapeutic treatment leads to characteristic tissue changes affecting both vascularisation, tumour microstructure, i.e. extracellular space and chemistry, e.g. choline metabolites. While the first is assessed by DCE-MRI, further MRI techniques such as diffusion weighted imaging (DWI) and MR-spectroscopy (MRS) provide means to measure changes in tumour microstructure and chemistry due to neoadjuvant chemotherapy. This talk will introduce and discuss different MRI concepts for monitoring of neoadjuvant chemotherapy using MRI. Furthermore, accuracy and limitations of MRI for prediction of response will be discussed.

Learning Objectives:

1. To understand principal mechanisms of tumour vascularisation and microstructure.
2. To understand changes in tumour vascularisation and microstructure due to neoadjuvant chemotherapy.
3. To understand the accuracy and limitations of response monitoring using breast MRI.

A-434 16:51

C. Surveillance for and detection of recurrent disease after therapy

F.J. Gilbert; Aberdeen/UK (f.j.gilbert@abdn.ac.uk)

Recurrent disease following treatment for primary breast cancer can occur in the same breast following conservation surgery, ipsilateral breast tumour recurrence (IBTR) or in the contralateral breast, metachronous contralateral breast cancer (MCBC). Estimations for the rate of recurrence are between 0.4 and 0.8% each year. The rate of recurrence is higher than breast cancer incidence in the general population. Risk factors for recurrence are young age (< 50), high grade disease, incomplete tumour excision and no radiotherapy. Due to the large numbers of women who develop and survive breast cancer the cost and resource required to follow-up these women is considerable. There are variable guidelines in Europe for the surveillance of women but most regimes include clinical follow-up and mammography. Variations concern the frequency of mammography, the length of follow-up required, and whether clinical examination is required. The clinical effectiveness and cost-effectiveness of different surveillance mammography regimens after the treatment of primary breast cancer will be reviewed together with the results of systematic reviews. Modelling of two data registries was undertaken to ascertain the survival benefit. Alternative methods of surveillance will be considered such as MRI with the diagnostic accuracy of the various imaging techniques considered. A summary of the economic evaluation will be presented to demonstrate the assumptions that require to be made in this complex area where there is a paucity of evidence.

Learning Objectives:

1. To understand the risk of recurrent disease and second primary following the treatment of breast cancer.
2. To review literature on surveillance mammography and other imaging methods for detection.
3. To appreciate the range of recommendations for surveillance mammography and clinical follow-up with cost benefit analysis.

Panel discussion:

The new challenge in breast cancer: evaluation of response 17:14

Evaluation of the treated breast is one of the major challenges in breast imaging. There is especially much debate on the evaluation of response to therapy. The best imaging modality, the best imaging criteria, timing, accuracy and limitations of imaging are currently being investigated. Whether it is time to reach conclusions regarding these aspects is the issue of this panel discussion.

16:00 - 17:30

Room G/H

Neuro

RC 1411

Update on brain aneurysms

Moderator:

S. Bracard; Nancy/FR

A-435 16:00

Introduction to brain aneurysms

S. Bracard; Nancy/FR (s.bracard@chu-nancy.fr)

Cerebral aneurysm is a challenging problem. Subarachnoid haemorrhage (SAH) remains a devastating accident. The incidence of SAH is around 6 per 100000 patient-years, higher in Finland and account for around 5% of all strokes. The diagnosis may be difficult on CT or MR but is essential. Complications are frequent and precocious: hydrocephalus, vasospasm and the most important, rebleeding. In the first day, up to 15% of patients have a rebleeding and after the first day, the risk of rebleeding is more-or-less constant at a rate of 1 to 2% per day during the next 4 weeks with a poor prognosis. After rebleeding, 80% of patients died or remain disabled. Ruptured aneurysms are the cause of SAH in 85% of patients, whereas 5-10% fit into the pattern of so-called non-aneurysmal perimesencephalic haemorrhage. The remaining are caused by various causes. Both CTA and MRA may be proposed as a first-choice, non-invasive examination. The average sensitivity of CTA for the detection of intracranial aneurysms reaches 90%, but the negative predictive value is poor, and therefore digital subtraction angiography (DSA) is mandatory for all SAH cases with negative CTA or MRA. During the past decade, endovascular occlusion by means of detachable coils (coiling) of aneurysms has largely replaced surgical occlusion as the intervention of choice for the prevention of rebleeding. On the other hand, more and more unruptured aneurysms are fortuitously discovered and the question to treat or not to treat is also a challenging issue.

A-436 16:05

A. Subarachnoid haemorrhage

L. van den Hauwe¹, C. Venstermans², M. Voormolen², T. van der Zijden², F. De Belder², J.W. Van Goethem², P.M. Parizel²; ¹Brasschaat/BE, ²Antwerp/BE (lucvdhauwe@mac.com)

In 85% of nontraumatic cases, subarachnoid haemorrhage (SAH) is the result of aneurysmal rupture. Other causes of SAH include perimesencephalic SAH (10%) and other disorders (5%) such as arteriovenous malformation (AVM), vertebralbasilar artery dissection, dural AV-fistula, cortical vein thrombosis, amyloid angiopathy, ... SAH represents an emergency situation and diagnosis should be established ASAP. Plane computed tomography (CT) is the initial diagnostic test of choice (wide availability, easy accessibility, high sensitivity and specificity). If CT is negative, lumbar puncture and/or MRI of the brain (including FLAIR images) and spine should be performed. 3D TOF MR angiography (MRA) sequences have high sensitivity and specificity in detecting cerebral aneurysms; but because of their lower spatial resolution are insufficient to analyse in detail aneurysm morphology. This in contrast with CTA. Both CTA and MRA may be proposed as a first-choice, noninvasive examination, but the negative predictive value is poor, and therefore digital subtraction angiography (DSA) is mandatory for all SAH cases with negative CTA or MRA. Catheter angiography remains the golden standard in the detection and evaluation of cerebral aneurysms (size, relationship between neck and adjacent vessels, etc). Increased attenuation (CT) and hyperintense signal (FLAIR) within the basal cisterns and sulci are a characteristic finding of SAH; however, it is aspecific. Pattern and location of the blood may help to locate the ruptured aneurysm; sometimes helpful when multiple aneurysms are found. Pseudo-SAH may be a potential imaging pitfall because it may be observed in other acute neurological conditions (cerebral edema, bacterial meningitis, etc).

Learning Objectives:

1. To review the different causes of subarachnoid haemorrhage.
2. To learn about the basic imaging strategies in the diagnostic work-up of subarachnoid haemorrhage.
3. To learn how to recognise the early CT and MR signs of subarachnoid haemorrhage.

A-437 16:28

B. CTA/MRA in aneurysm diagnosis

Z. Merhemic; Sarajevo/BA (merhemic.zulejha@gmail.com)

Intracranial aneurysms are abnormal dilatations of the arteries, and will be found in 1% to 14% in general population. In 90% cerebral aneurysms are saccular and develop from the arteries of the circle of Willis or its major branches. Aneurysms typically become symptomatic between the age of 40 and 60 years, with subarachnoid haemorrhage (SAH) or intracerebral haematomas. Less common are giant aneurysms usually found in middle-aged women presenting with signs more indicative of a mass lesion. CT angiography (CTA) has been proven to be an excellent tool to visualise intracranial arteries. The average sensitivity of CTA for the detection of intracranial aneurysms reaches 90%. Post-processing allows assessment of the aneurysm with maximum intensity projections (MIP) and surface-rendered 3D projections in multiple planes. MR angiography (MRA) is a practical and noninvasive tool for screening of high-risk individuals for aneurysms. DSA is diagnostic method of choice for assessment of intracranial aneurysms and was considered to be a 'gold standard' for evaluation of cerebral vessels. A clear shift from invasive to noninvasive imaging of cerebral vessels has been noticed in the last decade. This lecture will discuss advantages and disadvantages of CTA, MRA and DSA in detection, assessment, and post-treatment evaluation of intracranial aneurysms.

Learning Objectives:

1. To understand the imaging findings on CTA and MRA of brain aneurysm.
2. To recognise the key features of an imaging protocol for patients with suspected aneurysm.
3. To understand the optimal CTA and MRA protocol for diagnosing brain aneurysm.

A-438 16:51

C. Treatment of aneurysms 2011

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

Intracranial aneurysms have a multifactorial origin. A heterogeneous and complex group of pathogenic mechanisms including luminal, mural and extramural factors interact for the development and growth of aneurysms. There are several types of intracranial aneurysms, being the saccular the most common type. The aneurysmal treatment is dependent on its type and needs a multidisciplinary approach including endovascular and microsurgical teams. Endovascular treatment is recognised as the first-line treatment for most of the ruptured saccular intracranial aneurysms. There has been an enormous improvement in the endovascular technology and techniques offering a wide spectrum of treatment possibilities that broadened the variety of aneurysms that can be treated. The treatment options include the use of coils with/without the help of balloon-remodelling and/or stenting. Other options include the use of covered stents, of "flow-diverter" stents, of liquid embolics, or the parent vessel occlusion. The multislice computer tomography angiography (MSCTA) is a reliable method for pretreatment evaluation of intracranial aneurysms. For the posttreatment evaluation, magnetic resonance angiography (MRA) can be used for the follow-up of embolised aneurysms; and MSCTA may be used for the follow-up of surgically treated aneurysms. There are several challenges remaining in aneurysm management. In the diagnostic field, improvement of the non-invasive techniques for the diagnosis, for the morphological and haemodynamic characterisation and for the posttreatment follow-up of aneurysms is expected. In the endovascular field, technological breakthroughs to improve the occlusion rate, to increase the treatment durability, and to promote the vessel wall healing are desired.

Learning Objectives:

1. To learn about present treatment of brain aneurysms.
2. To understand the strategies for multimodal CT and MR aneurysm imaging pre and post-treatment.
3. To present the challenges for neuroimaging in the field in the near future.

Panel discussion:

Where do we stand in brain aneurysm treatment today? 17:14

There is a significant difference in the management of patients with ruptured versus un-ruptured brain aneurysms. This panel discussion will focus on the management of patients with brain aneurysms and will with simple case presentations show the management in ruptured and un-ruptured aneurysms and discuss the involvement of the neurosurgeon in more complex cases.

16:00 - 17:30

Room I/K

Cardiac

RC 1403

MRI and CT before cardiac interventions or surgery

Moderator:

G.P. Krestin; Rotterdam/NL

A-439 16:00

Chairman's introduction

G.P. Krestin; Rotterdam/NL (g.p.krestin@erasmusmc.nl)

Advancements in CT and MRI technology have led to an increasing use of these modalities in the non-invasive assessment of coronary arteries, myocardial perfusion, and cardiac function. While their role in detecting coronary artery disease and functional disorders has been widely accepted, it is still unclear whether they could be adopted in triaging patients for the best therapeutic approach. Large studies have already suggested that indication for surgery and percutaneous interventions cannot be solely based on the demonstration of morphologic alterations and that such "cosmetic" interventions are not always leading to the expected outcomes. Therefore, non-invasive imaging techniques have to offer more than just the detection of grades of coronary artery stenosis, of areas of infarcted myocardium, or of valvular alterations. Adjustment of imaging protocols for additional evaluation of coronary flow reserve, of myocardial perfusion and contractility and of valve size, position and damage with subsequent quantification of degree of stenosis and/or regurgitation are necessary in order to allow to choose the most appropriate therapeutic approach and thus become the "gold standard" for prognosis and pretherapeutic diagnosis of cardiac diseases.

A-440 16:05

A. Can CT predict the outcome of percutaneous intervention?

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

The outcome of coronary revascularisation is not only defined by primary technical success but also by improvement of symptoms and quality of life. Thus, despite the individual comorbidities, the outcome and thus the potential benefit of coronary revascularisation depends on many different factors, including morphology, distribution and severity of coronary lesions, myocardial viability, and ventricular function. Consequently, the detection of coronary stenosis is not sufficient for planning an optimised treatment. It should be evaluated if the myocardial territory supported by the diseased artery is still vital. In addition, lesions at risk for plaque rupture (culprit lesions) should be identified and treated to avoid major coronary events. Cardiac CT allows for the exact assessment of coronary morphology including length, calcification and severity of lesions. Based on this morphological information, success of a percutaneous revascularisation procedure can be anticipated with high prognostic accuracy. In addition, the possibility of identification of culprit lesion by means of coronary CT has been described recently. By this, dedicated treatment of only the relevant stenosis should become possible avoiding multiple, potentially unneeded, stents. Finally, even the assessment of myocardial viability by means of CT becomes possible. Using all the possibilities of cardiac CT optimised treatment plan can be established, and outcome can be estimated. This presentation should give an overview about potential applications of cardiac CT for optimised treatment decisions and planning. Recent literature should be introduced based on clinical examples. Potentially useful algorithms for appropriate treatment selection should be provided allowing for improving the outcome of coronary interventions.

Learning Objectives:

1. To understand the role of CT coronary angiography in the assessment of patients prior to percutaneous intervention.
2. To appreciate the role of CT findings regarding the myocardium in patients prior to cardiac interventions.
3. To understand the positive and negative predictive value of CT in the assessment of potential candidates for cardiac interventions.

A-441 16:28

B. Can MRI predict the outcome of coronary revascularisation?

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

Prediction of coronary revascularisation outcome represents a major clinical question because a large number of medical and surgical options have become available for ischaemic cardiomyopathy with need to identify more rigorous criteria for patient's selection. The combination in a single examination of function, stress-perfusion and tissue characterisation with T2-weighted 'oedema-sensitive' and late-gadolinium enhancement (LGE) techniques supported the role of cardiac MR (CMR) as an important technique for the evaluation of patients candidates to revascularisation. Besides more "traditional" indicators such as ejection fraction, end-diastolic wall thickness or end-systolic volumes, extent and distribution of myocardial scar depicted with LGE has been identified as one of the most important predictors of post-revascularisation outcome with direct influence on functional recovery and on major adverse cardiovascular events (MACE) due to the potential induction of arrhythmias from the scar. LGE technique has been shown to be superior to nuclear medicine for the assessment of myocardial viability due to the higher spatial resolution (up to 60-fold greater than SPECT) and an intrinsic high contrast resolution. A further technique that could be adopted before revascularisation is stress imaging. Myocardial ischaemia detected by either CMR adenosine first-pass perfusion or dobutamine-induced wall motion abnormalities has been shown to predict subsequent cardiac death whereas normal stress perfusion showed a high negative predictive value for MACE. In conclusions, although as a relatively new diagnostic modality prognostic evidence is predominantly derived from single-center studies, CMR is increasingly becoming an important tool for risk stratification of patients before revascularisation, offering indications about outcome and mortality.

Learning Objectives:

1. To review the scientific evidence of MRI in CAD.
2. To understand the important prognostic factors that MR is able to provide.
3. To learn about the advantages of performing cardiac MR prior to coronary revascularisation.

A-442 16:51

C. The value of CT before percutaneous aortic valve replacement

R. Salgado; Antwerp/BE (rodrigo.salgado@uza.be)

Cardiac valve diseases are an important public health problem, strongly linked to the general increasing age of the Western population. The most frequent valve disease is aortic stenosis, for which percutaneous aortic valve replacement (PAVR) is currently evolving to a feasible alternative therapy for the classical surgical approach in high-risk patients. Nevertheless, careful evaluation of all aspects of this new approach is still required to avoid uncontrolled diffusion. Imaging plays a key role in selecting patients who may be eligible for PAVR, focusing on the evaluation of leaflet anatomy, severity of valve dysfunction, haemodynamic consequences and potential problems in the access route. While echocardiography is commonly used for both the anatomical and functional evaluation, multidetector CT (MDCT) has important intrinsic advantages providing state-of-the-art 3D imaging with a high spatial resolution over a large anatomic coverage. During this course, we will discuss the advantages and disadvantages of MDCT compared to other imaging modalities. The relevant anatomy of the aortic valve and annulus will be reviewed, with emphasis on correct alignment of the imaging planes, and its implications for correct reporting of the necessary measurements targeted at the clinicians need. Furthermore, MDCT scan protocol design will be reviewed, focusing not only on optimal implementation of common scan parameters but also on the need of ECG-triggering and its consequences. Finally, we will present the current status of evidence on using MDCT in PAVR procedures, and discuss future challenges and perspectives.

Learning Objectives:

1. To understand how to optimise the imaging protocol for aortic valve imaging.
2. To learn how to report the findings and what to include in the report.
3. To understand the impact of this approach on patient management.

Panel discussion:

Improve your interaction with your colleagues 17:14

MR and CT are increasingly being used as the modalities of choice in the evaluation of patients prior to cardiac interventions or surgery. It is very important to understand the specific clinical question that prompted the clinician to order the exam and to answer it in the best possible way. The radiologist has to make clear statements and should know the therapeutic implications of his report and findings.

16:00 - 17:30

Room L/M

Radiographers

RC 1414

Radiography in the operating theatre

Moderators:

R. Passariello; Rome/IT

A. Yule; Cardiff/UK

A-443 16:00

A. Cone-beam CT imaging in the operating room during endovascular aortic repair (EVAR)

K.R. Eide, A. Ødegård, H.O. Myhre, S. Hatlinghus, O. Haraldseth;

Trondheim/NO (kari.eide@hist.no)

Cone beam CT (CBCT) is a method for obtaining CT-like images using a C-arm system. Our aim was to investigate the accuracy of these images compared with multi-detector CT (MDCT) as a gold standard in radiological imaging of abdominal aortic aneurysms (AAA). 40 patients with AAA referred for elective EVAR were included in a pre-therapy protocol (20 patients) and in a post-therapy protocol (20 patients). All were exposed to standard MDCT and one additional CBCT. Image data were evaluated by two radiologists and statistically compared using a linear mixed model. First, 6 predefined arterial measurements were performed, then 9 predefined anatomical areas were assessed and scored for visibility on a scale from 1 to 4. All measurements were chosen to be relevant for evaluating of AAA before and after EVAR. For the arterial measurements no significant differences were found between MDCT and CBCT. Visibility for the anatomical areas was significantly better for MDCT; however, most of the CBCT readings were above lowest acceptable level. Visualisation of the iliac arteries was suboptimal. We think that our results support the start of clinical trials that scientifically can test the outcome without the use of MDCT immediately before and after EVAR. The problem with poor visualisation of the distal iliac arteries might be solved with newer technology. In conclusion, the result indicates that CBCT in the operation room gives sufficient image-based information to support EVAR in a pre- and post-therapy setting.

Learning Objectives:

1. To gain knowledge about visualisation of high- and low contrast structures using cone-beam CT.
2. To appreciate some strengths and limitations using intraoperative cone-beam CT.
3. To become familiar with doses of radiation needed to plan and carry out EVAR.

A-444 16:45

B. Key radiographic skills in the operating theatre

K.G. Holmes; Lancaster/UK (ken.holmes@cumbria.ac.uk)

Undertaking theatre radiography can appear a daunting task for the radiographers lacking in confidence in their ability but others (like all expert practitioners) make it look easy and uncomplicated. Theatre radiography requires all the knowledge, skills and abilities of a competent radiographer together with assertiveness, reflection and the ability to modify your technique at a moment's notice. There are a multitude of 'traits' which distinguish the expert from the novice. These include production of optimum images, effective use of the equipment, radiation protection, infection control, effective communication and teamworking. There is also a clear depth of knowledge together with a multitude of skills and abilities. The key to a stress-free experience is preparation. It is essential that there is a mechanism for theatre staff and the radiology department to communicate effectively and give the radiographer prior notice of all cases requiring their attendance. It is also desirable to be in the theatre when the patient arrives for their examination to enable you to check the patient's identity, pregnancy status and ensure the patient is positioned correctly to facilitate screening. There are few excuses to give the surgeon if you cannot screen the area of interest because of poor positioning of the patient and equipment. This paper will discuss the knowledge, skills and abilities required to undertake theatre radiography in a safe and proficient manner without feeling threatened by the experience.

Learning Objectives:

1. To understand the key skills required to undertake radiographic procedures in the operating theatre.
2. To gain an insight into the interpersonal skill required for effective radiographic practice in the operating theatre.

3. To appreciate effective methods for reducing radiation dose to patients and staff during radiographic procedures in operating theatres.
4. To learn how to improve radiographic techniques in theatre to ensure optimum images are produced during procedures.

16:00 - 17:30

Room N/O

Joint Course of ESR and RSNA

(Radiological Society of North America)

MC 1425

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

Moderator:

H.-U. Kauczor; Heidelberg/DE

A-445 16:00

A. Lymphoma

M.P. Federle; Stanford, CA/US

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-446 16:30

B. Musculoskeletal neoplasms

M.F. Reiser; Munich/DE

Learning Objectives:

1. To review imaging features of common malignant musculoskeletal neoplasms.
2. To learn about key imaging findings required for staging of bone and soft tissue tumours, as well as associated imaging pitfalls.
3. To learn about criteria for conventional imaging, perfusion MR imaging and diffusion-weighted MR imaging and PET/CT in assessing response to treatment in musculoskeletal neoplasms.

A-447 16:55

C. Chemo- and radiation therapy-induced toxicity

H.-U. Kauczor; Heidelberg/DE

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.

Questions 17:20

16:00 - 17:30

Room P

Physics in Radiology

RC 1413

Visualisation, perception and image processing

Moderators:

A.A. Lammertsma; Amsterdam/NL

B. Wein; Aachen/DE

A-448 16:00

A. Visualisation and perception

A.G. Gale; Loughborough/UK (a.g.gale@lboro.ac.uk)

Radiological interpretation always incurs some degree of error due to the nature of disease presentation coupled with the difficulty in diagnosis, especially where early signs of disease need to be identified such as in medical screening. Early research studies of radiologists' performance concentrated upon the chest radiograph but more recent work has studied breast screening extensively, as well as MRI and CT. As radiology is now almost fully digital then research has also examined observer behaviour with a range of digital images, viewing conditions, and image display presentations. It is possible that radiological interpretation will never be accomplished without some errors occurring; however, it is important that steps are taken to minimise any causes of errors as far as possible. The reported error rates found in numerous investigations across different radiological domains will be reviewed and the reasons for these will be elucidated. Appropriate reporting conditions will be highlighted for different image viewing scenarios. A theoretical framework for understanding error causation, especially where abnormalities are missed will be detailed. Furthermore, the underlying visual, perceptual and cognitive processes which lead to errors will be detailed and approaches to minimise error occurrence will then be proposed. The relationship between human perceptual and cognitive skills and computer imaging processing will be discussed and the usefulness of CAD systems outlined as how they can best aid the radiologist from the human performance viewpoint.

Learning Objectives:

1. To review the basic principles of perception, detection and detectability.
2. To learn about specifics of perception in medical imaging.
3. To learn how image processing can help us with the perception process.

A-449 16:30

B. Image processing and perception

B.M. ter Haar Romeny; Eindhoven/NL (B.M.terHaarRomeny@tue.nl)

The need for quantitative image analysis in radiology is universal: computer-aided detection, segmentation for 3D volume visualisation, image enhancement, pattern recognition, etc. All need effective, robust and preferably generic (not 'ad hoc') algorithms for the computer. How to design such algorithms? A good inspiration source is the functionality of the visual system, the best investigated brain structure today. In this talk we will explain how we think the brain calculates features in images, why the retina measures at a wide range of resolutions and how we can exploit this. The visual system is strongly adaptive and self-learning. New optical recording techniques have given new insight in how the cells in the visual cortex are functioning. We will go through these functionalities step-by-step. What we discover is quite amazing. We recognise huge amounts of filter banks in the first stages of vision: many filters analyse each pixel of the incoming image at a range of scales, orientations, derivative order, for each colour, and also as a function of time. Extensive feedback loops take care of optimal settings locally. We programmed these filters into the computer, and were able to build many interesting applications for computer-aided diagnosis: detection of catheters at seriously reduced levels of x-ray radiation dose, automatic polyp detection, quantitative analysis of ischaemic heart ventricle deformation, breast cancer CAD, pulmonary emboli CAD and analysis of in vivo microscopy images now so abundant in modern life-sciences research.

Learning Objectives:

1. To gain insight into modern computer vision techniques for computer-aided diagnosis.
2. To learn how the first stages of human visual perception process information.
3. To learn a range of application areas of image processing techniques for medical imaging.

A-450 17:00

C. Clinical application of image processing

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

The practice of medical image diagnosis is currently undergoing a fast transformation. Vast amounts of data can be generated in standard examinations and focus is shifting from improving the collection of relevant data for diagnosis to development of effective methods to analyse, visualise, navigate and interact with medical information. It is now becoming generally accepted in the medical community that one of the most important keys to manage the increasing information work load is the use of 3D and 4D applications. This talk will take its starting point in state-of-the-art medical visualisation and then discuss the need for a research agenda that focuses on the development of the next generation of medical visualisation tools, emphasising the fact that these tools must be based on medical user requirement and work flow studies as well as on new technical developments.

Learning Objectives:

1. To learn how to use adequate reconstructions/image sequences in CT/MR.
2. To learn when to use transverse, sagittal and coronal displays.
3. To learn when to use 3D displays.

16:00 - 17:30

Room Q

Paediatric

RC 1412

Children's bones and joints

Moderator:

M. Rasero; Madrid/ES

A-451 16:00

A. Imaging findings in childhood osteomyelitis

R.R. van Rijn; Amsterdam/NL (r.r.vanrijn@amc.uva.nl)

Childhood osteomyelitis is a relatively rare finding in childhood with an estimated annual incidence of 1 per 5000 and is predominantly seen in young children (< 5 years). It can be caused by via haematogenous spread, contiguously from local areas of infection or from penetrating trauma or surgery. Usually it is caused by bacterial infections, but occasionally fungi, viruses or parasites are causative agents. Clinical findings can range from mild to severe and depends on many factors such as age, site of infection, acute versus chronic osteomyelitis, and causative agent. The CRP and sedimentation rate are usually elevated; however, this is not always the case. Given the variability in clinical presentation radiology plays a crucial role in the detection of osteomyelitis. Although conventional radiography (CR) has a limited sensitivity and specificity for the diagnosis of osteomyelitis, its wide availability makes it the first diagnostic technique of choice in children. For further analysis both MRI and radionuclide bone scintigraphy (RBS) have shown to have a high sensitivity for the detection of osteomyelitis. The advantages and disadvantages of both the techniques will be addressed. CT mostly plays a role in the diagnosis of chronic osteomyelitis or in the pre-surgical work-up. The use of radiology also allows for a differential diagnosis of osteomyelitis, based on clinical cases, an overview of this differential diagnosis will be given. The aim of this lecture is to present an evidence-based diagnostic strategy for childhood osteomyelitis.

Learning Objectives:

1. To get an overview of current imaging practices in the evaluation of osteomyelitis.
2. To learn about patterns of skeletal lesions found in osteomyelitis.
3. To understand findings that point to alternative diagnoses.

A-452 16:30

B. Hip dysplasia: US techniques and recommendations

K. Rosendahl; Bergen/NO (karen.rosendahl@helse-bergen.no)

Developmental dysplasia of the hip (DDH) is the most common musculoskeletal disorder in childhood, with a reported prevalence of 1-4% according to method of ascertainment and definitions used. Ultrasound has enabled a detailed view of both neonatal hip stability (NHI) and morphology, and two different schools have developed; one arguing that NHI alone is the major pathology warranting splinting, the other including acetabular dysplasia as an important feature. Both static (Graf, Morin) and dynamic (Harcke) ultrasound techniques, as well as a combination of the two (modified Graf (Rosendahl)), have been described and are currently used. In Europe, Graf's ultrasound technique or a modification of this is commonly used within the German speaking countries and areas, in parts of Scandinavia, the UK, Italy, France, Hungary and the Netherlands. Others use a modified Morin's method while Harcke's method is used only occasionally. Initially, universal ultrasound screen-

ing using Graf's method led to higher treatment and follow-up rates than that based on NHI alone, i.e. 3-5% vs. 0.4-1.5% and 10-20% vs. 6-7%, respectively. However, improved examination techniques and a better understanding of the findings have led to a more tailored approach, and an extensive meta-analysis performed in 2000, including 534 papers, could not find any differences in treatment rates due to different ultrasound techniques. In this lecture I will present a crude status for US techniques used and also give recommendations for a worth while screening strategy based on present knowledge, and on work performed within the ESPR's DDH Task Force group.

Learning Objectives:

1. To learn about the different approaches of hip sonography in neonates.
2. To understand the need for a systematic study.
3. To learn about proposed standardisation for examination and reporting.

A-453 17:00

C. Whole body imaging: PET/CT vs MRI

P.D. Humphries; London/UK

With technological advances in recent years, paediatric whole body imaging is now a clinically feasible and increasingly accessible technique. The two principle modalities available are PET, with or without co-registered CT images, and whole body MRI (WB-MRI), both of which can be utilised to evaluate widespread disease states efficiently. The main application of these techniques has hitherto been oncological; however, as these techniques become more accepted, their use is becoming more varied. PET provides functional assessment, utilising a radiotracer, most commonly FDG-18, to assess metabolic activity within tissues, with areas of greater metabolic activity depicted as increased tracer uptake. The use of combined CT-PET enables accurate specific uptake values (SUV) to be determined, via attenuation correction, and anatomical co-registration which reduces perceptual errors. WB-MRI primarily provides an anatomical assessment, using tissue contrast to identify pathology. This typically uses water sensitive sequences to provide high sensitivity. "Physiologic" MRI sequences, such as diffusion weighted imaging (DWI) can also be employed to obtain functional MRI data, either qualitatively or quantitatively. There are advantages and disadvantages to both techniques, including ionising radiation exposure, acquisition times, movement and other artefacts, and reproducibility, which all need to be considered when choosing a particular technique for whole body assessment in any given paediatric patient, with the disease process being investigated also influencing the technique used. The relative merits, clinical applications and evidence base for the use of PET/CT and WB-MRI in paediatrics will be discussed. Near future developments, such as PET-MRI will be touched upon.

Learning Objectives:

1. To get an overview of PET/CT and whole body MRI.
2. To learn about advantages and limitations of each technique.
3. To learn about examples of benign and malignant diseases.

Monday, March 7

08:30 - 10:00

Room A

Radiology in Abdominal Emergencies

CC 1517

The acute abdomen

Moderator:

J.-M. Bruel; Montpellier/FR

A-454 08:30

A. Abdominal hernias

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

Abdominal hernias are common in daily practice and can be divided into: external or abdominal wall hernias, internal hernias and diaphragmatic hernias. External hernias typically involve protrusion of abdominal contents through a defect in the abdominal wall. Internal hernias involve protrusion of viscera through congenital or acquired defects in the mesentery or the peritoneum. Diaphragmatic hernias involve protrusion of abdominal contents into the chest. Among these conditions, the diagnosis of internal hernia is the most challenging. Bariatric surgery and liver transplantation with biliary-enteric anastomosis, with the Roux-en-Y loop placed in a retrocolic position, are recognised predisposing factors for internal hernia development. Symptoms of hernia are nonspecific and vague, and clinical and radiologic diagnosis can sometimes be challenging. Immediate diagnosis is mandatory because misdiagnosis can be complicated by bowel obstruction, volvulus, strangulation, incarceration, or trauma. MDCT with its multiplanar capabilities is widely believed to facilitate this diagnosis, because it is able to delineate hernia type, location, size, and shape and is particularly useful to diagnose unsuspected hernias. It also allows distinguishing hernias from masses of the abdominal wall, such as tumours, haematomas and abscesses. As a result, knowledge of the CT findings of abdominal hernias may allow early and more accurate diagnosis, with a resultant decrease in the mortality rate.

Learning Objectives:

1. To understand the predisposing factors, clinical presentation and complications of abdominal hernias.
2. To be able to recognise abdominal hernias on imaging through multiple examples with an emphasis on MDCT.
3. To illustrate the postsurgical anatomy underlying internal hernias.

A-455 09:00

B. The wrong twist: mesenteric and omental torsion

S.C. Efremidis; Ioannina/GR (sefremid@cc.uoi.gr)

The title of this talk limits the discussion of torsion to the mesentery and omentum. It has to be mentioned, however, that an abnormal twist (torsion) can involve any peritoneal reflection of those suspending and fixating hollow viscera, (e.g. stomach, small bowel, cecum, sigmoid and gallbladder), solid organs, (e.g. spleen, ovaries), or even extraperitoneal (extraabdominal) organs such as the testicles, leading to the pathologic entity of volvulus or torsion of the corresponding viscus with its associated (different) imaging findings, prognosis and treatment. Moreover, twisting of the mesentery and volvulus can occur secondary to a variety of conditions including congenital anomalies of intestinal rotation with variable prognosis. Finally, torsion of the omentum can be either primary or secondary, also associated with different pathology, imaging findings and treatment. Consequently, a broad spectrum of abnormalities ensues related to the pathophysiology of torsion which requires a detailed classification, an accurate description and the use of correct terminology making it impossible to be covered within the time limits of a presentation. Therefore, focusing the discussion on to abnormal twist of small bowel mesentery and omentum will simplify the approach to avoid overlaps and confusion.

Learning Objectives:

1. To understand the pathophysiology of mesenteric and omental torsion.
2. To know the typical presentation on cross-sectional imaging modalities.
3. To learn imaging strategies with focus on MDCT.

A-456 09:30

C. Acute stages in neoplastic diseases

J.A. Guthrie; Leeds/UK (Ashley.Guthrie@leedsth.nhs.uk)

After the initial presentation, a patient with cancer enters a phase of active treatment (surgery, chemotherapy or radiotherapy), and then remission/cure or palliative phases. An „acute abdomen“ may complicate any phase. The principle causes are obstruction, perforation, haemorrhage, ischaemia and sepsis. Tumours arising from

the GI tract are leading causes but any tumour involving the abdominal cavity or haematological malignancy may be implicated. During treatment with chemotherapy or radiotherapy acute abdominal symptoms are common as a consequence of direct toxicity. Imaging must be used as an adjunct to clinical assessment. Patterns of abdominal involvement are often modified in the later phases of disease. GI tract obstruction may be due to progression or the mechanical consequences of prior surgery and is more commonly at multiple levels. Perforation or fistulation may occur with either progressive disease or tumour lysis in response to therapy. Cancer does not protect against the common inflammatory conditions but poor host response and the use of steroids may mask signs leading to extensive abnormality at diagnosis. Bone marrow suppression increases susceptibility to infection including neutropenic enterocolitis and haemorrhage. Bone marrow transplantation and consequent graft versus host disease is a potent cause of acute abdominal symptoms. CT is the major imaging technique although MR has an increasing role particularly in the assessment of the female pelvis. Major determinants when considering the differential diagnosis include; the nature and initial stage of the primary, any prior anatomical modification (surgery), the nature and relationship to current treatment and the bone marrow status.

Learning Objectives:

1. To be able to list neoplastic diseases that may potentially lead to acute abdominal symptoms.
2. To appreciate the differences in causes and findings of the acute abdomen between the initial presentation with neoplasia and when undergoing treatment.
3. To understand typical CT findings and pitfalls, and the potential role of MRI.

08:30 - 10:00

Room B

Interactive Teaching Session

E³ 1520

Prostate cancer: what the radiologist must report

A-457 08:30

Prostate cancer: what the radiologist must report

A.R. Padhani¹, H.-P. Schlemmer²; ¹Northwood/UK,

²Heidelberg/DE (anwar.padhani@stricklandscanner.org.uk)

This workshop will begin by describing the current limitations of MRI in evaluating prostate cancer patients and will show how to overcome these with advanced imaging techniques including diffusion weighted MRI (DW-MRI), MR spectroscopic imaging (1H-MRSI) and dynamic contrast enhanced MRI (DCE-MRI). The emphasis will be on the use of processing tools that are readily available for clinical practice. We will describe how to analyse images and provide a scheme for reporting findings back to surgeons/oncologists. We will show that using more than one MRI tool improves imaging performance and that the relative importance of each technique remains unresolved. We will demonstrate new indications for advanced MRI in prostate cancer patients.

Learning Objectives:

1. To understand the current crisis in prostate cancer diagnosis and patient care.
2. To appreciate that limitations of morphological imaging methods can be overcome by functional techniques such as diffusion MRI, dynamic contrast enhancement and spectroscopy.
3. To get to know the biological basis for observations, data acquisition and analysis methods, validation, interpretation of data of these technique.
4. To learn methods for reporting findings back to surgeons/oncologists.
5. To appreciate that advanced MRI tools will enable us to tackle new indications in prostate cancer diagnosis.

08:30 - 10:00

Room C

CLICK (Clinical Lessons for Imaging Core Knowledge): Common

Clinical Cases

CC 1518

Female pelvic pain

Moderator:

A.J.M. Maubon; Limoges/FR

A-458 08:30

A. Clinical considerations

G. Restaino, V. Chiantera; Campobasso/IT (gennares@hotmail.com)

Pelvic pain is an important part of clinical practice for any clinician who provides health care for women. Pelvic pain may be acute, recurrent or chronic. Acute pelvic pain (APP) rarely lasts more than one month without crisis, resolution, or cure. Pain of more than 1 or 3 or 6 months of duration is considered as chronic pelvic pain (CPP) and in many settings may be considered and treated as an illness itself. Women who present with APP frequently exhibit nonspecific signs and symptoms. Diagnostic considerations encompass multiple organ systems, including obstetric, gynaecologic, urologic, gastrointestinal, and vascular aetiologies. As the first priority, urgent life-threatening conditions (e.g. ectopic pregnancy, appendicitis and ruptured ovarian cyst) and fertility-threatening conditions (e.g. pelvic inflammatory disease and ovarian torsion) must be considered. Adolescents and pregnant and postpartum women require unique considerations. CCP is a common and significant disorder of women, with a prevalence of 3.8-12%. Many disorders of the reproductive tract, gastrointestinal system, urological organs, musculoskeletal system, and psychoneurological system may be associated with CCP, the most common being endometriosis, adhesions, irritable bowel syndrome and interstitial cystitis. Ultrasonography should be the initial imaging test because of its sensitivities across most aetiologies and its lack of radiation exposure. Computed tomography (CT) serves an important role in patients with nonlocalizing symptoms, an indeterminate US evaluation, or in patients who require a wider search beyond the field of view available with US. Magnetic resonance imaging is an extremely useful second-line modality for problem solving after US or CT.

Learning Objectives:

1. To learn more about the clinical conditions causing pain in the female pelvis without an apparent origin.
2. To be informed about the clinician's way of thinking in the process of differential diagnosis.
3. To become familiar with the potential role of imaging in the establishment of the final diagnosis and planning of therapy.

A-459 09:00

B. Imaging techniques and typical findings

B. Brkljacic; Zagreb/HR (boris.brkljacic@zg.htnet.hr)

Many gynaecologic and nongynaecologic conditions causing pelvic pain are grouped according to the anatomic origin; after determining whether the patient is pregnant imaging work-up is tailored to establish potential causes within and outside of pelvis. Transabdominal and transvaginal ultrasound (TVUS) with color duplex-Doppler are first imaging modalities. Examination technique will be discussed. Most patients with pelvic pain and normal US findings have improvement or resolution of symptoms; normal TVUS has negative predictive value of 92%. US findings are often inconclusive, some diseases are hard to diagnose, and appearance of benign and malignant conditions may overlap. CT is performed when US and/or clinical findings are equivocal or indicate pelvic abscess, haematoma, postpartum complications, complications of pelvic inflammatory disease, and when GI or urinary diseases need to be excluded. Advantage is availability in emergency, but CT lacks precise definition of pelvic structures and includes exposure to ionising radiation, problematic in young or pregnant women. Examination technique and protocols will be presented. MRI has the highest accuracy. Fast MRI considerably shortened imaging time. Fat-suppression sequences help to establish fat-containing lesions and increase the conspicuity of inflammatory lesions. Different sequences will be discussed. MR is rated below US and CT for evaluation of acute pelvic conditions, but is excellent alternative when administration of iodinated contrast media or radiation exposure is undesirable, especially in young or pregnant patients. Long imaging times, limited access and cost are major drawbacks of MRI. Imaging findings of various gynaecologic and nongynaecologic conditions causing female pelvic pain will be presented.

Learning Objectives:

1. To learn about the available imaging modalities to be used for the evaluation of female patients with pelvic pain.

2. To become familiar with the technical imaging considerations and the proper diagnostic algorithm.
3. To know more about the typical imaging findings.

A-460 09:30

C. Interactive case discussion

A.G. Rockall; London/UK (andrea.rockall@bartsandthelondon.nhs.uk)

This case-based lecture will present typical clinical cases of pelvic pain as well as some unusual but important causes. Cases of acute and of chronic pelvic pain, and benign as well as malignant disease will be included. The audience will have the opportunity to participate in case discussion by the use of interactive voting pads. The selection of imaging modality for each clinical presentation and the importance of knowing the clinical findings at the time of the radiological interpretation will be discussed. For each case, the key radiological features will be illustrated. The essential elements of the radiology report and the key information required by the clinician will be discussed. In each case, the differential diagnosis and the need for follow-up imaging will be considered. The key teaching points for each diagnosis will be reviewed.

Learning Objectives:

1. To introduce typical cases illustrating the role of imaging modalities in the differential diagnosis of pelvic pain in female patients.
2. To motivate the audience by the use of voting pads to be involved in the diagnostic process.
3. To highlight the conclusion that may be drawn on the basis of the discussed cases.

08:30 - 10:00

Room D1

KISS (Keep It Simple and Straightforward): Musculoskeletal MRI

CC 1516

The hip

Moderator:

C.W.A. Pfirrmann; Zurich/CH

A-461 08:30

A. How I do it

A. Kassarjian; Majadahonda/ES

MR imaging of the hip and pelvis can be challenging given the complex anatomy, multiple potential sites of injury, lack of dedicated hip coils, the deep location of the hip joint, and the tightly opposed intra-articular structures. Optimisation of patient positioning, scan parameters, and use of contrast can vastly improve diagnostic accuracy in assessing both intra- and extra-articular lesions that may result in hip and groin pain.

Learning Objectives:

1. To understand the influences of patient positioning, scan parameters and magnet/coil technology on image quality.
2. To learn how to optimise scan protocols to maximise patient throughput without compromising diagnostic quality.
3. To recognise how and when to modify scan protocols to answer specific clinical questions.

A-462 08:55

B. Normal variants and pitfalls

U. Studler; Basle/CH (studleru@uhbs.ch)

This lecture provides a practical approach to the fundamentals of normal cross-sectional anatomy of the hip. Basic knowledge necessary to identify the different portions and contents of the joint anatomy is provided. A special emphasis is on cartilaginous structures, the acetabular fossa, and capsular fibers and ligaments. Functional anatomy of muscles and tendons about the hip is reviewed. The location of bursae and their association with adjacent structures is discussed. In the second part of the lecture attendees will learn how to avoid commonly seen pitfalls about the hip. A special focus on anatomic variants of the acetabular labrum simulating disease is given. Osseous variants including acetabular ossicles and the superior acetabular notch will be explained and explored. Debates about the role of herniation pits referred to as a normal variant are reviewed. The lecture offers an overview of muscular and tendinous variations around the hip joint.

Learning Objectives:

1. To become familiar with the normal anatomy.
2. To be able to identify normal variants.
3. To appreciate the range of pitfalls that may simulate pathology.

A-463 09:20

C. Identifying and reporting abnormal findings

P.M. Cunningham; Navan/IE

The differential diagnosis of hip pain is broad and includes intra-articular pathology, extra-articular pathology including referred pain from the spine, and mimickers including groin pain and pain from the joints of the pelvic ring. The diagnosis of all causes of hip pain/pathology has improved with greater use of magnetic resonance imaging (MRI) to complement traditional investigations. In this session pathology involving the hip and groin will be reviewed in a systematic way which will outline an approach to the hip that will allow the reader to maximise their diagnostic ability. The review will include evaluation of bone marrow disorders such as avascular necrosis and transient osteoporosis and intra-articular pathology including labral tears and femoroacetabular impingement (arthritis and traumatic fractures will not be reviewed). Extra-articular diagnoses such as bursitis, groin pain (osteitis pubis and adductor/gracilis dysfunction) and common muscle and tendon injuries will then be reviewed.

Learning Objectives:

1. To review the imaging appearances of common abnormalities.
2. To understand the use of terminology to describe pathological findings.
3. To learn how to structure a radiological report to ensure clarity and brevity.

08:30 - 10:00

Room D2

Interventional Radiology

RC 1509

Musculoskeletal interventions

Moderator:

A. Gangi; Strasbourg/FR

A-464 08:30

Chairman's introduction

A. Gangi; Strasbourg/FR (gangi@rad6.u-strasbg.fr)

Today, many procedures of bone and joint are performed under imaging control. Minimally invasive procedures require less resources, time, recovery, and cost, and often offer reduced morbidity and mortality, compared to other modalities. Many percutaneous techniques are available. Some aim to treat pain and consolidate bone (cementoplasty). Others ablate or reduce the tumour (chemical and thermal ablation techniques). The interventional radiologist with an efficient imaging-guided technique (flat panel fluoroscopy, CT, and MRI) can increase the precision of the above-described procedures allowing an improvement of the results and reduction of the complications. Furthermore, the presented interventions are carried out either on an outpatient basis or with 24 hours hospitalisation which contributes to the reduction of overall costs and presents a major advantage for patients of working age. Some of these minimally invasive procedures can be considered as alternatives to surgery without excluding further surgical options if necessary.

A-465 08:35

A. Guidelines for spinal infiltrations and nerve blocks

S. Masala; Rome/IT (salva.masala@tiscali.it)

Back pain is one of the most common complaints, it is estimated that almost 50% of working adults will experience it in any given year. Diseases of peripheral skeleton may produce painful symptomatology as well. Some of the algogenic structures of the spine and peripheral skeleton are lumbar intervertebral discs, facet joints and atlanto-axial/occipital joints, sacroiliac joints, nerve root dura, periosteum, ligaments, fascia. Among several aetiologies which can involve these structures, spine degenerative pathology plays the leading role. Nowadays, several different interventional techniques are available, each one with its specific target of action. With the right indication each of them has been proved to be effective as painkilling modality. Herein, we present an up to date comprehensive overview on the interventional techniques available with their own indications.

Learning Objectives:

1. To learn about examination methods and indications to treat.
2. To learn about treatment modalities.
3. To review results.

A-466 08:58

B. Vertebroplasty and kyphoplasty

T. Sabharwal; London/UK (Tarun.Sabharwal@gstt.sthames.nhs.uk)

Bone filling with cement aims to treat and prevent pathological fractures and relieve pain in patients with osteoporosis and bone metastases. Several advances have occurred with new mechanical devices for effective restoration of vertebral height, as well as the introduction of osteoconductive and osteoinductive cements that will promote more physiological bone healing.

Learning Objectives:

1. To learn about indications to treat.
2. To learn about how to treat non-surgically.
3. To review the results. Is there evidence that it works on a long term or placebo treatment?

A-467 09:21

C. Interventional management of painful osseous metastases

A.G. Ryan; Waterford City/IE (jackoriain@yahoo.ca)

An overview of the interventional radiology management of painful osseous metastases will be presented. Consideration will be given to patient, lesion and treatment modality selection (including radiofrequency ablation, cryoablation, microwave ablation, laser ablation, ethanol ablation, MR focused ultrasound ablation, cement osteoplasty, transarterial embolisation and combinations therein, e.g. combined radiofrequency ablation and cement osteoplasty). The evidence supporting these techniques and patient outcomes will be reviewed.

Learning Objectives:

1. To review the typical hierarchy of pain relief methods used in the treatment of painful osseous lesions.
2. To review the technical and anatomic appropriateness of individual treatments and their combinations.
3. To review the evidence supporting the use of these techniques and their impact on patients' pain outcome.

Panel discussion:

Experience-based vs evidence-based practice in spinal intervention 09:44

Experience/sense/empirical/economic vs evidence-based practice in spinal and extremity intervention. Who needs treatment and which modality (RFA, Cryo, osteoplasty, embolisation, coblation) is best, alone or in combination? Which modality should be recommended for management of painful osseous lytic or sclerotic lesions in the spine or extremities? What are the interventional limitations and which patients should not be offered treatment by IR?

08:30 - 10:00

Room E1

Special Focus Session

SF 15a

Molecular imaging made easy

Moderator:

F.M.A. Kiessling; Aachen/DE

A-468 08:30

Chairman's introduction

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

Molecular imaging - defined as the non-invasive assessment of biological mechanisms at molecular and cellular level - will play a major role in future disease diagnosis and treatment planning. In this context, the aim of this session is to introduce in simple terms several major research areas in molecular imaging and to discuss their future potential for clinical radiology.

Session Objectives:

1. To learn about important applications for molecular imaging in drug development and in the clinics.
2. To understand the main challenges and research tasks for molecular imaging.
3. To become familiar with the areas where the profound knowledge of a radiologist is required.
4. To identify areas in which radiologist's interested in molecular imaging should be trained.

A-469 08:35

Probes and targets in optical imaging

C.W.G.M. Löwik; Leiden/NL (c.w.g.m.lowik@lumc.nl)

Whole body fluorescent imaging and bioluminescent imaging are now widely applied in small animals to study all kinds of biological and molecular processes like i.e. gene expression, tumour progression and metastasis, apoptosis, inflammation, angiogenesis, proteolysis and to follow trafficking, differentiation and fate of cells (i.e. stem-, immune- and tumour cells). This has been done mainly by using gene reporters expressing fluorescent proteins or luciferases. Recently new mutated red shifted fluorescent proteins (with better light penetration and less absorption and autofluorescence) and codon optimized and mutated luciferases have been developed making optical imaging more sensitive and offering the possibility to use dual gene reporters. Apart from new „smart gene reporters“ there has also been a great development in injectable near infrared fluorescent (NIRF) probes, especially for tumour detection. These NIRF probes can either be targeted or enzyme-cleavable. These new developments has opened up the possibility to apply NIRF imaging in the clinic especially to image tumour tissue and to identify sentinel lymph nodes during operation. The assessment of the tumour-free margin during cancer surgery is critical to completely remove the tumour and improve the prognosis of the patient. By injecting a tumour specific NIRF probe, tumour tissue and local metastases can be visualised in real-time during operation using a dedicated NIRF camera system. We now already use NIRF imaging in the clinic to detect the sentinel lymph node (SLN) in several types of cancers. In the current presentation preclinical and clinical applications of NIRF imaging in image-guided surgery will be discussed.

Learning Objectives:

1. To understand the principle of near infrared optical imaging.
2. To learn about the strengths and limitations of optical imaging.
3. To understand the principle of activatable probes.
4. To identify indications for its use in preclinical and clinical research as well as in clinical routine.

A-470 08:58

Ultrasound providing molecular imaging

M. Palmowski; Aachen/DE (mpalmowski@ukaachen.de)

Targeted ultrasound contrast agents have opened up the door for molecular imaging with sonography. These contrast agents, which consist of encapsulated gas microbubbles, are coated with antibodies or specific ligands. Injected into the circulation, microbubbles are retained in diseased tissue where they can be detected and quantified by different approaches such as “semiquantitative 2-D” or “quantitative 3-D” imaging techniques. Due to their size, microbubbles behave similar to red blood cells and remain within the intravascular space. Therefore, the disease process must be characterised by specific molecular changes on the surface of the endothelial cells to be assessable by ultrasound. Several angiogenic markers such as VEGFR2, $\alpha_v\beta_3$ -integrins, ICAM-1 and VCAM are known to be overexpressed by the endothelium in neoplastic, inflammatory and vascular diseases. Thus, molecular ultrasound imaging seems perfectly suited to detect these markers and monitor changes which might occur during treatment response or disease progression. Today, targeted ultrasound contrast agents are becoming a routinely used preclinical tool and the first application of specific microbubbles in a clinical scenario is expected for the near future. This talk will introduce into the principles of molecular imaging with ultrasound. Based on recent studies, basics of tumour biology, potential endovascular targets, synthesis of molecular probes and different imaging approaches for a preclinical and clinical application of molecular ultrasound will be discussed.

Learning Objectives:

1. To learn about potential targets and indications for molecular ultrasound imaging of tumour angiogenesis.
2. To understand the principle of target-specific ultrasound contrast agents.
3. To learn about different MB detection techniques and about the requirements on ultrasound hardware.

A-471 09:21

MR in molecular imaging

E.A. Schellenberger; Berlin/DE (eyk.schellenberger@charite.de)

A summary about the advantages, problems and challenges of USPIO-based lymph node diagnostics are given. Examples of clinical cell tracking are demonstrated. The contrast mechanisms of paramagnetic and superparamagnetic contrast agents and their use for the design of non-targeted, targeted and activatable MR imaging probes are explained. The function of different designs of activatable MR-probes

are explained. Principle requirements for clinical translations of MR-based molecular imaging strategies are discussed.

Learning Objectives:

1. To get an overview on clinical studies on USPIO-based lymph node imaging and cell tracking.
2. To learn about different designs for molecular MR-probes.
3. To understand the principle of activatable MR-contrast agents.
4. To identify areas for clinical translation.

Panel discussion:

Which role can radiologists easily play in molecular imaging? 09:44

A.K. Dixon; Cambridge/UK

Disease stage, aggressiveness, and therapy response are not sufficiently characterised by morphologic features. Therefore, imaging should assess disease-specific pathophysiology down to the cellular and molecular level. Multimodal imaging and experts with profound knowledge about imaging modalities and diagnostic agents are required. However, knowledge about the molecular biology of pathologies is also needed. Mostly interdisciplinary teams will drive this innovative field forward, in which the role of radiologist will be discussed.

08:30 - 10:00

Room E2

Special Focus Session

SF 15b

CT of small airways: elementary images for disease classification

Moderator:

J.A. Verschakelen; Leuven/BE

A-472 08:30

Chairman's introduction

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

Small airways and small airways diseases (SAD) have attracted a lot of interest that has resulted in a large number of publications since the early 1970s. Despite the several histopathological and clinical subtypes that have been described diagnosis is not always obvious. The introduction of thin section CT and the fact that this CT technique is able to depict signs of SAD has not only renewed interest but has also improved insights in these disorders. In this session the direct and indirect CT signs of SAD will be presented and the CT techniques that can improve their detection will be explained. Correlations between pathological findings and the presence of these CT signs will be made and diseases that can mimic these CT findings will be discussed. Schemes of classification of SAD based on clinical and pathological findings will be discussed briefly, but most attention will be given to the radiological classification, which is based on the recognition of the direct and indirect signs of SAD. Algorithms that help to identify the cause of SAD will be presented. Finally, the use of CT and also of MR as a tool to examine the structure-function relationship in SAD will be discussed. It will be shown how careful interpretation and software tools can help to generate data about disease extent and global and regional lung function.

Session Objectives:

1. To become familiar with the direct and indirect CT signs that indicate the presence of small airway disease (SAD).
2. To understand how these signs can be helpful in classifying and diagnosing the different types of SAD.
3. To learn about the use of CT and other imaging methods to determine disease extent and disease activity, and to predict pulmonary function deterioration.

A-473 08:35

Basic signs in small airways disease

D.M. Hansell; London/UK (davidhansell@rbht.nhs.uk)

The ability to recognise direct and indirect signs of small airways disease on HRCT has led to renewed interest in these elusive disorders. The “purest” of these diseases is constrictive obliterative bronchiolitis which is manifested on HRCT by the indirect sign of a mosaic attenuation pattern; the differential diagnosis for mosaicism and an algorithm that helps to identify the correct cause of small airways disease will be presented. The necessity for routine expiratory HRCT to make the diagnosis of obliterative bronchiolitis is controversial and will be discussed jointly

by the speakers at the end of the session. At the other end of the clinical and imaging spectrum to obliterative bronchiolitis is exudative small airways disease, typified by (Japanese) diffuse panbronchiolitis. The exudative bronchiolitis is characterised by direct signs on HRCT, notably a tree-in-bud pattern. While this is a readily appreciated and specific sign, other diseases that mimic this HRCT finding will be discussed. Bronchiectasis of variable severity is a usual accompaniment to both obliterative and exudative bronchiolitis and the relationship between large and small airways disease will be explored. The instances in which HRCT findings of obliterative and exudative bronchiolitis co-exist are relatively few, and the differential diagnosis for this situation will be considered. In practice, HRCT will often show signs of bronchiolitis (whether obliterative or exudative) limited to a segment or even subsegment, and the interpretation of the clinical significance of such a chance finding is sometimes a difficult judgement.

Learning Objectives:

1. To become familiar with the direct and indirect signs of small airway involvement on CT.
2. To know how to correlate these signs with the pathological changes.
3. To understand the differential diagnosis with other diseases that can show similar CT findings.

A-474 08:58

From pattern to diagnosis

C. [Beigelman](#); Paris/FR

Various schemes of classification of SAD have been proposed according to clinical, pathologic or imaging criteria that are confusing. An optimal approach, mainly based on CT analysis of direct and indirect features, usually allows the recognition of the two main types of SAD, namely inflammatory/exudative and fibrotic/constrictive/obliterative bronchiolitis. A miscellaneous group that corresponds to bronchiolar involvement in diverse diffuse lung diseases may also be individualised. Direct signs of SAD that refer to direct visualisation of diseased bronchioles strongly suggest inflammatory bronchiolitis. They mainly consist in centrilobular nodules with tree in bud appearance. Conversely, indirect signs mainly represented by mosaic attenuation, air trapping, bronchial wall thickening and dilation characterise fibrotic bronchiolitis. Volumetric acquisition, performed a dose reaching that obtained with classical HRCT protocols, may be of interest in several ways. Particularly, maximum intensity projection tool may facilitate the recognition of the tree in bud pattern. The minimum intensity projection mode may optimise the recognition of the mosaic attenuation pattern requiring an appropriate contrast resolution, as well as the analysis of proximal airways. Expiratory CT, optimally performed on a dynamic mode, may be useful in some conditions at a dose equivalent to around 2 chest x-rays. A combination of post-processing tools from a volumetric acquisition performed with carefully chosen parameters might therefore appear useful in the evaluation of SAD. Furthermore, additional co-existing findings such as ground glass opacity or other features of interstitial pneumonias may be detected. Their analysis may help to recognise the cause of SAD in addition to clinical data.

Learning Objectives:

1. To learn about the different types of SAD and to become familiar with the terminology used to describe them.
2. To understand how CT can help to classify these different types of SAD.
3. To learn how CT can contribute to the specific diagnosis.

A-475 09:21

Beyond morphology

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

Structural changes associated with SAD are difficult to depict directly on CT. Indirect signs of SAD, such as mosaic attenuation on an inspiratory scan and/or air trapping on an expiratory scan, are common findings. They nicely illustrate the structure-function relationship between obstruction or expiratory collapse of the small airways and the subsequent effects on ventilation (local hyperinflation) and perfusion (hypoxic vasoconstriction). These "functional" signs are thought to be more sensitive than the direct visualisation of the underlying structural changes. Careful interpretation and software tools help to generate data about disease extent as well as global and regional lung function. Beyond paired inspiratory-expiratory CT scanning, dynamic expiratory cine as well as perfusion and ventilation imaging on the basis of both, CT and MRI, can be applied to increase sensitivity, specificity and accuracy of the diagnosis of SAD. Some of them are ready for routine clinical use, such as dynamic expiratory cine CT, cine MRI during continuous breathing as well as gadolinium-enhanced perfusion MRI. Future developments in the fields of CT and MRI will provide novel technical approaches for functional imaging of SAD. These will include novel applications of dual energy/spectral CT using iodine-enhancement for perfusion and xenon-enhancement for ventilation enhancement as well as ventilation MRI using hyperpolarised gases

(helium or xenon), oxygen-enhancement or other technologies. All of these might also provide quantitative read-outs for disease and/or therapy monitoring.

Learning Objectives:

1. To learn how CT and other imaging methods can be used to examine the structure-function relationship in SAD.
2. To review the state-of-the-art imaging methods that can provide information about disease extent, disease activity and global and regional lung function in patients with SAD.
3. To become familiar with the current use and the future developments of these techniques.

Panel discussion:

Signs of small airways disease can be seen on CT but when and why do they really matter? 09:44

Signs of small airways disease are a frequent finding on CT especially when expiratory scans are performed in addition to inspiratory scans. When should we report these changes? Are they always important, do they perhaps predict the development of more severe disease, or are there cases where they have little influence on diagnosis and therapy? When should an expiratory scan be performed?

08:30 - 10:00

Room F1

Abdominal and Gastrointestinal

RC 1501

Rectal cancer imaging: all you need to know

Moderator:

G. [Brown](#); Sutton/UK

A-476 08:30

Chairman's introduction

G. [Brown](#); Sutton/UK (gina.brown@rmh.nhs.uk)

Careful preoperative staging and preoperative using high-resolution MRI together with preoperative multidisciplinary team discussion has been shown to reduce margin involvement by tumour from 30% to < 5% by identification of patients that require more radical preoperative therapy and surgery. The detailed demonstration of preoperative prognostic factors also recognises patients on imaging that are not at risk of local recurrence and therefore the avoidance of unnecessary preoperative therapy in a proportion of patients. The use of EUS can help in the assessment of early stage flat lesions suitable for local excision and is a powerful complementary tool. PET-CT is crucial for the preoperative work up of patients undergoing radical procedures such as metastatectomy. Follow-up for colorectal cancer patients at high risk for developing recurrent disease is now well established, and the emergence of specialised multidisciplinary teams, combined with a range of treatment options for recurrent disease has improved curative resection rates following metastatectomy and pelvic recurrence surgery. Radiologists with a solid understanding of not only the pathological manifestations of primary and recurrent rectal cancer but also the treatment options available play a key role in enabling the appropriate selection of patients - increasing overall cure rates and reducing treatment-related morbidity. This refresher course aims to provide radiologists with an understanding of local staging of rectal cancer, the assessment of recurrent disease, and assessing response to treatment. The course will highlight how imaging underpins the key preoperative decisions for surgical and oncological treatment planning in rectal cancer.

A-477 08:38

A. Staging with US and CT

A. [Maier](#); Vienna/AT (andrea.maier@meduniwien.ac.at)

For rectal cancer surgery a variety of alternative operations are currently possible. Furthermore, there is an increasing trend towards treating patients with radiotherapy before surgery. The choice of operation and the decision whether to employ radiotherapy is based on preoperative staging. In patients with primary rectal cancer accurate assessment of tumour extent and the presence or absence of lymph node invasion are factors for determining prognosis and risk of tumour recurrence. Endorectal ultrasound (EUS) is effective for T-staging. It has been recommended as the investigation of choice in the selection of potentially curative local excision. Lymph node staging by this method is less precise than tumour staging. Initial reports of the use of CT for tumour staging were encouraging. Studies which compare CT with EUS staging consistently show the latter to be more accurate for both tumour stage and lymph node stage. Thus, the usefulness

of CT for rectal cancer is disappointing. Accurate assessment of local spread can only be achieved in advanced tumours. The value of CT as an investigation tool for staging rectal cancer has to be seen in the detection of distant metastases. New approaches with perfusion technique may lead to an increased relevance of CT in the preoperative assessment of rectal cancer.

Learning Objectives:

1. To describe the technique of endorectal ultrasound illustrated with both normal and abnormal findings.
2. To discuss the role of endorectal ultrasound in rectal cancer staging.
3. To describe state-of-the-art CT techniques for local staging of rectal cancer.
4. To discuss the role of optimised CT techniques in rectal cancer staging.

A-478 09:00

B. Staging with MRI

L.C.O. Blomqvist; Stockholm/SE (lennart.k.blomqvist@ki.se)

MRI has become established as the modality of choice for preoperative local staging of rectal cancer. The most important general advantages of MRI compared to other cross-sectional imaging modalities are the soft tissue contrast resolution between the propria muscle layer of the rectum and the perirectal fat, the ability to visualise the different pelvic compartments including the visceral pelvic (mesorectal) fascia and the surrounding tissues in the pelvis. High resolution T2-weighted sequences sagittal, transaxial and perpendicular to the tumour is the basic standard for morphological evaluation of the tumour, the distance of the tumour to the anal verge and for evaluation of extramural extension and the distance to the circumferential resection margin. Presence of other adverse features such as extramural venous invasion and local lymph node metastases is also noted. The MR-images are ideally demonstrated by the radiologist in a local multidisciplinary conference to make sure that the information is used to select the best possible treatment for the patient. When neo-adjuvant treatment is administered, MRI is usually performed both before and after treatment to assess treatment response. When planning surgery, both the pre- as well as the post-treatment images should be available for surgical planning. Finally in this lecture, the potential benefits of 3 T compared to 1.5 T for pre-operative imaging of rectal cancer as well as the present role of additional techniques, such as diffusion-weighted imaging (DWI) and specific contrast agents that have been evaluated for assessment of rectal cancer will be addressed.

Learning Objectives:

1. To describe optimised MR techniques for rectal cancer staging.
2. To understand the role of the radiologist in the context of the multidisciplinary assessment and correct triaging of patients with rectal cancer.
3. To discuss the follow-up of patients post neoadjuvant chemoradiation.
4. To discuss the potential impact of modern MR imaging techniques in improving rectal cancer staging (3 Tesla, diffusion-weighted MR, USPIO-enhanced MRI for lymph node imaging etc).

A-479 09:22

C. Monitoring therapy and detection of local recurrence

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

Locally recurrent rectal cancer is the main concern after rectal cancer surgery and has long been regarded as a rarely curable disease. Patients were treated palliatively, and subsequent median survival was 14 months and the 5-year survival rate was 5%. However, during the past 20-30 years, more patients were considered candidates for curative treatment due to better treatment options. Patients with distant recurrences from colorectal cancer, especially those in the liver or lung, have improved chances for cure with better imaging, better surgery and alternative minimal invasive treatment. In the follow-up after colorectal cancer surgery it is thus important to detect recurrences at an early stage. Besides CEA, imaging is often used as a surveillance tool. It is still unclear which is the most cost-efficient (imaging) tool for monitoring distant and local recurrences. This lecture aims at providing the evidence for surveillance by imaging and reviewing the guidelines for the detection of recurrences after colorectal cancer surgery. It will also discuss the role of MRI for establishing resectability of locally recurrent rectal cancer and the imaging patterns and features of recurrent disease.

Learning Objectives:

1. To understand the evidence base for follow-up after treatment of primary rectal cancer.
2. To review the guidelines for imaging of local recurrence and distant disease.
3. To understand the patterns of recurrent disease.

Panel discussion:

What are the clinicians really expecting from us: the main questions/ answers 09:44

The chairperson and speakers will discuss an integrated approach to the imaging of rectal cancer based on the range of currently available techniques and therapeutic options. The use of imaging in post treatment patients will be discussed along with the potential for MRI to triage and follow-up patients in whom surgery is withheld

after apparently curative chemoradiation. The potential contribution of newer techniques (including perfusion CT, diffusion-weighted MR, PET CT, USPIO-enhanced MR for lymph node imaging etc) will be discussed.

08:30 - 10:00

Room G/H

Neuro

RC 1511

Epilepsy

Moderator:

B. Gómez-Ansón; Barcelona/ES

A-480 08:30

Chairman's introduction

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

Intractable epilepsy is a common and relevant medical condition, where imaging has made a tremendous impact. Neuroradiology (MRI) has improved diagnosis in patients with epilepsy, making it possible to recognise underlying pathologies that may have different, curative treatment options. This is the case of hippocampal sclerosis, and of abnormalities of cortical development, conditions with very different treatment options, and prognosis. In addition, MRI has added in the recognition and characterisation of neoplasms in the context of epilepsy. Finally, neuroradiology has demonstrated to be a valuable tool for surgical treatment of patients with epilepsy. New MR techniques add anatomical detail and more precise risk assessment of postsurgical deficits, thus providing important information for patients' management. In this RC, a general insight of imaging in epilepsy, including indications, protocols, and the most common neuroradiological conditions to be identified, will be covered. Particular interest will be given to tumours as a cause of epilepsy, and to their more relevant neuroradiological aspects. Finally, the contributions of different imaging techniques in the specific context of epilepsy surgery will be reviewed.

Session Objectives:

1. To get a general insight of imaging in epilepsy.
2. To understand how neuroradiology improves the diagnosis and management of patients with tumours and epilepsy.
3. To learn about the contribution of imaging in the context of surgery for intractable epilepsy.

A-481 08:35

A. Tumour as a cause of epilepsy

M. Stajgis; Poznan/PL (stajgis@o2.pl)

Brain tumours are a common cause of epilepsy more often in adults, less in children. Tumours detected in patients with chronic epilepsy are predominantly located in the brain cortex area, affecting the temporal lobe most often. Any benign or malignant brain tumour can be responsible for seizures, but some are more frequently associated with epileptic symptoms. Low-grade astrocytomas, oligodendrogliomas, gangliomas, dysembryoplastic neuroepithelial tumours (DNETs) and glioblastomas multiforme are the tumours significantly often presenting with seizures in adult population. Brain tumour-related epileptogenesis is not fully understood yet, but one can list a number of factors playing an important role in this process, including: disruption of physiological neuronal structure, tumour affection on the release of neurotransmitters and abnormal electrical activity of the brain. Different imaging techniques are widely used for evaluation for neoplasms in epileptic patients. CT is reserved for acute conditions, one must remember to exclude other possible aetiologies of seizures like haemorrhage, trauma or inherited malformations. MRI remains the gold standard in imaging investigation of patients with epilepsy. Conventional pre- and post-contrast SE sequences are mandatory to perform in every subject. Newer and more sophisticated techniques such as diffusion-weighted imaging (DWI), functional studies (fMRI), spectroscopy (MRS) and PET are helpful in qualification for surgery and preoperative functional mapping.

Learning Objectives:

1. To be aware of the common neoplasms that may cause epilepsy.
2. To understand why and how a neoplasm can cause epilepsy.
3. To be familiar with different imaging techniques for evaluating for neoplasms in epilepsy patients.

A-482 08:58

B. Non-neoplastic causes of epilepsy

M.A. Papathanasiou; Athens/GR (matpapath@hotmail.com)

Epilepsy is a common disorder with a prevalence of up to 1% in the general population. Epilepsies are broadly classified into generalized and focal. Though most generalised seizures are controlled pharmaceutically, 30% of focal seizures are medically intractable. In this subset of patients, the overall sensitivity of MRI in identifying responsible substrates is approximately 80%. The purpose of neuroimaging in epilepsy patients is to identify underlying structural abnormalities that require specific treatment (usually surgical) and to aid in formulating a syndromic or aetiological diagnosis. In this presentation imaging findings of the most common non-neoplastic lesions responsible for focal epilepsy, namely: a. hippocampal sclerosis, b. malformations of cortical development, c. vascular abnormalities and e. gliosis, will be discussed along with their differential diagnosis and pertinent imaging pitfalls. Since routine MR imaging is suboptimal in identifying epileptogenic substrates, imaging should be tailored accordingly. Hippocampal sclerosis, the most common cause of mesial temporal lobe epilepsy, is best demonstrated when the temporal lobes are imaged with thin sections in coronal plane perpendicular to the longitudinal axis of the hippocampus. Inversion recovery sequences best demonstrate morphology and volume loss in the hippocampus, mammillary body and fornix. T2 and FLAIR images best demonstrate the increased signal due to gliosis. For malformations of cortical development FLAIR is useful in assessing hyperintense signal. T1 gradient volume sequences can demonstrate subtle developmental malformations. Finally, because many epileptogenic lesions are subtle and easily overlooked, a systematic diagnostic approach to MRI interpretation in the clinical setting of epilepsy is helpful and will be discussed.

Learning Objectives:

1. To learn the characteristics of non-neoplastic causes of epilepsy.
2. To learn the characteristic neuroimaging findings that may be useful in establishing differential diagnoses.
3. To be aware of differences in diagnosis depending on age.

A-483 09:21

C. Multimodality epilepsy protocol

L. Stenberg; Lund/SE (lars.stenberg@med.lu.se)

Epilepsy surgery is an effective and safe therapy for selected patients with intractable localisation-related epilepsy. When morphological MRI fails to reveal focal, structural pathology (e.g. tumour, dysplasia, etc.) as the putative aetiology for the seizures, other modalities may be taken into account. In the absence of structural pathology it is essential to identify the epileptogenic zone as exactly as possible in order to (a) increase the chance of a good outcome (reduction or termination of seizures) and (b) limit post-surgical sequelae. This lecture will cover some modalities that may add valuable information in this process. The need to individualise the pre-surgical evaluation and the concept of a multimodality epilepsy protocol will be discussed. The main focus will be on SPECT (single-photon-emission computed tomography), functional MRI, PET (positron-emission tomography) and the added value of co-registration on morphological MRI (e.g. SISCOM). Briefly, ictal SPECT may help to identify focal areas of hyperperfusion (ictal zones). Functional MRI is used for several reasons. One is to determine language laterality (dominant hemisphere); another is to localise eloquent cortical structures to aid the planning of the surgical approach. PET may detect hypometabolic areas corresponding to areas involved in epilepsy. MRS (magnetic resonance spectroscopy), MEG (magnetoencephalography) and intradural EEG-registration and stimulation will be mentioned.

Learning Objectives:

1. To understand which different modalities can be used in diagnosing epilepsy.
2. To learn the protocols of different modalities.
3. To consolidate the best neuroimaging protocols for evaluating different forms of epilepsy.

Panel discussion:

Imaging epilepsy? 09:44

The term epilepsy covers a wide spectrum of symptoms and underlying etiologies. An essential part of the work-up of patients with epilepsy includes the radiological examination. In recent years more sophisticated radiological methods have emerged and the discussion will focus on how these new advanced techniques may help finding underlying causes and be of help in the pre-surgical work-up.

08:30 - 10:00

Room I/K

Cardiac

RC 1503

Imaging advanced stages of ischaemic heart disease

Moderator:

J.-N. Dacher; Rouen/FR

A-484 08:30

A. CT: angiography, function and perfusion

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

Multislice coronary computed tomography angiography (CTA) is an accurate tool in the non-invasive work-up of patients with suspected coronary artery disease (CAD). Its strength comprises a high sensitivity in detecting coronary stenosis > 50% and an excellent negative predictive value. The stringent limitation of CTA lies in its confinement to anatomic grading of coronary stenosis and a lack of information regarding whether a stenosis causes reversible myocardial ischaemia indicating the need for coronary revascularisation. Recently published data in animals and humans indicate that myocardial computed tomography perfusion (CTP) imaging is feasible, promising and accurate. The advantage of CTA is the comprehensive evaluation of coronary arteries and myocardial perfusion defects from the same datasets, which permits both visualisation of coronary anatomy and physiology. Further, CT provides information about regional and global myocardial function. The aim of this course is to understand basic principles of CT perfusion and functional imaging, to learn "how-to" perform CTP and comprehensive CTA/CTP scans, to review current scientific evidence and to discuss potential clinical applications.

Learning Objectives:

1. To review the performance of CT in CAD.
2. To understand the role of functional assessment and how it can help in reaching the correct diagnosis.
3. To review the current data supporting the use of CTA perfusion.

A-485 09:00

B. MR perfusion imaging: how much quantification do we need?

L. Natale; Rome/IT (lnatale@rm.unicatt.it)

Nuclear medicine tests (SPECT and PET), MRI and more recently MDCT have been involved in myocardial perfusion imaging. In clinical practice, perfusion analysis is routinely performed with qualitative or semiquantitative assessment, both based on relative evaluation of uptake or enhancement of myocardium, considering a remote region as normal. However, the assumption of part of myocardium as normal can be wrong and cause false negatives. Absolute quantification has been introduced mostly with PET perfusion imaging (water, ammonia and rubidium), but its incremental value for the clinical decision making has not been widely investigated. More recently, MR perfusion imaging has been used for quantitative analysis with different technical approach. There are some clinical scenarios where quantification can change the clinical interpretation: 1. multivessel coronary artery disease (CAD), 2. balanced multivessel CAD, 3. exclusion of CAD in symptomatic patients, 4. microvascular disease, 5. revascularised patients. However, there are still some limitations in the use of absolute quantification: first, the setting of cut-off value for normal or abnormal perfusion; second, some clinical situations, such as heart failure patients, where perfusion is reduced and heterogeneous. Finally, studies concerning the prognostic value and the cost-effectiveness are needed.

Learning Objectives:

1. To review the different quantification techniques and indices available.
2. To become familiar with the strengths and limitations of the various quantification techniques.
3. To understand the current and future role of MR perfusion imaging in risk stratification of patients with CAD.

A-486 09:30

C. Imaging patients after bypass surgery

K.-F. Kreitner; Mainz/DE (kreitner@radiologie.klinik.uni-mainz.de)

Besides drug therapy, the mainstays in the treatment of coronary heart disease (CHD) are interventional therapy and coronary bypass surgery. The need to image coronary bypass grafts is based on their limited lifetime: the occlusion rate at 10 years ranges between 5 and 15% for arterial, and between 40 and 50% for venous

grafts, respectively. Graft sclerosis develops in 38% of nonoccluded venous bypass vessels after 5 years and in 75% after 10 years. This sclerosis causes more than 50% luminal narrowing in approximately half of the affected vessels. Non-invasive imaging of coronary bypass grafts by MD-CT require information about the operative procedure. With the increasing implementation of 64slice CT scanners and beyond, it is possible to scan the heart and the full anatomic extent of grafts with sub-millimeter slice-thickness within a single breath-hold. When analysing the grafts, three graft segments should be assessed: the origin or proximal anastomosis, the body of the graft and the cardiac anastomosis, either single or sequential. Recent studies have shown that graft patency and the presence of significant graft stenosis can be assessed with an accuracy of 100% using most recent MD-CT technology (256/320 slice CT or dual source CT). The assessment of native coronaries with respect to the progression of CAD may still be problematic in cases with severe calcifications of the native coronary arteries. In these cases, MR perfusion imaging in combination with Cine and late gadolinium enhancement (LGE) imaging may be helpful in detecting newly developed, stress-induced myocardial ischaemia.

Learning Objectives:

1. To review the indications of CTA for bypass graft assessment.
2. To understand the clinical impact of CTA in this subgroup of patients.
3. To elucidate possible indications for MR imaging in patients after bypass grafting.

08:30 - 10:00

Room L/M

Professional Challenges Session

PC 15

Teleradiology: for better or for worse

Moderator:

L. Donoso; Barcelona/ES

A-487 08:30

Chairman's introduction

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

Teleradiology services have developed substantially over the last few years from limited use between hospitals and tertiary care centres for second opinions and patient transfer to the international provision of reporting services. There is no doubt that teleradiology provides a valuable service in some circumstances, but it also has a number of inherent limitations regarding the proper provision of imaging services to the patient and therefore may increase risks for the patient. We will highlight the problems that have arisen and to reiterate key parts of the guidelines which were developed for the benefit of patient care.

Session Objectives:

1. To learn about the e-health regulatory initiatives at the European level.
2. To understand the importance of proper workflow management.
3. To become familiar with different scenarios in which teleradiology can be used.
4. To appreciate the implications for patient care of using teleradiology.

A-488 08:35

Are we safeguarding patients' rights?

D. Caramella; Pisa/IT (davide.caramella@med.unipi.it)

It is now well understood that teleradiology cannot be considered just as 'telerreporting', i.e. the simple interpretations of images remotely acquired and sent as a message in the bottle. Teleradiology procedures, being medical acts, must ensure the full involvement of the interpreting radiologist in all phases of the well established practice of diagnostic imaging: appropriateness check, personalised acquisition protocols, access to clinical history and prior imaging examinations, communication with referring physician and patient. Any obstacle that teleradiology causes to these activities may put our patients at risk (and therefore may expose us at liability suits). The presentation will describe the organisational as well as technological remedies for reducing such risk.

Learning Objectives:

1. To appreciate that radiological procedures are medical acts, not just reporting.
2. To understand the difference between locally delivered radiological services and teleradiology.
3. To recognise potential risks for the patients when using teleradiology.
4. To learn about the strategies for reducing such risks.

A-489 08:58

Excellence in teleradiology: key issues in workflow management

J. Schillebeeckx; Bonheiden/BE (jan.schillebeeckx@imelda.be)

The healthcare market is undergoing significant change. The market is evolving from a provider centric to a patient centric model, requiring relevant data to converge at patient level in a timely and structured fashion. The push towards setting up collaborative networks for radiology is strong in most European countries. The most important challenge for teleradiology is to ensure that it develops in a manner that benefits patient care and ensures overall patient safety, and does not in any way reduce the quality of radiology services provided to the citizen. Therefore, these collaborative networks require more than just IT infrastructure with IT support. But as important is case management, workflow management and the administrative and management support that provides all the stakeholders with operational, analytical and statistical QA reports. Through a centrally operated hub, the radiology workflow is optimised to ensure throughput of cases, involving radiologists in the network, with the difference that only the services are provided by the Hub to the network, not the medical acts, which remain in the hands of the radiologists.

Learning Objectives:

1. To learn about the technical needs of a teleradiology infrastructure adapted to a distributed environment.
2. To understand that teleradiology involves much more than just technology. Optimising the workflow and time management are also important.
3. To appreciate how creating collaborative networks can improve the efficiency of radiology procedures and bring improved work/life balance to radiologists.

A-490 09:21

Dedicated solutions for specific clinical scenarios

H. Billing; Barcelona/ES (hb@telemedicineclinic.com)

To make teleradiology an integrated part of clinical radiology, it must change from being a provider of radiology reports into a close collaboration with the client radiology department. There are many different aspects on workflow in a clinical setting and the teleradiology service should adapt to these specific needs in order to make a seamless collaboration. However, there are advantages with the global aspects of teleradiology that could improve diagnostic accuracy and efficiency in the clinical setting that should be woven into the collaboration.

Learning Objectives:

1. To understand the need for close communication between remote radiologists and local clinicians. Different clinical scenarios need different solutions.
2. To be aware of the need for local adaptation of service vs. the advantages of global solutions.
3. To appreciate that there are specific workflow needs for different kinds of clinical work.

Panel discussion:

To what extent has teleradiology demonstrated it can improve radiological services? 09:44

Teleradiology services have developed substantially over the last few years from limited use between hospitals and tertiary care centres for second opinions and patient transfer to the international provision of reporting services. There is no doubt that teleradiology provides a valuable service in some circumstances, but it also has a number of inherent limitations regarding the proper provision of imaging services to the patient and therefore may increase risks for the patient. We will highlight the problems that have arisen and reiterate key parts of the guidelines which were developed for the benefit of patient care.

08:30 - 10:00

Room N/O

Head and Neck

RC 1508

Common pains in the head and neck

Moderator:

K. Hrabák; Budapest/HU

A-491 08:30

A. Salivary colic

T. Beale; London/UK (timothy.beale@royalfree.nhs.uk)

This lecture will demonstrate a multimodality approach to the imaging of salivary colic. The relevant US and MRI salivary anatomy will be highlighted and the ultrasound, computed tomography and magnetic resonance appearances of salivary

colic will be shown and techniques for optimising the imaging of salivary colic given. The use of US, CT, MRI, and both MRI and conventional sialography in the imaging of salivary colic will be discussed. The role of interventional sialography and minimally invasive techniques in benign salivary gland obstruction will be demonstrated.

Learning Objectives:

1. To review the role of imaging in the evaluation of salivary colic.
2. To understand the advantages and limitations of the different available imaging techniques.
3. To become familiar with MR sialography technique and how it compares with conventional sialography.
4. To learn the indications and limitations of interventional sialography.

A-492 09:00

B. Trigeminal neuralgia

B.F. Schuknecht; Zurich/CH (image-solution@ggaweb.ch)

Trigeminal neuralgia is defined as recurrent episodes of lancinating pain most common in the second (V_2) or third division (V_3) of the trigeminal nerve. The pathogenesis is a neurovascular conflict by an artery or vein associated with focal demyelination of sensory fibers at the glia-Schwann cell junction. Apposition of demyelinated fibers induces abnormal generation and transmission of impulses. MR Imaging is based on high-resolution 3D sequences: CISS/Fiesta/3D T2Space with coronal and sagittal oblique MPR and a 3D TOF intracranial sequence with axial and coronal thin MIP reconstruction to delineate the course of vessels along the trigeminal nerve form the pons, and glia Schwann cell junction to the Gasserian ganglion. The brainstem and brain are assessed by T2, Flair and 3D isotropic Gd-enhanced T1 sequences; the viscerocranium is examined by a noncontrast and coronal T1 Gd fat suppressed sequence. Analysis of images is focussed on recognition of displacement and distortion of the proximal trigeminal nerve by the SCA, rarely by the AICA, BA or petrosal, pontomesencephalic or peduncular vein. Correlation of the circumferential site of distortion at the root entry zone with the somatopic representation of fibres increases the, in general, low specificity of the neurovascular contact. Ruling out compressive tumours, neoplastic infiltration, inflammation or demyelination and delineating a neurovascular conflict stratifies patients for potential microvascular decompression in case of failure of medication.

Learning Objectives:

1. To review the critical diagnostic criteria and pathophysiology of trigeminal neuralgia.
2. To learn how to tailor an MR imaging exam.
3. To become familiar with the most common causes.
4. To understand the value of imaging in patient management.

A-493 09:30

C. Painful swallowing

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

The purpose of this lecture is to provide an overview of the key imaging features of painful swallowing with or without associated mucosal pathology. In the presence of a mucosal lesion, painful swallowing is most often caused by infectious, neoplastic or traumatic lesions of the pharynx itself, whereas in the absence of mucosal alterations, painful swallowing is the result of functional disorders (dysfunction of the cricopharyngeus muscle), infectious, inflammatory or neoplastic diseases affecting adjacent neck spaces (retropharyngeal and parapharyngeal space), neurologic impairment (glossopharyngeal neuralgia), carotidodynia and Eagle's syndrome. The indications for CT, MRI, US and videofluoroscopy will be reviewed and their respective role in the detection and precise description of the underlying cause. Major emphasis will be put on how to report the findings in a comprehensive way.

Learning Objectives:

1. To recognise the most common causes of painful swallowing in patients with a normal pharynx at clinical examination.
2. To review the role of different imaging techniques in the diagnosis and treatment of painful swallowing.
3. To review the key imaging techniques in the diagnosis and treatment of painful swallowing.
4. To review the key imaging features of the most common causes of painful swallowing as seen with the respective imaging techniques.

08:30 - 10:00

Room P

Physics in Radiology

RC 1513

Simulations make us understand x-ray imaging

Moderators:

K. Bacher; Gent/BE
S. Barter; Cambridge/UK

A-494 08:30

A. Monte Carlo simulations of x-ray tubes and x-ray spectra

M. Koutalonis; London/UK (Manthos.Koutalonis@bartsandthelondon.nhs.uk)

For several decades, Monte Carlo simulation has been recognised as a powerful technique to simulate the transport of radiation in media, as well as to provide solutions for calculations too complex for classical approaches. Several general purpose codes and databases providing particle interaction cross-sections have been developed, and with the increase in computing power, simulation has become more and more popular within the field of medical imaging. Using Monte Carlo simulation methods, the different steps involved in the formation of a medical image can be analysed in detail, and the whole system optimised. A topic that has deserved particular attention in the past is the simulation of x-ray tubes and x-ray spectra, which is the first step in the simulation of a medical imaging system. When simulating an x-ray tube, various complex phenomena need to be taken into account, such as the electron multiple scattering, bremsstrahlung interactions, characteristic x-rays emitted from the K-shell and Auger electrons emitted during a photon interaction. Together with the simulation of the target material and the filtration of the x-ray beam through permanent (e.g. a Be window) and added filtration (e.g. Al, Mo, Rh, Ag, etc.), this technique can lead to a good estimation of the emitted x-ray spectrum, a task which is hard to achieve with experimental methods. This review will provide an overview of the basic knowledge necessary to start the simulation of an x-ray tube as well as of how to accelerate the calculations. Emphasis will be given to mammographic x-ray tubes.

Learning Objectives:

1. To understand the basics of Monte Carlo simulations of x-ray tubes and x-ray spectra.
2. To learn why and how to start a Monte Carlo software platform.
3. To learn how to accelerate Monte Carlo calculations.

A-495 09:00

B. Monte Carlo simulations of virtual patients (anthropomorphic phantoms)

P.R. Bakic; Philadelphia, PA/US (Predrag.Bakic@uphs.upenn.edu)

Breast cancer screening and diagnostic imaging, as all clinical imaging, are increasingly multimodality. A number of new imaging modalities have been developed, including digital breast tomosynthesis and dedicated breast CT. They have shown promise in early studies; however, their technological complexity present obstacle for optimisation. The ultimate technology tests are clinical trials, which are, however, challenging, particularly for breast cancer screening, as large studies are needed due to the small number of detected lesions. Clinical trials are costly, long, and they involve repeated exposure of women to radiation. As an alternative, we have been developing virtual clinical trials, based upon our virtual breast phantoms and simulation of phantom images. This talk will describe the development of anthropomorphic computer breast phantoms, and illustrate their use in the analysis of phantom digital mammography and digital breast tomosynthesis images. Different currently used phantom designs will be compared in terms of their flexibility and realism. Specific phantom requirements related to different imaging modalities will be emphasised. The role of phantoms in tissue-specific analysis of the radiation dose during mammography will be discussed. In addition to the anthropomorphic phantoms for breast imaging, the use of virtual patients in various clinical imaging disciplines will also be illustrated.

Learning Objectives:

1. To learn about requirements for anthropomorphic phantoms (virtual patients).
2. To understand the value of anthropomorphic phantoms for breast imaging.
3. To compare advantages and disadvantages of several types of anthropomorphic phantoms.
4. To learn how to estimate typical patient doses from simulations with virtual phantoms.

A-496 09:30

C. Monte Carlo simulations of x-ray detectors and x-ray images

K. Smans, H. Bosmans; *Leuven/BE (kristien.smans@gmail.com)*

During the lecture we will present and validate methods to simulate radiographic images with the Monte Carlo software MCNP/MCNPX in a time efficient way. We will start the lecture by introducing three image detector models that can be used in MCNP/MCNPX. The first detector model that will be presented is the standard semi-deterministic radiography tally, which has been used in previous image simulation studies. Furthermore, we will present two alternative stochastic detector models: a perfect energy integrating detector and a detector based on the energy absorbed in the detector material. The image detector models will be validated by comparing calculated scatter-to-primary ratios (SPRs) with published and experimentally acquired SPR values. Subsequently, we will introduce a method to modify the images, generated with the MCNP/MCNPX image detector models, for the physical characteristics of a computed radiography (CR) imaging systems. The method presented in this lecture takes into account the signal intensity variations due to the heel effect along the anode-cathode axis, the spatial resolution characteristics of the imaging system and the various sources of image noise. To demonstrate the accuracy of our model we will compare the threshold-contrast detectability in simulated and experimentally acquired images of a contrast-detail phantom.

Learning Objectives:

1. To learn basic methods for simulating imaging detectors.
2. To learn how to simulate x-ray images.
3. To learn how to validate Monte Carlo simulations of an x-ray imaging system.

08:30 - 10:00

Room Q

Paediatric

RC 1512

Chest imaging: what to use and when to use it

Moderator:

M. Raissaki; *Iraklion/GR*

A-497 08:30

A. Thoracic trauma and foreign body inhalation

M.L. Lobo; *Lisbon/PT (mluisalobo@gmail.com)*

Thoracic trauma in children is most commonly seen in a polytrauma context, and is associated with significant morbidity and mortality. Blunt trauma accounts for the majority of cases, often resultant from motor vehicle accident and pedestrian crash. Common thoracic injuries include pulmonary contusion, rib fractures, pneumothorax and haemothorax. Diaphragmatic and mediastinal injuries, such as aortic rupture and tracheobronchial tear, are rare but potentially life threatening. Different patterns of injury are seen in children due to anatomical and physiological differences, and these should be recognised. Chest radiography is the first and most important imaging modality. MDCT allows accurate diagnosis for most traumatic injuries, and is usually performed for severe chest and/or polytrauma. Adapted paediatric protocols are essential. Foreign body inhalation is a common paediatric domestic accident, with potential serious or even fatal consequences. Clinical history is the key for the diagnosis. With a definite history, bronchoscopy is the modality of choice for both diagnosis and treatment. However, in many cases the aspiration event is not witnessed and the diagnosis is often delayed or overlooked. The majority of aspirated foreign bodies are non-opaque and imaging findings largely result from complete or incomplete airway obstruction. Chest radiography is the first imaging modality. Expiratory films (or lateral decubitus or fluoroscopy) are very useful to demonstrate air-trapping. Chest MDCT offer excellent details of the tracheobronchial tree and pulmonary parenchyma, and is usually reserved for more complex cases and/or long-standing foreign bodies.

Learning Objectives:

1. To become familiar with lesions observed in thoracic trauma.
2. To learn about strategies for imaging.
3. To become familiar with the classical and atypical signs of foreign body inhalation.

A-498 09:00

B. Infiltrative diseases of the chest

G. Staatz; *Mainz/DE (staatzt@radiologie.klinik.uni-mainz.de)*

High-resolution CT of the chest is the imaging technique of choice for the evaluation of most infiltrative diseases of the chest. In children dose-adapted protocols should be used and recommendations for suitable protocols will be given in the course.

The typical HRCT features of interstitial lung disease are ground-glass opacity, consolidation, pulmonary nodules, tree-in but sign, bronchiolar wall thickening, mucoid impaction, air trapping, septal thickening, mosaic perfusion and honey combing. Most frequent diseases in children to be dealt with are bronchiectasis, cystic fibrosis, asthma, constrictive bronchiolitis, bronchiolitis obliterans and extrinsic allergic alveolitis and they will be demonstrated with use of a systematic approach.

Learning Objectives:

1. To understand the role of chest CT.
2. To learn about the typical CT findings of the interstitial lung disease.
3. To become familiar with the most frequent diseases and learn about a systematic approach.

A-499 09:30

C. MRI of the chest in children

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

Diseases of the respiratory system are of great importance in paediatrics. Early detection and follow-up of infectious, congenital and environmental diseases in young patients is crucial for adequate treatment and improved outcome. Here, imaging techniques play an indispensable role. In the past the interest was focused on morphological aspects of pulmonary tissue. Here, computed tomography (CT) serves as the gold standard. In the course of the development of MRI, MR imaging of the lung played a subordinate role. This was caused by several technical problems: 1. low signal to noise ratio because of low proton density of the lung, 2. artefacts because of cardiac and breathing motion, 3. susceptibility artefacts because of air-soft tissue transition. Despite these inherent difficulties of MRI of the lung, significant progress has been made recently. Although spatial resolution is lower than at CT, MRI allows for the visualisation of the lung parenchyma using ultra-short echo time (TE). Furthermore, MRI has the advantages to evaluate different tissue aspects (T1w, T2w, fat suppression) and to improve lesion characterisation. In addition, MRI is capable to assess lung function, e.g. perfusion, angiography, ventilation and respiratory mechanics. Using up to date scanner systems a complete study of the chest including morphological and functional imaging can be performed in less than 30 minutes. Especially diseases that go along with pulmonary structure augmentation and/or involve vascular structures can be studied by MRI.

Learning Objectives:

1. To learn about MR techniques available for chest imaging in children.
2. To learn about specific clinical scenarios where MRI is helpful.
3. To understand the strengths and weaknesses of chest MRI with the help of case-based illustrations.

10:30 - 12:00

Room B

Interactive Teaching Session

E³ 1620

Common radiological problems: cognitive decline and dementia

A-500 10:30

Common radiological problems: cognitive decline and dementia

B. Gómez-Ansón¹, F. Barkhof²; ¹Barcelona/ES, ²Amsterdam/NL
(bgomez@sanpau.cat)

With advances in healthcare and age, the prevalence of dementia increases exponentially, with ~20% of subjects over 85 years becoming demented. While the guidelines differ by country, many recommend imaging at least once during the work-up of patients suspected of dementia. Beyond exclusion of surgically treatable disorders (e.g. tumour, subdural haematoma or hydrocephalus), imaging can now be used to positively determine the underlying disorder (e.g. hippocampal atrophy in Alzheimer's disease). While MRI is the modality of choice, multislice CT with multiplanar reformats provides a robust and quick alternative to assess general cortical atrophy, hippocampal atrophy and vascular pathology. SPECT and PET should be reserved for second line investigation, e.g. suspicion of frontotemporal lobar degeneration (FTLD) lacking characteristic atrophy on structural imaging. The advent of amyloid imaging using PIB-PET provides a future tool to secure a diagnosis of Alzheimer through molecular imaging, but its value over CSF examination needs to be determined. Increasing insights are being gained into the aetiology, clinical features and imaging findings in other neurodegenerative diseases, e.g. Lewy-body dementia. Structural imaging plays an essential role in establishing the diagnosis of vascular dementia (VaD), and cases of mixed dementia. Serial MRI is

very sensitive to the degenerative process underlying neurodegenerative disorders, providing insights into their pathogenesis and offers a possibility to determine the effects of putative new treatments in randomised clinical trials.

Learning Objectives:

1. To learn about the usefulness of imaging in patients with dementia.
2. To be able to approach conventional CT and MRI examinations for patients with cognitive decline and dementia.
3. To become familiar with the most common types of dementia and their characteristic imaging findings.
4. To appreciate the role of imaging in early diagnosis of dementia and in differentiating the vascular and neurodegenerative disease dementia.
5. To understand the indications for SPECT and PET in dementia.

12:30 - 13:30

Room Z

The Beauty of Basic Knowledge: Interpretation of the Chest

Radiograph

MC 21E

Decreased opacity of the lung(s)

A-501 12:30

Decreased opacity of the lung(s)

J. Cáceres; Barcelona/ES (josecac@gmail.com)

Decreased opacity of the lung may be a bilateral or unilateral process. If unilateral, it may involve an entire lung, a lobe or a segment. Faulty radiological technique must always be excluded. The most common cause of unilateral decreased opacity is a previous mastectomy. Bilateral decreased opacity occurs in COPD and asthma. It is also caused by decreased blood flow in the lung/s. Expiratory films separate the true lung causes from all the others, by demonstrating air trapping.

Learning Objectives:

1. To learn useful signs to recognise emphysema.
2. To evaluate unilateral hyperlucent lung.
3. To evaluate localised areas of increased lucency.

14:00 - 15:30

Room B

Interactive Teaching Session

E³ 1720a

Common radiological problems: incidental chest lesions

A-502 14:00

A. Solitary pulmonary nodule

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

Pulmonary nodules are spherical radiographic opacities (solid and subsolid) that measure up to 30 mm in diameter. Extremely common in clinical practice, pulmonary nodules, especially small ones under 1 cm in diameter, are a challenge to manage. It is important to identify malignant nodules because they are potentially curable. The first step in assessing a pulmonary nodule on a chest radiograph is to determine that it is indeed a lung nodule rather than a pleural or chest wall abnormality. It is essential to review images from previous examinations, because a solid nodule that remains stable for at least 2 years is probably benign. Topics discussed in this talk include the importance of nodule size, growth rate, margin morphology, density (solid, ground-glass and part solid), calcifications or fatty components within the nodules, the significance of cavitations or bubble-like densities, enhancement patterns at dynamic contrast-enhanced CT, and findings on positron emission tomography (PET). The talk also covers the current guidelines for the management of incidentally detected nodules (solid and subsolid).

Learning Objectives:

1. To learn how to detect and characterise a pulmonary nodule.
2. To learn how to detect and characterise a mediastinal mass.
3. To learn how to apply adequate protocols according to the clinical situation.

A-503 14:45

B. Mediastinal mass

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

The mediastinum is a region of the thorax that separates both lungs and communicates with the neck and the abdomen. These two anatomic features are very important to understand the behaviour of some diseases and their radiological manifestations. Most asymptomatic mediastinal masses are benign, while clinical symptoms might raise the possibility of a malignant lesion. Imaging plays a very important role, especially CT and MRI. In the presence of a mediastinal mass we must ask ourselves two questions: 1. Where is the mass located? The classic divisions of the mediastinum in compartments remains very useful, because it narrows the differential diagnosis. 2. Is the lesion cystic or solid? Pure mediastinal cysts are benign and their characterisation depends on their location. Thymic cyst (anterior mediastinum), bronchogenic and duplication cysts (middle mediastinum) and meningoceles (posterior mediastinum). Solid lesions may be benign or malignant while some lesions may have a cystic component. Solid lesions of the anterior mediastinum are usually thymomas, germ cell tumours or lymphomas. In the middle mediastinum most masses are of lymphatic origin but we should also include aortic or oesophageal pathology. Intrathoracic thyroid usually follows the trachea and thus is situated in the upper-middle mediastinum although posterior and anterior extensions may occur. In the posterior mediastinum most masses are of neural origin. There are some locations that will typically indicate specific diagnosis or a narrow differential. Such is the case of the cardiophrenic angle masses, juxtadiaphragmatic lesions and thoracic inlet pathology.

Learning Objectives:

1. To learn how to detect and characterise a pulmonary nodule.
2. To learn how to detect and characterise a mediastinal mass.
3. To learn how to apply adequate protocols according to the clinical situation.

14:00 - 15:30

Room C

Interactive Teaching Session

E³ 1720b

Colorectal cancer: what the radiologist must report

A-504 14:00

Colorectal cancer: what the radiologist must report

R.G.H. Beets-Tan¹, C. Hoeffel²; ¹Maastricht/NL, ²Reims/FR (r.beets.tan@mumc.nl)

Colorectal cancer is common. Approximately 280,000 new cases occur each year in the 500 million population of the 27 states which comprise the EU. After lung, it is the second commonest cause of cancer death resulting in approximately 140,000 deaths per annum. These relatively high mortality figures are a reflection of the fact that the disease is often advanced at the time of presentation. Efforts to reduce mortality, therefore centre on early detection as well as accurate staging. The latter is particularly important in rectal cancer-the commonest site for colonic cancer. Detection depends on presentation, which is often protean or non-existent; hence, the introduction of screening programs. Typical diagnostic tools include the barium enema, optical colonoscopy and CT colonography. The limitations of the barium enema have been exposed by optical colonoscopy and it can no longer be advocated in this role. CT colonography, however, rivals optical colonoscopy in the detection of polyps and tumours, although of course has no therapeutic potential. Major advances in the treatment of rectal cancer include total mesorectal excision (TME) of the rectum as well as neo-adjuvant therapies such as chemo-radiation. Their use depends on highly accurate staging of the primary disease, which can only be achieved by MR examination, although of course CT or PET/CT is required for the assessment of more distant metastatic disease. Finally, once treated, it is essential that these patients are followed-up; usually by a regime of colonoscopy and CT. These issues will be discussed in an interactive lecture.

Learning Objectives:

1. To review the genetic and environmental factors predisposing to colorectal cancer and to consider the significance of colorectal cancer in overall health terms.
2. To understand the rationale of screening and to discuss the role of CT colonography and its relation to other screening tests such as FOB test and colonoscopy.
3. To learn the principles and rationale for accurate preoperative imaging of rectal cancer.

16:00 - 17:30

Room B

Interactive Teaching Session

E³ 1820

Female pelvic infections: what the radiologist must report

A-505 16:00

Female pelvic infections: what the radiologist must report

J.A. Spencer¹, R. Forstner²; ¹Leeds/UK, ²Salzburg/AT
(johnspencer50@hotmail.com)

Most episodes of infection within the female pelvic organs are simply diagnosed on clinical grounds and resolve over time with or without antibiotic therapy. Infection which drains spontaneously usually resolves with these simple measures. Infection trapped within the female pelvic organs results in pyometra and/or tuboovarian abscess. These complications may require imaging. More severe infections may discharge internally with the development of a pelvic abscess or dissemination to the peritoneal cavity. Chronic infection may result in fibrosis with stricture formation in the female pelvic organs or the adjacent bowel, bladder and ureters. This involvement may result in lower GI or urinary tract symptoms. Other secondary effects include lymphadenopathy which can be cystic/necrotic and venous thrombosis with iliac and/or ascending ovarian vein thrombosis. Factors predisposing to complicated infection include: recurrent infections, previous surgery/radiotherapy, intrauterine devices, instrumentation, immunocompromise. US is the first line imaging test, ideally from the transvaginal route. This may be poorly tolerated by women with severe infection/pelvic peritonitis. MR imaging is useful for sonographically indeterminate pelvic masses. Women with pelvic or generalised peritonitis may be suspected to have appendicitis or diverticulitis. Diagnosis may therefore arise from emergency CT. Both US and CT are used for aspiration or drainage of pelvic infections. A variety of endocavitary and percutaneous approaches are available.

Learning Objectives:

1. To become familiar with the clinical spectrum of infection and inflammation of the female genital tract.
2. To understand their pathways of spread.
3. To recognise typical imaging findings of pelvic inflammatory disease and pelvic abscesses and the role of image-guided intervention.
4. To consider the appearances of unusual infections and the differential diagnosis of female pelvic infections.

16:00 - 17:30

Room C

Abdominal and Gastrointestinal

RC 1801

Peritoneum and mesentery

Moderator:

F.T. Fork; Malmö/SE

A-506 16:00

A. Primary solid peritoneal and mesenteric tumours

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

Primary solid tumours of the peritoneum and mesentery occur much less frequently than metastatic disease in the same location. However, these rare primary neoplasms (peritoneal mesothelioma, primary peritoneal serous carcinoma, desmoplastic small round cell tumour, mesenchymal tumours, mesenteric fibromatosis or mesenteric desmoid tumour, mesenteric sarcoma, etc.) are often first detected at CT and should be considered in the absence of a known primary organ-based malignancy. CT appearance combined with patient's relevant clinical and demographic data can help narrow the differential diagnosis for a primary peritoneal or mesenteric tumour in many cases; Diffuse sheetlike thickening of the peritoneum and stellate appearance of the mesentery at CT or MRI are suggestive of primary malignant mesothelioma in older men with high level of asbestos exposure. Absence of an ovarian mass is mandatory in suggesting the diagnosis of primary peritoneal serous carcinoma in a post-menopausal woman. Desmoplastic small round cell tumour occurs in young men and often presents with a large primary peritoneal mass with calcification. A solid mesenteric mass at CT or MRI, regardless of its pre- and post-contrast appearance, occurring in a patient with familial

adenomatous polyposis with prior history of abdominal surgery is highly suggestive of mesenteric fibromatosis.

Learning Objectives:

1. To review the imaging modalities used in the diagnosis of various solid peritoneal and mesenteric masses.
2. To learn about differential diagnostic clues.
3. To become familiar with radiological-pathologic correlations.

A-507 16:30

B. Imaging of cystic mesenteric or omental masses

C. Stoupis; Maennedorf/CH (c.stoupis@spitalmaennedorf.ch)

This presentation has the purpose to familiarise radiologists with the spectrum of mesenteric and omental cystic masses, demonstrating the additional correlation with the underlying pathology. Cystic masses of the mesentery or omentum are not common lesions; however, radiologists should be aware of these entities as well as with other cystic lesion of the abdomen. Important tool for the diagnosis is to determine the organ from which the mass originates. Common types of mesenteric and cystic masses include lymphangioma, enteric duplication cyst, enteric cyst, mesothelial cyst and non-pancreatic pseudocyst. Other entities such as cystic mesothelioma, cystic spindle cell tumour and cystic teratoma could be located in the mesentery also. Due to the overlap in the imaging features, not always the final diagnosis could be reached by imaging only and therefore histologic examination is necessary to establish the diagnosis. However, it is important for the radiologist to define the cystic nature of the mass and demonstrate the potential mesenteric or omental origin, targeting to the correct differential diagnosis of the cystic lesion.

Learning Objectives:

1. To review the imaging findings of cystic mesenteric or omental masses.
2. To learn to correlate imaging findings with the underlying pathology.
3. To appreciate the accuracy of imaging modalities and difficulties in differential diagnosis.

A-508 17:00

C. Patterns of peritoneal carcinomatosis

P.K. Prassopoulos; Alexandroupolis/GR (pprasopo@med.duth.gr)

Cancer cells from intraabdominal neoplasms, carried by peritoneal fluid throughout the abdominal cavity, result in widespread metastases in the form of implants, the so-called peritoneal carcinomatosis. The location of implants development is governed mostly by peritoneal fluid circulation and by specific anatomic pathways formed by peritoneal reflections. The most common sites where the peritoneal fluid may temporarily arrested facilitating implantation of cancer cells include cul-de-sac, distal small bowel mesentery, right paracolic gutter, posterior sub-hepatic space, greater omentum and sub-phrenic spaces. The role of imaging is to disclose the presence and extent of the disease - i.e. fundamental in candidates for cytoreductive surgery - to monitor response to treatment and to reveal recurrences. MDCT with thin collimation and i.v. contrast material supplemented by multiplanar reconstructions is the primary imaging modality for the investigation of peritoneal carcinomatosis. Ascitis, contrast enhanced smooth, nodular, or plaque-like peritoneal thickening, peritoneal nodules, plaques or masses, rounded, ill-defined soft-tissue or cystic mesenteric masses, mesenteric fixation with increased attenuation values and thickening, irregular soft-tissue permeation of omental fat or confluent solid omental masses are the most frequent CT findings of peritoneal carcinomatosis. CT has a sensitivity and specificity between 85 and 95%, depending on the size/location of implants and examination protocol used. MR imaging employing a post-gadolinium-enhanced 3d FLASH sequence with fat saturation may alternatively be used and it is advantageous in cases of diffused layered type of peritoneal/mesenteric involvement. Diffusion MRI may be of value in post-treatment imaging evaluation.

Learning Objectives:

1. To learn about the various imaging findings of peritoneal carcinomatosis.
2. To learn about the accuracy of different imaging modalities in disease staging.
3. To appreciate the role of imaging techniques in the evaluation of response to treatment.

16:00 - 17:30

Room D1

Special Focus Session

SF 18a

Transarterial treatment of liver tumours: major advances

Moderator:

J. Lammer; Vienna/AT

A-509 16:00

Chairman's introduction

J. Lammer; Vienna/AT (Johannes.Lammer@akhwien.at)

Hepatocellular carcinoma (HCC) is an increasingly common tumour with a poor prognosis and limited systemic treatment options; approximately 80% of patients die within a year of the diagnosis. In men, it is the fifth most common cancer worldwide and the third leading cause of cancer-related death. The Barcelona Clinic Liver Cancer (BCLC) tumour staging is considered the most conceptually useful in HCC. It includes the clinical performance of the patient, the stage of the liver cirrhosis and of the tumour, and includes treatment options. In stage A (early stage) ablation therapy (radiofrequency, laser, cryotherapy and electroporation), liver resection and transplantation are the treatment options of choice. In stage B (intermediate stage) transarterial chemoembolisation (TACE, precision TACE with drug eluting beads) or radioembolisation with yttrium-90 microsphere brachytherapy are the treatment options. For stage C (advanced stage) systemic therapy with sorafenib is recommended. In patients with metastatic disease confined to the liver surgery is first choice treatment. However, if surgery is not indicated and systemic chemotherapy failed tumour ablation with radiofrequency, laser, cryotherapy and electroporation, TACE and radioembolisation are further treatment options. Tumours most commonly treated by ablation, TACE and radioembolisation are metastases of colorectal and breast cancer, melanoma of the skin and retina. The purpose of the special focus session is to highlight the treatment which can be offered by intervention radiology.

Session Objectives:

1. To understand the treatment options.
2. To understand BCLC staging of HCC.
3. To review the accepted indications of TACE and tumour ablation.

A-510 16:03

Advances in chemoembolisation of liver metastases

M.A. Funovics; Vienna/AT (martin@funovics.com)

Trans-arterial chemoembolisation takes advantage of the largely portal vascularisation of liver tissue, while metastatic tissue is supplied almost exclusively by hepatic arteries. The benefit of intra-arterial application of chemotherapeutic drugs is proportional to the first pass extraction of the drug by the target tissue and inversely proportional to the body clearance of the drug. These figures vary greatly with different chemical properties of the drug. Intratumoural drug concentration after transarterial application (compared to intravenous application) is approximately 20x for THP-adriamycin, 5x - 10x for 5 FU, 6x - 8x for mitomycin, 4x for cisplatin or oxaliplatin, and 2x for doxorubicin. Several trials support superiority of intraarterial 5 FU over i.v. application in response rate, and partly with a moderate survival benefit. However, with the advent of novel chemotherapeutics (mainly oxalyplatin, irinotecan), response rates of i.v. chemotherapy approached the results after i.a. 5 FU. More recently, i.a. oxaliplatin has shown a 45% response rate in a multicenter trial on non-responders to i.v. oxalyplatin. Also, combinations of i.a. oxalyplatin and i.v. 5 FU and cetuximab have achieved promising response rates as first line therapy. Even though intraarterial chemoembolisation alone can achieve promising response rates, the actual survival benefits are limited to date. Also, the beneficial effect of additional embolization (over conventional arterial injection) remains largely unproven for a large number of different embolisation agents in hepatic metastases. In an attempt to further increase tumour uptake, chemotherapeutic agents (anthracyclines and irinotecan) have been electrostatically coupled to microspheres. Irinotecan-eluting microspheres have been utilized in the treatment of CRC metastases in smaller case series. Due to the high parenchymal drug uptake, appropriate medications to mitigate postembolization side effects need to be emphasised. While the initial response rates were over 60% (according to EASL), tumour progression was observed within 6 months in the majority of responders, suggesting potential stimulation of angiogenesis at the tumour borders. Potentially, adjuvant antiangiogenic treatment can provide an overadditive effect in these patients.

Learning Objectives:

1. To understand newer techniques with micro catheters, drug-eluting beads, rotational angiography and flat panel CT.
2. To understand the technique and results of TACE and RF ablation of colorectal metastases.
3. To understand the technique and results of interventional treatment of endocrine tumour metastases.

A-511 16:21

Embolisation of HCC with drug eluting beads

K. Malagari; Athens/GR (kmalag@otenet.gr)

Drug eluting beads have proved predictable pharmacokinetics and achievement of higher doses of the chemotherapeutic, prolonged contact time with cancer cells. In addition, research data today have shown response, and tolerance benefit of drug eluting beads compared to conventional chemoembolisation for the more advanced subgroup of BCLC - class B patients. For diameters larger than 100 µm DC Bead loaded with doxorubicin have proven to be more effective with respect to local response, recurrence rates and time to progression (TTP) compared to bland embolisation with similar diameters. In this session results of studies on DC Bead loaded with doxorubicin for the treatment of HCC will be discussed, and guidelines for optimal clinical use will be presented.

Learning Objectives:

1. To appreciate the difference between conventional TACE and TACE with drug eluting beads.
2. To understand the technique and experimental results.
3. To learn about the results of clinical trials in HCC.

A-512 16:39

Selective internal radiotherapy

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

Selective internal radiotherapy, also called radioembolisation (RE), consists in the delivery of beta-radiation to liver tumours using microspheres loaded with yttrium-90 (Y90) that are injected into the hepatic artery or its branches. Y90 is a pure beta-emitting radioisotope, with a limited tissue penetration (average: 2.5 mm and maximal: 11 mm) and a half life of 64 hours. Y90 can be either incorporated or labelled into glass or resin microspheres (25 µm). Once the particles are infused into the hepatic artery, they travel to the distal tumoural arterioles, from where the beta-emissions from the isotope irradiate the tumour. With traditional external beam radiation, doses are limited to 30-40 Gray (Gy) due to the risk of radiation-induced liver disease that may occur with higher doses. With RE, tumours can receive a higher dose of radiation due to their preferentially arterial vascularisation and a higher tolerance of the non-tumoural liver parenchyma to this form of radiation. RE has shown an encouraging antitumoural activity with a good safety profile in patients with hepatocellular carcinoma, even in the presence of portal vein thrombosis or invasion. Local tumour growth control is achieved in the majority of patients although response rates using volumetric criteria are achieved in only 20-40% of patients. In liver-predominant unresectable metastases, there is promising evidence that RE combined with systemic chemotherapy significantly extends the time to progression of liver metastases and increases objective response rates as well as enabling patients to receive systemic chemotherapy for a longer period of time.

Learning Objectives:

1. To learn about the technique, legal and safety requirements in the cathlab.
2. To understand the diagnostic and interventional procedures before radioembolisation.
3. To learn about the results of clinical trials in HCC and liver metastases.

A-513 16:57

Combined therapies before and after ablation

R. Lencioni; Pisa/IT (lencioni@med.unipi.it)

Image-guided RFA is currently established as the standard of care for patients with early-stage HCC when transplantation or resection is precluded. However, histologic data from liver specimens of patients who underwent RFA as bridge treatment for transplantation showed that the rate of complete tumour eradication is highly dependent on the size and the presence of large abutting vessels. Combined percutaneous-transcatheter approaches that aim at increasing the ablation volume by minimising heat loss due to perfusion-mediated tissue cooling have been developed, using either a balloon catheter occlusion of the tumour arterial supply at the time of the RFA or by performing a prior TACE. Experimental studies in animal tumour models have shown that lowering the temperature threshold at which cell death occurs by combining sublethal heating with cell exposure to

chemotherapeutic agents is an attractive alternate strategy to increase tumour necrosis. The efficacy of a combination therapy, including RFA plus the intraarterial administration of drug-eluting beads has been recently demonstrated, while the use of intravenously administered, thermally sensitive drug carriers is currently being explored. Despite the advances in local treatment, the long-term outcome of treated patients remains unsatisfactory because new tumours emerge in about 80% of the cases within 5 years. Clinical trials evaluating the usefulness of adjuvant molecular targeted therapies with anti-angiogenic and anti-proliferative activity in preventing early recurrence after successful ablation are ongoing.

Learning Objectives:

1. To understand the pros and cons of TACE before and/or after tumour ablation.
2. To understand the technique of a combined approach.
3. To learn about indications and results.

Panel discussion:

Which treatment option is the best for the various stages of disease? 17:15

In early HCC (BCLC A) tumour ablation is a curative treatment option. In intermediate stage HCC (BCLC B) TACE or radioembolisation are the treatment options. Interventional treatment of advanced HCC is under debate. Borderline cases should be discussed. In patients with liver metastases tumour ablation and TACE with drug eluting beads offer new options for patients after unsuccessful first line chemotherapy. The place of interventional therapy will be discussed.

16:00 - 17:30

Room E1

Musculoskeletal

RC 1810

Bone tumours

Moderator

J.L. Bloem; Leiden/NL

A-514 16:00

Chairman's introduction

J.L. Bloem; Leiden/NL (j.l.bloem@lumc.nl)

In this integrated refresher course, the impact of basic and advanced imaging on the entire process from diagnosis to treatment of bone tumours will be addressed. Diagnosis is based on understanding the imaging features from a histopathologic perspective. Staging, biopsy and image-guided treatment require an integration of imaging findings with basic knowledge of surgical-oncological principles, as well as skills. Can technically driven development of advanced MR techniques change how we diagnose, monitor therapy and determine prognosis. Techniques and procedures that improve patient outcome in a cost-effective way will be identified based on 3 presentations and a panel discussion.

A-515 16:05

A. Diagnosis: from radiographs to MRI

K. Wörtler; Munich/DE (woertler@roe.med.tum.de)

The diagnosis of a bone tumour is based on clinical findings, the age of the patient, the location of the lesion, its radiologic appearance, and, if imaging does not allow for a specific diagnosis, its histopathologic features. Radiography remains the initial imaging modality for evaluation of the localisation of the lesion with respect to the longitudinal and axial planes of the involved bone, for the depiction of matrix mineralisations, and for estimation of biologic activity by analysing the patterns of bone destruction and periosteal response. CT can add „radiographic“ information particularly in regions of complex skeletal anatomy such as the spine, pelvis and shoulder girdle. MR imaging has classically been used to determine the local extent of a bone tumour (local staging). In addition to radiography and/or CT, it can at times also be valuable in establishing the differential diagnosis, especially in cystic bone lesions and cartilaginous tumours. Whole-body applications have recently gained importance in demonstrating the presence and extent of bone (marrow) involvement in benign and malignant systemic/polyostotic tumourous diseases. This course reviews the basic principles of diagnosing bone tumours in a multimodality approach (with an emphasis on conventional radiography). The different steps of morphologic analysis as well as the advantages and disadvantages of the individual imaging techniques are illustrated on the basis of pathologically confirmed cases.

Learning Objectives:

1. To become familiar with the basic principles of diagnosing bone tumours.
2. To learn how to determine the biological activity of bone neoplasms and tumour-like lesions on the basis of radiographic findings.
3. To understand the role of CT and MRI in the diagnosis of bone tumours.
4. To recognise imaging patterns on the basis of radiologic-pathologic correlation.

A-516 16:28

B. Staging and intervention

S. James; Birmingham/UK (steven.james@roh.nhs.uk)

Primary bone tumours require both local staging and the identification of distant metastases to guide management. MR imaging is the modality of choice to determine local disease extent and allows excellent depiction of intra- and extra-osseous disease. Chest CT enables pulmonary metastases to be identified and bone scintigraphy allows evaluation of the presence of bone metastases. The roles of whole body MRI and PET/CT in the staging of bone tumours will also be discussed. Whilst imaging may allow a narrow differential diagnosis to be reached, histological confirmation of the nature of the lesion is required pre-operatively to plan appropriate treatment. Image-guided biopsy may be performed using fluoroscopy, CT, MRI and occasionally ultrasound guidance. The relative values of each of these techniques will be covered. Percutaneous therapies are increasingly being utilised in the treatment of a number of primary bone tumours. Radiofrequency ablation is the method of choice for osteoid osteoma and is now used in the treatment of chondroblastoma. Alternatives include microwave therapy, cryotherapy and sclerotherapy. These percutaneous techniques may also be used for local disease control where disease recurrence is encountered.

Learning Objectives:

1. To understand the role of radiographs, MRI, CT and bone scintigraphy in the staging of primary bone tumours.
2. To appreciate the principles and techniques of percutaneous bone biopsy.
3. To be aware of the indications, technique and outcome of percutaneous therapies in the treatment of bone tumours.

A-517 16:51

C. New techniques (including DWI)

S. Pans; Leuven/BE (Steven.Pans@uz.kuleuven.ac.be)

Magnetic resonance imaging (MRI) has evolved to become the most important diagnostic method for local staging of primary bone tumours and for detecting postoperative tumour relapse. It allows accurate preoperative staging of local tumour extent and helps to obtain adequate safety margins. MRI is a noninvasive technique that can be used to obtain information regarding tumour vascularisation, metabolism, and pathophysiology, and allows early assessment of therapeutic effects of cancer drugs. One approach is dynamic contrast-enhanced (DCE) MRI, which measures tumour vascular characteristics after administration of a contrast medium. MRI enhanced with small-molecular-weight contrast agents is extensively used in the clinic to differentiate benign from malignant lesions, as well as to monitor tumour microvascular characteristics during treatment. Diffusion-weighted MRI (DWI) is a more recent technique and it allows noninvasive characterisation of biologic tissues based on the random microscopic motion of water proton measurement. Several studies have shown that DWI allows early detection of tumour response to chemotherapy. The use of water diffusion is a surrogate marker used to distinguish highly cellular regions of tumour from acellular and necrotic regions. Whole body diffusion-weighted sequence (WB DWI) is a new promising technique feasible to evaluate multifocal disease. DWI has revealed great potential in the evaluation of patients with cancer or benign disease, as it supplies both quantitative and qualitative information of the whole body. This presentation will focus on the potential role of DWI in combination of DCE MRI in bone tumours as well as on the possibilities of WB DWI.

Learning Objectives:

1. To learn about new techniques in the diagnosis and follow-up of bone tumours.
2. To appreciate the integration of DWI in whole-body MRI.
3. To become familiar with diffusion-weighted imaging in bone tumours.

Panel discussion:

What is the clinical impact of advanced imaging, and when should what kind of advanced/sophisticated imaging be used? 17:14

In this integrated refresher course, the impact of basic and advanced imaging on the entire process, from diagnosis to treatment of bone tumours, will be addressed. Diagnosis is based on understanding the imaging features from a histopathologic

perspective. Staging, biopsy and image-guided treatment require an integration of imaging findings with basic knowledge of surgical-oncological principles, as well as skills. Techniques and procedures that improve patient outcome in a cost-effective way will be identified, based on three presentations and a panel discussion. Can technically-driven development of advanced MR techniques change how we diagnose and monitor therapy, and determine prognosis?

16:00 - 17:30

Room F2

Special Focus Session

SF 18b

Brain perfusion made easy: CT/MR?

Moderator:

E.T. Tali; Ankara/TR

A-518 16:00

Chairman's introduction

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

Perfusion imaging is helpful to analyse and assist in judging the biological behaviour (especially haemodynamic features) of central nervous system diseases. Qualitative and quantitative information can be obtained to evaluate pathoanatomical structures and pathophysiological changes of the lesions. Cerebral blood flow (CBF), cerebral blood volume (CBV), mean transit time (MTT), permeability surface (PS), regional blood volume, microvascular permeability measurements and more information can be obtained for the diagnosis and differential diagnosis of the diseases. Advantages and disadvantages of the CT perfusion imaging (CTP) and magnetic resonance perfusion imaging (MRP) in the different diseases will be evaluated in detail. Hints and tips for the better applications and postprocessing will also be discussed.

Session Objectives:

1. To become familiar with perfusion imaging techniques.
2. To become familiar with the benefits of perfusion imaging.
3. To learn about the potential applications.

A-519 16:05

Techniques for CT and MR, post-processing, radiation

R.A. Meuli; Lausanne/CH (reto.meuli@chuv.ch)

Brain perfusion can be assessed by CT and MR. For CT, two major techniques are used. First, Xenon CT is an equilibrium technique based on a freely diffusible tracer. First pass of iodinated contrast injected intravenously is a second method, more widely available. Both methods are proven to be robust and quantitative, thanks to the linear relationship between contrast concentration and x-ray attenuation. For the CT methods, concern regarding x-ray doses delivered to the patients need to be addressed. MR is also able to assess brain perfusion using the first pass of gadolinium based contrast agent injected intravenously. This method has to be considered as a semi-quantitative because of the non linear relationship between contrast concentration and MR signal changes. Arterial spin labeling is another MR method assessing brain perfusion without injection of contrast. In such case, the blood flow in the carotids is magnetically labelled by an external radiofrequency pulse and observed during its first pass through the brain. Each of this various CT and MR techniques have advantages and limits that will be illustrated and summarised.

Learning Objectives:

1. To understand and compare the different techniques for brain perfusion imaging.
2. To learn about the methods of acquisition and post-processing of brain perfusion by first pass of contrast agent for CT and MR.
3. To learn about non contrast MR methods (arterial spin labelling).

A-520 16:28

Brain tumours

A. Jackson; Manchester/UK (Alan.Jackson@manchester.ac.uk)

This presentation will discuss the current 'state of the art' in the use of perfusion imaging techniques in neuro-oncology. The term "perfusion imaging" is commonly used but is in fact a misnomer since perfusion and blood flow are not the only imaging biomarkers of microvascular structure and function in common use. Indeed, in oncological applications measurements of proportional blood volume, endothelial capillary permeability or vessel size can be of equal or greater importance. We will

review: (1) the biological rationale for using perfusion imaging in brain tumours, (2) methods available for the imaging of microvascular structure and function in brain tumours. We will discuss the relevant advantages and disadvantages of T1 versus T2 weighted acquisition strategies. (3) A detailed review of methods for dynamic contrast enhanced imaging and its analysis, (4) a review of current evidence for clinical application focusing on: (a) distinguishing abscess from tumour, (b) distinguishing tumour types, (c) distinguishing glioblastoma from solitary metastases, (d) predicting grade, histological subtype and prognosis in glioblastoma, (e) monitoring radiotherapy and predicting radiotherapy response, (f) applications in clinical trials of novel therapeutic agents, particularly antiangiogenic agents.

Learning Objectives:

1. To understand the different methods available for perfusion imaging of brain tumours and their advantages and disadvantages.
2. To understand the clinical uses of perfusion imaging in neuro-oncology.
3. To understand the benefits of perfusion imaging in clinical trials of novel therapeutic agents.
4. To get an insight into the potential advances in perfusion imaging as they relate to neuro-oncology.

A-521 16:51

Stroke and vascular diseases

J. Vymazal, J. Keller, A. Rulseh, J. Tintera; Prague/CZ

(Josef.Vymazal@homolka.cz)

Early diagnosis and treatment of acute stroke is crucial for a favourable prognosis. While non-contrast MRI is much more sensitive to ischaemia in comparison with non-contrast CT, perfusion studies make both techniques comparable. Ultrafast CT scanners cover most of the brain with perfusion imaging; the scanning is faster and quality imaging results depend less on patient co-operation than in MRI. However, MRI enables diffusion imaging adding more specific information to the diagnostic process. Because of the short time window to eventual vascular intervention, in many institutions CT is the technique of choice. Besides depiction of hyperacute stroke by means of diffusion weighted imaging, MRI has the advantage of performing a contrast agent-free perfusion study using a promising new technique called arterial spin labelling (ASL). Thus, an MRI perfusion study can be performed even in patients with impaired renal functions where iodine and gadolinium-based contrast agents may be dangerous.

Learning Objectives:

1. To understand the role of perfusion imaging in the management of acute stroke.
2. To be able to distinguish the advantages and disadvantages of CT vs MRI in perfusion imaging.
3. To develop insight into the use of non-contrast arterial spin labelling technique in vascular diseases.

Panel discussion:

Guidelines, recommendations, hints and tips to get more from perfusion imaging in CNS pathologies 17:14

Perfusion imaging is an emerging non-invasive tool that enables evaluation of brain function via assessment of various hemodynamic measurements such as cerebral blood volume, cerebral blood flow, and mean transit time. These techniques have become important clinical tools in the diagnosis and treatment of patients with CNS disorders via evaluation of brain tissue during cerebrovascular diseases, non-invasive histopathologic assessment of tumours, evaluation of neurodegenerative conditions and assessment of the effects of drugs.

16:00 - 17:30

Room G/H

Neuro

RC 1811

Spinal cord

Moderator:

M. Muto; Naples/IT

A-522 16:00

A. Myelitis vs myelopathy

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

The term myelopathy indicates every generic form of pathological involvement of the spinal cord. Under this definition, even the category of myelitis is enclosed. Nonetheless, usually the term myelitis is restricted to inflammatory forms that involve a segmental extension of the spinal cord: the so-called "transverse myelitis". Symptoms are not specific for aetiology in most cases, and MRI is the most

sensitive diagnostic tool. Radiological semiotics are always useful and often very specific in addressing the diagnosis: some fundamental concepts include the peculiar pattern of vasogenic oedema, which, in opposition to what happens in the brain, tends to involve the central grey more than the peripheral white matter. Distribution pattern of the lesion can also often address to aetiological diagnosis. In fact, lesions selectively involving posterior or lateral columns, asymmetrically, and sparing the central grey matter, are more typical expression of demyelinating-inflammatory diseases (multiple sclerosis, ADEM, Devic's disease, LES, Behcet's disease), while selective and symmetrical involvement of both posterior columns, extended for more than 2 myelomers, and possibly associated with involvement of lateral columns, is typical expression of combined sclerosis (B12 vitamin deficit). Ischaemic lesions are also usually symmetrical, but they involve both grey and white matter, extending to the anterior two-third of the cord, or, sometimes, remain limited to the central grey matter. On the other hand, selective involvement of the anterior horns is typical of poliomyelitis.

Learning Objectives:

1. To learn to differentiate between myelitis and myelopathy.
2. To learn the imaging patterns of myelitis and myelopathy.
3. To consolidate knowledge of the best neuroimaging protocols for evaluating patients with suspected myelitis and myelopathy.

A-523 16:30

B. Spinal intradural tumours

J.W.M. [Van Goethem](#), C. Venstermans, F. De Belder, L. van den Hauwe, P.M. Parizel; *Antwerp/BE (johan.vangoethem@ua.ac.be)*

Spinal tumours are uncommon lesions and affect only a minority of the population. However, these lesions can cause significant morbidity in terms of limb dysfunction and can be associated with mortality as well. In establishing the differential diagnosis for a spinal lesion, location is the most important feature. MR imaging, which plays the central role in the imaging of spinal tumours, easily allows tumours to be classified as extradural, intradural-extramedullary or intramedullary. Although this classification is somewhat of an oversimplification, since lesions can reside in several compartments, it is very useful in tumour characterisation. In general, extradural lesions are the most common (60% of all spinal tumours), with the majority of lesions originating from the vertebrae. Intradural tumours are rare, and the majority is extramedullary (30% of all spinal tumours), with meningiomas, nerve sheath tumours (schwannomas and neurofibromas) and drop metastases being the most frequent. Intramedullary tumours are uncommon spinal tumours (10% of all spinal tumours), and occur most often in the cervical spinal cord. Astrocytomas and ependymomas comprise the majority of the intramedullary tumours, with ependymomas occurring with about double the frequency of astrocytomas.

Learning Objectives:

1. To review the most common spinal cord tumours.
2. To learn the key imaging findings in different spinal cord neoplasm.
3. To understand how to create the optimal MR imaging protocol for preoperative planning of spinal cord tumours.

A-524 17:00

C. Vascular disorders of the spinal cord

R.J. [Nijenhuis](#)¹, T. Krings², M. Mull³, A.K. Thron³, J.T. Wilminck¹, W.H. Backes¹; ¹Maastricht/NL, ²Toronto, ON/CA, ³Aachen/DE (nijenhuis@rad.unimaas.nl)

Vascular spinal cord malformations are rare entities with unspecific neurological presentations leading often to a late diagnosis. Delay in diagnosis can be hazardous to patient outcome as these abnormalities can lead to paraparesis if not treated properly. Apart from confirming the presence of a vascular spinal cord malformation, the lesion also has to be classified to a specific subtype as this determines the choice of therapy. The vascular spinal cord lesions can be differentiated in pial and dural arteriovenous shunting lesions depending on the vessels feeding the shunt. Pial arteriovenous malformations are supplied by arteries normally feeding the neural tissue. Dural arteriovenous fistulae (DAVF) are the most common encountered vascular spinal cord lesions and are supplied by radiculomenigeal arteries. MRI is the modality that should be used first to identify the vascular lesion and rule out other potential differential diagnosis (e.g. tumour, ischaemia, myelitis and degenerative disease). When a vascular spinal cord malformation is suggested on MRI, catheter angiography has to be performed to classify the vascular lesion. Recently, non-invasive imaging techniques such as MR and CT angiography have been used to depict the origin level of the vascular lesion. Especially, for localising the level of a DAVF they have proven to have additional value in reducing catheter angiography examination time by guiding the interventionalist to a specific region. In most cases the treatment of vascular spinal cord malformations will be endovascular with a combined or surgical approach in selected cases.

Learning Objectives:

1. To understand the pathophysiology of spinal vascular anomalies.
2. To learn the key imaging findings in different vascular diseases of the spinal cord.
3. To consolidate the best neuroimaging protocols and comprehend the concepts of CTA, MRA and angiography in evaluation of spinal vascular diseases.

16:00 - 17:30

Room I/K

Chest

RC 1804

The new faces of pulmonary infection

Moderator:

B. Feragalli; *Chieti/IT*

A-525 16:00

A. Aspergillosis in the immunocompromised patient

S.J. [Copley](#); *London/UK (suecopley@hotmail.com)*

Aspergillus is a genus of around 200 fungi (moulds) which are ubiquitous in the environment. The common species affecting humans are *A. fumigatus*, *A. flavus*, *A. niger* and *A. terreus*. *Aspergillus fumigatus* is exceptional among microorganisms in being both a primary and opportunistic pathogen as well as a major allergen. Reproduction is by spore formation which is prolific and therefore human respiratory tract exposure is almost constant. The spectrum of aspergillus infection includes aspergilloma (mycetoma), chronic pulmonary aspergillosis, chronic necrotising pulmonary aspergillosis (subacute invasive, chronic airway invasive), invasive pulmonary aspergillosis (angioinvasive, non-angioinvasive including acute tracheobronchitis, exudative bronchiolitis and bronchopneumonia), and allergic disease (allergic bronchopulmonary aspergillosis (ABPA) and bronchocentric granulomatosis). Immunocompromised individuals are particularly susceptible to invasive aspergillosis. The risk factors for invasive aspergillosis include: profound neutropenia, haematopoietic stem cell transplant recipients, solid organ transplantation, potent immunosuppressive therapy, prolonged corticosteroid use and AIDS. Invasive aspergillosis can be further subdivided into angioinvasive and non-angioinvasive forms. The imaging features of angioinvasive aspergillosis are characterised on CT by nodules with a 'halo' of surrounding ground glass opacity due to alveolar haemorrhage. In the context of neutrophil recovery, nodules may demonstrate cavitation. Airway invasive aspergillosis may manifest as areas of consolidation (bronchopneumonia), nodular 'tree-in-bud' densities on CT (exudative bronchiolitis), or an acute tracheobronchitis with large airway thickening.

Learning Objectives:

1. To review the epidemiology and clinical settings of aspergillosis.
2. To understand the role of imaging in immunocompromised patients.
3. To understand radiological findings of pulmonary aspergillosis.

A-526 16:30

B. The changing patterns of pulmonary tuberculosis

W.F.M. [De Wever](#); *Leuven/BE (walter.dewever@uzleuven.be)*

Tuberculosis (TB) is an airborne infectious disease caused by *Mycobacterium tuberculosis* and is a major cause of morbidity and mortality. Worldwide, there were 9.4 million new TB cases in 2008 and more than two billion people were infected with TB bacilli. The estimated global incidence rate fell to 139 cases per 100,000. Falling rates are stabilising in Europe. Tuberculosis is developing new faces due to changes in host cellular immunity, such as HIV infection, immunosuppressive therapy, malignancy and due to multi-drug resistance. Chest radiography plays a major role in screening, diagnosis, and response to treatment of patients with TB; however, radiographs may be normal or show only mild or nonspecific findings in active disease. CT and high-resolution CT (HRCT) are more sensitive than chest radiography in the detection and characterisation of parenchymal disease, small foci of cavitation, mediastinal lymphadenopathy, and pleural complications. Based on these findings, HRCT is useful in determining disease activity and plays also an important role in the management of TB. Radiological manifestations of primary tuberculosis are lymph node enlargement, airspace consolidation and pleural effusion. The most common findings of post-primary tuberculosis are centrilobular nodules, branching linear and nodular opacities, patchy or lobular areas of consolidation, and cavitation. Miliary tuberculosis results from acute haematogenous dissemination of TB bacilli in lungs and other organs and CT-findings consist of innumerable small nodules randomly distributed throughout both lungs. Airway tuberculosis is characterised by circumferential wall thickening and luminal narrowing, with involvement of a long segment of the bronchi.

Learning Objectives:

1. To review the current demographics of pulmonary tuberculosis in Europe.
2. To understand the role of imaging in patients with tuberculosis.
3. To understand radiological findings of pulmonary tuberculosis.

A-527 17:00

C. Emerging viral infections

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

Viral agents are part of the spectrum of organisms which cause community acquired pneumonias. Furthermore, they are thought to function as a trigger for bacterial infections in the hospital or health care setting. In addition, viruses play a significant role as causative agents for infections in the immunocompromized host. Within the last years, outbreaks of viral infections have challenged regional, national and even global health care systems, have effected thousands of individuals and have resulted in significant morbidity and mortality. Most of the involved viral agents represented emerging organisms with an unpredictable impact on individual and society health. The radiologic community has learned several lessons from the documented outbreaks, and radiologists around the world have contributed to the early diagnosis of the disease, the monitoring of its course, and the documentation of complications as well as of response to therapy. Thus, imaging plays an important role in the diagnosis and management of these patients. In this course, epidemiologic aspects, patho-physiology and clinical features of emerging viral infections will be presented. In addition, their radiologic features and the role of radiology in diagnosis and management will be discussed. Attendees will learn how to understand, recognize, report and follow patients with emerging viral infections.

Learning Objectives:

1. To review the epidemiology and etiology of viral infections.
2. To become familiar with radiological patterns of different viral pneumonias and pulmonary infections.
3. To understand the role of imaging in patients suspected of having viral infections.

16:00 - 17:30

Room N/O

Head and Neck

RC 1808

Management of the post-treatment head and neck: a diagnostic dilemma

Moderator:

R. Maroldi; Brescia/IT

A-528 16:00

Chairman's introduction

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

Major changes in the treatment of head and neck neoplasms encompass the advances of endoscopic-based surgical techniques, mainly for nasosinusal and laryngeal tumours, and the application of sophisticated radiation therapy techniques, combined with chemotherapy. As most tumours arise from the mucosa of the upper aero-digestive tract, clinical surveillance is necessary to detect superficial recurrences, while morphological and 'functional' imaging techniques are indispensable to detect subclinical extra-mucosal and nodal recurrences. How can imaging techniques discriminate recurrence, inflammation, necrosis or scar? Key points include the knowledge of the normal appearance of tissues (morphology and signals) on CT, MRI, and PET-CT after surgery and chemo-radiotherapy. Specifically, when non-surgical treatment has been used, that means to become familiar with the expected changes both of tumour and adjacent tissues. Morphology-based imaging techniques are often inadequate to discriminate small recurrences from vascularised scar tissue (enhancing). CT or MRI do require to be integrated by information provided by functional-based imaging techniques, FDG-PET-CT being the most established. Recently, a great interest among radiologists is focused on the application of DCE-CT or DCE-MRI and DWI-MRI in the follow-up of head and neck neoplasms. In fact, several studies have credited these techniques for providing functional information about tissues (perfusion, water exchange) that help to discriminate scar from recurrences. Obviously, the horizon pursued is to combine morphology and functional data in a single examination. Though clearly promising, these new techniques share significant limitations, like the reproducibility of CT and MR-based functional results, their introduction and feasibility in the day practice.

A-529 16:05

A. Expected changes after treatment

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

Early stage head and neck cancer can be cured by surgery or radiotherapy. The choice depends on the functional and cosmetic result to be expected, tumour histology, patient's condition and preference, and institutional policy. In advanced lesions, nowadays concomitant chemoradiotherapy is offered, with surgery reserved for salvage. A relatively high locoregional control rate can be obtained, at the expense of acute and late toxic side effects, and a higher incidence of treatment complications. On post-therapeutic imaging studies, treatment-induced tissue changes are often visible; these changes should not be misinterpreted as evidence of persistent or recurrent tumour, or treatment complication. After radiotherapy, the visible changes depend on the radiation dose and rate, the irradiated tissue volume, and the time elapsed since the end of treatment. Basically, thickening of the laryngeal and pharyngeal walls, increased attenuation of fat planes, postirradiation sialadenitis, lymphatic tissue atrophy, and retropharyngeal oedema will be seen. These irradiation-induced tissue changes usually appear symmetrical. The acute effects of radiotherapy occur during or immediately after treatment, and usually settle spontaneously. Complications of radiotherapy are usually seen months to years after the end of treatment. The limits of surgery are determined by safeguarding critical functions and maintaining a cosmetically acceptable appearance. Extensive resections are possible by the use of various reconstructive materials. Most surgical complications occur early after treatment, and are dealt with on a clinical basis. Imaging may be required, for example, in case of a postoperative collection, for fistula detection and follow-up, or to confirm flap failure because of necrosis.

Learning Objectives:

1. To learn about the current treatment options in head and neck cancer.
2. To understand the expected tissue changes on imaging studies after radiotherapy for head and neck cancer.
3. To appreciate the expected imaging findings after surgery for head and neck cancer.

A-530 16:28

B. Surveillance imaging, tumour recurrence and treatment complications

A.D. King; Hong Kong/CN (king2015@cuhk.edu.hk)

There is no clear consensus regarding optimal time points for surveillance, but clinical assessments are more frequent in year 1 and are performed over at least 2-3 years, during which time most locoregional failures and second primary tumours are detected. Ideally for imaging surveillance at least one post-treatment baseline head and neck scan (MRI/CT) should be performed at 3-6 months, and often closer surveillance is desirable. Candidates for salvage surgery after (chemo) radiotherapy undergo a post-treatment scan at 6-8 weeks, followed by regular scans (4-6 months in year 1; 6-12 months thereafter, the exact time period being tailored to the patient). A residual mass after (chemo)radiotherapy may be caused by cancer, benign treatment mass (BTM), or both. In the later post-treatment period residual/recurrent cancer (homogeneous moderately contrast-enhancing expansile mass of intermediate T2 signal) can be distinguished from a BTM (retracted/straight edged non-enhancing fibrotic scar tissue of low T1 and T2 signal). Earlier stages are more problematic when both cancer and BTMs form expansile masses of marked/moderate contrast-enhancement and high/moderate T2 signal. This limitation has focused attention on functional imaging techniques. ¹⁸F FDG-PET has a high negative predictive value for cancer at ≥ 3 months. Functional MR techniques are showing promise for even earlier post-treatment assessment using DWI, MRS and DCE. The delayed effects of treatment cause a wide range of complications. Osteoradionecrosis, chondronecrosis, muscle denervation, inflammatory polyps and radiation-induced tumours may be mistaken for tumour recurrence. Features of these treatment-induced complications will be illustrated.

Learning Objectives:

1. To become familiar with the ideal time points for follow-up.
2. To become familiar with morphological and functional changes occurring with tumour recurrence.
3. To understand treatment complications and to differentiate them from tumour recurrence.

A-531 16:51

C. Predicting outcome after radiation therapy in head and neck cancer: what is evidence-based?

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

The most recent advances of radiotherapy techniques are characterised by the increased precision with which the radiation energy is released to the target, the reduced collateral damage to adjacent non-neoplastic tissues, and the synergic

effect of chemo-radiotherapy. As the treatment planning becomes progressively 'tailored', strong predictive factors for the individual tumour arising in a specific patient have to be identified. These factors would ideally provide a quantitative assessment of the risks of both relapsing (in the primary, nodal or distant sites) and developing treatment-related (early or late) complications. Predictors are related to tumour's characteristics (biology, metabolism, site, volume and spread) and to patient's overall clinical conditions. Imaging-based predictive factors have been founded upon morphological findings (2D, volume) until the development of new techniques, which analyse 'functional' parameters like FDG-PET-CT, the most established, and perfusion-CT or DWI-MRI. Evidence of level A has been provided on the impact of negative predictive value of FDG-PET-CT in ruling out residual disease, whilst there is no clear data regarding the role of pre-treatment intensity of glucose metabolism (SUV) in predicting the outcome after radiotherapy. This limitation can be addressed to the enrolment of tumours arising in various sites in the head and neck. A major disadvantage common not only in PET studies but also in most DCE and DWI-MRI studies. Perfusion-CT and DWI-MR are promising techniques, as they provide information about neo-angiogenesis and water-flow in submicroscopic tissue compartments. However, these techniques still require randomised trials and confirmation studies about the reproducibility of their interesting results.

Learning Objectives:

1. To become familiar with the prognostic significance of MR imaging-determined tumour parameters.
2. To become familiar with the prognostic significance of CT imaging-determined tumour parameters.
3. To discuss what is evidence-based, including future perspectives.

Panel discussion:

Recurrence, inflammation, necrosis or scar: is imaging useful? 17:14

In the follow-up after minimal invasive surgical techniques or chemo-radiation, a major limitation of standard morphological imaging is the differentiation of the highly vascularised scar tissue (enhancing, with mass effect) from persistent or recurrent neoplasm. Is it time for integrating standard imaging with the functional information provided by DWI and/or CT or MR perfusion techniques? Which evidence level are we at presently? Is it now feasible in daily practice?

16:00 - 17:30

Room P

Vascular

RC 1815

Advances in vascular imaging

Moderator:

P.M.T. Pattynama; Gouda/NL

A-532 16:00

A. Vascular imaging at 3 T

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

Three-Tesla MRI scanners offer an increased signal and contrast for MR-angiography (MRA) compared to 1.5-Tesla machines. MRA can be performed within a shorter time enabling the acquisition of temporally resolved three-dimensional datasets with high spatial resolution. Due to high signal and contrast the dose of gadolinium may be reduced. Furthermore, novel imaging protocols for MRA at 3.0-Tesla with intravascular contrast agents and prolonged enhancement during high-spatial-resolution steady-state enable new possibilities for angiography of the upper and lower extremities including veins and vessels below the knee, spinal arteries, vascular malformations, and double-gated angiography of coronary arteries and bypass vessels to compensate for the complex cardiac motion pattern. A 3.0-Tesla MRI system equipped with a matrix coil system allows for whole body MRA with continuous table movement, which is an applicable technique for imaging peripheral vessels without the need for planning different steps and field of view positioning, thereby considerably reducing the examination time. Phase contrast magnetic resonance angiography may develop into an important, non-invasive method for obtaining quantitative information on blood flow. In addition, non-enhanced three-dimensional MR angiography using turbo spin echo (TSE) imaging with non-selective refocusing pulses may be a promising imaging technique for vascular imaging in patients with renal insufficiency.

Learning Objectives:

1. To learn the major advantages of vascular imaging at 3 T.
2. To become familiar with imaging protocols for vascular imaging.
3. To learn about future developments.

A-533 16:30

B. Dual energy CT and time resolved CT

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

Today, CT angiography (CTA) is considered as a safe, non-invasive and well-established procedure for vascular imaging. Modern multi-slice CT technology allows for coverage of larger vascular territories - even the whole body - in just several seconds. Further technical improvements such as wide detectors of up to 16 cm width or moving table techniques are making new applications possible, such as perfusion imaging, or time-resolved CT angiography. Especially with the moving table technique (the so-called „shuttle-mode“), vascular territories of up to 50 cm can be covered in a dynamic fashion, which can be helpful in the diagnosis of aortic dissections or peripheral vascular occlusive disease. On the other side, radiation exposure has to be maintained within a reasonable range applying these repeated acquisition modes. Another interesting field opening new options in CTA is dual energy CT (DECT). A number of technical setups may allow for spectral CT imaging, such as systems with two tubes (dual source CT), CT systems with switching kV modes or with special detectors. In vascular applications, DECT is especially helpful for automated bone removal, plaque removal, and potentially for „perfusion“ imaging (iodine mapping). In this course, the basics of modern CT angiography will be highlighted, with a special focus on new applications such as time-resolved CTA and dual energy CTA.

Learning Objectives:

1. To learn the basic principles of dual energy CT and time resolved CT and its advantages for vascular imaging.
2. To review imaging protocols, results and radiation exposure aspects.
3. To learn about future developments and advantages in comparison with MRA.

A-534 17:00

C. Flat panel CT (C-arm CT)

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Angio-3D with digital flat-panel detector has recently been adapted for use with C-arm systems and provides a higher detector quantum efficiency (DQE) than conventional detectors based on II camera. This configuration represents the next generation of imaging technology available in the interventional radiology suite and is predicted to be the platform for many of the three-dimensional (3D) roadmapping and navigational tools that will emerge in parallel with its integration. It provides projection radiography, fluoroscopy, digital subtraction angiography, and volumetric computed tomography (CT) capabilities with the ability for immediate multiplanar post-treatment assessment in a single patient setup, within the interventional suite. Such capabilities allow the interventionalist to perform intraprocedural volumetric imaging without the need for patient transportation. The clinical benefits of 2D angiography with these new systems have been assessed in the fields of cardiology and interventional radiology. These key features alone may translate to a reduction in the use of iodinated contrast media, a decrease in the radiation dose to the patient and operator, and an increase in the safety and performance of interventional procedures. Proper use of this new technology requires an understanding of both its capabilities and limitations. This article provides an overview of the potential of this new technology.

Learning Objectives:

1. To learn the basic principles of flat panel CT.
2. To review imaging protocols, results and radiation exposure aspects.
3. To become familiar with the most common applications.

16:00 - 17:30

Room Q

Computer Applications

RC 1805

Image sharing

Moderator:

D. Caramella; Pisa/IT

A-535 16:00

Chairman's introduction

D. Caramella; Pisa/IT

The introduction of picture archiving and communication systems (PACS), through a much more effective image sharing, has dramatically changed the role of radiology both within the hospital and on a geographic perspective. Historically, the latter has become apparent first with the early implementation of teleradiology applications. Physicians and the general public have understood that digital images can be read, processed, and stored independently on the site of production. Therefore, teleconsultation and telereporting activities have been carried out among medical users, and generic users have learnt to include radiological images in their own on-line personal health records. Only later the full potentialities of multidisciplinary image sharing within the hospital have been discovered, and now it is increasingly common to see advanced integration between radiologists and surgeons for planning and guiding surgical interventions. During this session, the lecturers - exceptionally expert in their respective fields - will give insights into image sharing: from the geographical applications (teleradiology) to the hospital-based applications, with specific reference to the support to surgeons (intraoperative guidance and model-guided surgery).

Session Objectives:

1. To become familiar with models of PACS and imaging networks.
2. To understand the evolution of teleradiology.
3. To understand the utilisation of general public communication tools.

A-536 16:05

A. Image data beyond radiology: new techniques

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Medical imaging is part of a changing medical environment, a changing patient environment and consequently a new medical world. In the recent decennium one of the most important changes in radiology is the conversion from analogue to digital. In no time medical images have become interchangeable through the digital highway and could be post-processed in a different location. Teleradiology has become a reality since then. We have seen the maturation of commercial international teleradiology companies offering a wide portfolio of services. Another aspect is the availability of image data for all medical specialties beyond radiology and beyond the regular medical disciplines. An increasing number of surgical or oncological specialties and even pharmaceutical companies increasingly use image data to prepare a strategy for operative procedures, to choose the right therapy, to decide which prosthesis to the best to use, for follow-up or for post-processing purposes. They are supported by many new techniques and software. An increasing number of medical computer applications such as complex navigation and visualisation tools based upon digital images is already in clinical use or under development. Another trend is the increasing interest in E-health and telemedicine in Europe, also among European policy makers. Now we see mobile health that brings care directly into the patient environment. The purpose of this presentation is to give a comprehensive overview of and insight into these new developments and to create awareness among radiologists of the increasing importance of integration of medical imaging in a multidisciplinary environment.

Learning Objectives:

1. To review remote consultation.
2. To review second/expert reading.
3. To understand image data beyond radiology.
4. To understand communication, visualisation and navigation.

A-537 16:28

B. Intraoperative imaging for surgeons

A. Pietrabissa; Pisa/IT (andrea.pietrabissa@gmail.com)

The advent of minimally invasive surgery has made even more important the place of preoperative imaging assessment of patients selected for this type of surgery. In fact, the loss of tactile feed-back and the bi-dimensional intraoperative vision have limited the capability of surgeons to assess extent and anatomic relationship of a given disease, particularly cancer. Preoperative planning can be further enhanced by the use of 3D models of the target anatomy, derived from CT scan dataset. In addition, dedicated technology can be implemented to introduce mixed reality environments in the operative room. Using 3D helmets with built-in microcameras, the surgeons' view of the operative field can be fused with the preoperative 3D anatomy of the patient. Localiser should be used, either infrared based or electromagnetic. The last step would be intraoperative navigation. This offers special problems to be addressed, due to organ shifting and soft tissue in the setting of abdominal surgery.

Learning Objectives:

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

A-538 16:51

C. Images and models for CAS

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

The appropriate use of information and communication technology (ICT) and associated systems is considered by many experts as a significant contribution to improve workflow and quality of care in clinical settings. A conceptual design and prototypical implementation of such an infrastructure, i.e. a therapy Imaging and model management system (TIMMS) will be introduced as a solution to a patient-specific medicine. A TIMMS is an information technology concept and framework for the collection, organisation, and utilisation of medical information from sources such as the electronic medical record, PACS, etc. TIMMS was originally designed as a surgical assist system, but has many general medical uses as well, including all forms of model-guided medicine and may therefore be generalised to a medical information and model management system. The architectural framework and a number of individual ICT components of a TIMMS have been realised. These include standardised interfaces for communication of patient-specific and workflow models, thereby creating a unified environment for the input and output of data, including the representation and display of information and images, as well as the electromechanical control of interventional and navigational devices. In conclusion, the patient-specific model (PSM) is the central construct for a patient within a personalised medicine environment in order to provide a clinician with a real-time representation of critical information about the patient. The required information concerning the patient for model-guided therapy is extracted by TIMMS agents and assembled within the framework of an active PSM and workflow management system.

Learning Objectives:

1. To become familiar with the problem of integration of image information for knowledge models of patients.
2. To become familiar with the concept of 'from image-guided to model-guided surgery'.
3. To learn about selected examples from ENT, neuro- and cardiovascular surgery.
4. To learn about IT infrastructures and standards for enabling image-guided and model-guided surgery.

Panel discussion:

The take-home points 17:14

1. Image sharing in teleradiology
2. Surgical workflow
3. Image and model-guided surgery
4. Patient-specific model