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# Notes

# Scientific programme abstracts Monday 7 June

## 0830–0930

### Biopsy tips and tricks

#### 0830 Optimising yield and minimising complications

Hatrick, A.

*Frimley Park Hospital, Surrey, UK*

No abstract supplied.

#### 0900 Top tips in biopsy of thorax and neck

Hughes, N.

*Frimley Park Hospital, Surrey, UK*

No abstract supplied.

## 0830–0920

### Fundamentals of Digital Mammography (DM)

#### 0830 The basics of the digital image and DM

Workman, A.

*Forster Green Hospital, Belfast, UK*

No abstract supplied.

#### 0855 Radiography practice with DM

McCollum, S.

*Action Cancer, UK*

**PURPOSE:** To consider some of the challenges involved with setting up Full Field Digital Mammography centre and to look at some of the practical issues involved and learned. **METHODS:** Action Cancer is a leading Northern Ireland Charity, we offer a breast screening service to women aged 40-49 and 70+ (outside of the NHSBSP invitation range in Northern Ireland). In 2006 we installed Full Field Digital Mammography (FFDM) both in our fixed site and in the new purpose built mobile unit. Since July 2006 the charity has screened on average of 8000 women per year using FFDM. We have experienced many of the practical aspects of installing FFDM including training staff, client perception and staff opinions of this new system of work, both in screening and reporting. We have also looked at our cancer detection rate with FFDM compared with our previous analogue system. **CONCLUSION:** The last few years have shown that FFDM can be used effectively and efficiently within our screening unit and has lead to an increase in cancer detection when compared with our previous analogue system.

## 0830–0930

### Trauma I: Military Radiology

#### 0830 Current standards in Military Trauma Care

Hodgetts, T.

*Royal Centre for Defence Medicine Headquarters, Birmingham, UK*

No abstract submitted.

#### 0850 Does FAST ultrasound have a role in trauma imaging in the age of Multislice CT?

Armstrong, M.

*Royal Navy, Derriford Hospital, Plymouth, UK*

No abstract submitted.

#### 0910 Damage control Radiology – Whole Body CT

Miles, R. and Armstrong, E.

*Royal Navy, Plymouth, UK*

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**KEY LEARNING OBJECTIVES:** A single pass whole-body multislice CT protocol for polytrauma substantially reduces the overall scan time and improves throughput in the case of multiple casualties. **DESCRIPTION:** Introduction of a single pass Whole-body CT protocol for polytrauma at the UK Field Hospital in Afghanistan has substantially reduced the scan acquisition times from around 12 min to 5 min. This is achieved by reducing the planning time and number of stages for each scan. Images of the whole spine are acquired in one data set facilitating analysis of spinal injury. Scanner throughput is improved thus facilitating imaging based triage of multiple casualties. **CONCLUSION:** A single pass Whole-body CT protocol has been shown to be both robust and rapid and in our experience applies equally to battlefield casualties and civilian type trauma.

## 0830–1000

### The future is bright

#### 0830 Price of quality and cost of failure

Easton, J.

*Department of Health, UK*

The quality, innovation, productivity and prevention (QIPP) challenge is our opportunity to prepare the NHS to defend and promote high quality care in a tighter economic climate. It will do this by identifying and making efficiency savings and reinvesting that money in quality improvements year on year. We know we have one more year of guaranteed growth in 2010/11 and then NHS investment will grow in line with general inflation. However, the demand for healthcare from a growing and ageing population, new technology and higher patient expectations mean there will be increasing pressures on the NHS budget. If we do not take action now to prioritise quality and tackle inefficiencies we will compromise the ability of the NHS of the future to consistently deliver high quality care to all patients. Addressing financial inefficiencies is a key personal, professional and moral responsibility for all staff because it allows us to free up resources which can then be used to give more patients high quality care.

#### 0900 Putting radiology on the map in the Southwest; did it work?

Cavanagh, P.

*Taunton & Somerset NHS Trust, Somerset, UK*

Following in the steps of the NHS Next Stage Review, NHS South West carried out a review specifically focused on radiology and how it would support this national work. The Review involved a large number of clinicians and managers as well as users of the service. The result was a set of stretching ambitions which if achieved would provide the people of the South West with an imaging service fit for the 21st century. It is now over a year since the Radiology Review was approved by the leadership in the South West. This presentation will focus on the agreed ambitions and the progress being made to achieve them.

#### 0930 Beyond activity: commissioning for quality and outcomes

Rafferty, J.

*Central Lancashire Primary Care Trust, Manchester, UK*

No abstract supplied.

## 0830–0930

### Body MRI school: Gynae imaging

#### 0830 Imaging the uterus

Rockall, A.

*Barts and the London NHS Trust, London, UK*

The pre-operative MRI assessment of cervical and endometrial cancer is now an integral part of patient management. This lecture will review the appropriate imaging sequences required for optimal delineation

of the tumour. The FIGO staging classification will be illustrated with examples. The potential diagnostic and staging pitfalls will be demonstrated. In addition, the role of MRI in patient follow-up will be discussed.

### 0900 Imaging the adnexae

Sala, E.

*Addenbrooke's Hospital, Cambridge, UK*

No abstract supplied.

### 1000–1130

#### On-call scenarios in the chest

##### 1000 Imaging in acute ischaemic heart disease

Greaves, K.

*Poole Hospital NHS Foundation Trust, Poole, UK*

No abstract supplied.

##### 1030 Suspected PE in patients with renal impairment or pregnancy

Matthews, S.

*Northern General Hospital, Sheffield, UK*

The BTS guidelines for imaging suspected PE (2003) refer to the general population and make no specific recommendation for patients with renal impairment or pregnancy. Both these groups pose specific challenges. Patients with renal impairment have an increased risk of contrast induced nephropathy (CIN). In pregnant patients there are concerns related to the radiation exposure of the foetus and maternal breast tissue, the potential risk of neonatal hypothyroidism secondary to maternal intravenous contrast media administration and problems related to adequate contrast opacification of vessels in the presence of a hyperdynamic circulation. Although D-dimer does increase in normal pregnancy and with renal impairment, a negative test together with a low or intermediate clinical pre-test probability can still be used to exclude patients from further investigation. Doppler ultrasound of the legs should be considered even in patients without symptoms of DVT. Perfusion imaging avoids the risk of CIN but may not be a realistic proposition in older patients with associated cardiothoracic disease. Perfusion imaging is more useful in the younger pregnant population with a low incidence of chest disease. If CTPA is to be performed, the risk of CIN can be minimised by adequate patient hydration, stopping nephrotoxic medication and administering the minimal dose of contrast medium to obtain a diagnostic investigation. For pregnant patients requiring CTPA, radiation exposure and contrast medium doses should be minimised with scrupulous radiographic technique. In both clinical situations, tactics to minimise potential risks should be employed. During this session, the above points will be explored.

##### 1100 Non-cardiac causes of chest pain – the thoracic aorta

Ettles, D.

*Hull Royal Infirmary, Hull, UK*

Disease of the thoracic aorta is common and accounts for a significant proportion of patients presenting with non-cardiac chest pain. In the acute aortic syndrome (AAS), chest pain is associated with disruption of the layers of the wall of the thoracic aorta. Underlying causes include penetrating atherosclerotic aortic ulcer, intramural haematoma and aortic dissection. Although the pathophysiological processes underlying each of these entities differs, some patients exhibit several or all of these lesions, suggesting a link between them. In such cases it can be difficult to determine, based on imaging findings alone, which was the initiating event. Recognition and classification of AAS has important prognostic and management implications. Proximal aortic dissection carries a high mortality and requires immediate repair, while distal dissections are initially managed conservatively in the absence of haemodynamic instability or distal ischaemia. The recognition of penetrating atherosclerotic ulcers as a precursor to aortic dissection or rupture has prompted a more proactive approach to their management. While echocardiography and MRI demonstrate excellent

sensitivity and specificity for thoracic aortic pathology, MDCT offers significant advantages in terms of access, speed of examination and multiplanar analysis and has come to the forefront as the investigation of choice in AAS. The detection of early or subclinical lesions presents significant management problems and increases the cohort of patients requiring surveillance. Although the incidence of AAS is relatively low in comparison with acute coronary syndromes, detection and classification by MDCT is straightforward and is part of the remit of most general radiologists. Increasingly, such cases are amenable to endovascular repair. This presentation will review the important imaging findings in the context of current clinical management.

### 1000–1130

#### Breast imaging

##### 1000 Breast imaging at 3T

Gilbert, F.

*University of Aberdeen, Aberdeen, UK*

Breast imaging at 3T has proved to be more challenging than anticipated, particularly in Europe where bilateral breast imaging is the norm. The combination of 3T and parallel imaging has allowed the acquisition of images with improved spatial and temporal resolution. The 30% increase in SNR with 3T offsets the reduction in signal inherent in parallel imaging and the parallel acceleration reduces the SAR effects. The manufacturers have developed breast coils with more receiver channels with 16 and 32 channels becoming standard. The variation in the radiofrequency B1 transmit field apparent in some systems means that the observed signal is different in each breast despite the tissue characteristics being identical. In unilateral sagittal breast imaging, as sometimes done in the USA, an appropriate flip angle can be chosen to ensure a  $T_1$  weighted image but in bilateral imaging this can be a problem, particularly where the breast coil is high in the magnet. In practice this might cause tumours to be overlooked depending on which flip angle has been used. Manufacturers have adopted various approaches to address this known problem. Dynamic contrast enhancement (DCE) at 3T has advantages over 1.5T. Faster acquisition and keyhole techniques mean 10 or 20 second time points can be used for the initial few minutes to capture the early signal peak seen in tumours followed by slower high spatial resolution images for detailed tumour morphology and to capture the wash out information. This provides the opportunity for pharmacokinetic modelling to be undertaken as well as measuring signal enhancement ratios. Diffusion weighted imaging (DWI) at 3T seems to have an improved performance and this is being used increasingly in the diagnosis of breast cancer, assessment of treatment response and metastatic disease. The parameters reported for 1.5T are not applicable for 3T and the literature will be reviewed to assess the most appropriate b values to differentiate benign from malignant disease. Proton spectroscopy (MRS) should be easier to perform at 3T because of the doubling of the distribution of spectra to 600–700 Hz improves the separation of the resonance lines. While this is true in the brain the composition of breast tissue where both fat and water need to be adequately suppressed MRS is much more difficult. Choline peaks are found in breast cancers and the literature reports promising results differentiating benign from malignant disease and identifying early response to chemotherapy. However, the practical issues around breast MRS mean that considerable attention to detail is required by the MR team in order to ensure a reliable reproducible result.

##### 1030 Indeterminate lesions on MRI

Dall, B.

*United Leeds Teaching Hospital, Leeds, UK*

Indeterminate lesions are a common problem throughout all aspects of imaging irrespective of sub-speciality. This is a particular problem in breast MRI because the investigation is very sensitive and because increasingly women undergoing this test will be well women attending for high risk screening as opposed to patients. We have to develop a management strategy for indeterminate lesions that minimises distress to our patients, our clinical colleagues and ourselves. I will summarise

what constitutes an indeterminate lesion on breast MRI and then I will outline how we manage them at our centre.

### 1100 Imaging the brachial plexus

Vinnicombe, S.

*Barts and the London NHS Trust, London, UK*

**KEY LEARNING OBJECTIVES:** To review the anatomy of the brachial plexus. To understand the technique of MRI of the brachial plexus. To appreciate the role of MR and other imaging modalities in the differential diagnosis of brachial plexopathy. **DESCRIPTION:** Patients with primary or metastatic tumours in the region of the axilla and supraclavicular fossa may develop brachial plexopathy for a number of reasons, including tumour recurrence and complications of therapy. Clinical examination can be difficult, especially in the treated patient, and imaging has an important role in defining the aetiology of the plexopathy. Though multidetector CT can demonstrate mass lesions affecting the brachial plexus, MRI is the technique of choice because of its superior soft tissue contrast and multiplanar imaging capability. A combination of high resolution  $T_1$  weighted and fat suppressed  $T_2$  weighted images in axial, coronal and sagittal planes, with intravenous contrast medium if necessary, provides excellent visualisation of the entire brachial plexus. With such sequences it is usually possible to differentiate tumour infiltration from post-surgical scarring or radiation-induced fibrosis. However, this distinction may not always be possible even with optimal imaging and in this situation, FDG-PET CT can provide valuable diagnostic information. **CONCLUSION:** Brachial plexopathy in patients with breast cancer is a rare but devastating clinical problem with a number of underlying aetiologies. However, modern imaging techniques provide a powerful non-invasive means of defining the cause, such that appropriate management can be instigated and monitored.

### 1000–1110

#### Advances in technology scientific session

#### 1000 Comparison of 2D and 3D $T_2^*$ as a sensitive indicator of lung microstructure using hyperpolarised helium-3 MRI

Hill, K. A.<sup>1,2</sup>, Pérez-Sánchez, J. M.<sup>2</sup>, Santarelli, R.<sup>2</sup>, Sarracanie, M.<sup>2</sup>, Hagot, P.<sup>2</sup>, Friese, M.<sup>3,2</sup>, Maître, X.<sup>2</sup>, Golding, S.<sup>1</sup>, and Darrasse, L.<sup>2</sup>

<sup>1</sup>University of Oxford, Oxford, UK, <sup>2</sup>Université Paris-Sud, Paris, France, <sup>3</sup>University of Queensland, Brisbane, Australia

**PURPOSE:** The MR signal lifetime,  $T_2^*$ , of hyperpolarised helium-3 in the lungs has shown promise in characterising pulmonary microstructure due to sensitivity to magnetic field gradients that change with pathophysiological modification. Despite the lung's heterogeneous structure, most helium-3  $T_2^*$  measurements use 2D imaging. This work compares  $T_2^*$  acquired with 2D projection and 3D imaging for five rats *in vivo*. **MATERIALS/METHODS:** 2D images ( $2 \times 2 \times 32$  mm<sup>3</sup>) and 3D images ( $2 \times 2 \times 2$  mm<sup>3</sup> slices) were acquired at 1.5T at Bicêtre Hospital in Paris. Five Wistar rats (254–270 g) were anaesthetised using a ketamine/xylazine solution and tracheotomized. 7 ml of helium-3 was administered followed by a four-interleaved-echo 2D acquisition (TE = {1.88, 8.88, 15.88, 22.88} ms) and a two-interleaved-echo 3D acquisition (TE = {1.88, 10.88} ms).  $T_2^*$  maps were computed using mono-exponential fits for each voxel. **RESULTS:** In 3D images, a Wilcoxon rank-sum test compared the mean  $T_2^*$  of three central slices with high SNR. Statistically significant differences were found between slices 8–10 ( $p=0.02$ ), slices 9–10 ( $p=0.03$ ), and a noteworthy difference between slices 8–9 ( $p=0.06$ ). One  $2 \times 2 \times 2$  mm<sup>3</sup>  $T_2^*$  map showed a pronounced ventilation defect in the left lung; this defect was not visible in 2D. **CONCLUSION:** Early detection of diseases which alter lung microstructure, such as emphysema or pulmonary fibrosis, requires localized whole-lung imaging. These results show that 3D  $T_2^*$  maps can detect statistically different local phenomena that may not be apparent in 2D. Helium-3  $T_2^*$  may ultimately be used as a diagnostic tool in chest radiology.

#### 1010 Comparison of apparent diffusion and $T_2^*$ measurements at 1.5T for sensitive lung characterisation using hyperpolarised helium-3 MRI

Pérez-Sánchez, J. M.<sup>1</sup>, Hill, K.<sup>1,2</sup>, Santarelli, R.<sup>1</sup>, Sarracanie, M.<sup>1</sup>, Friese, M.<sup>1,3</sup>, Hagot, P.<sup>1</sup>, Maître, X.<sup>1</sup>, and Darrasse, L.<sup>1</sup>

<sup>1</sup>Université Paris-Sud, Paris, France, <sup>2</sup>University of Oxford, Oxford, UK, <sup>3</sup>University of Queensland, Brisbane, Australia

**PURPOSE:** It has been demonstrated that the apparent diffusion coefficient (ADC) of helium-3 gas in the lungs can indicate changes in airway microstructure. The signal lifetime,  $T_2^*$ , is another parameter that carries similar promise. This study compares the sensitivity of ADC and  $T_2^*$  in detecting *in vivo* changes in the rat lung during inflation. **MATERIALS/METHODS:** Five male Wistar rats (254–270 g) were anaesthetised and intubated. Helium-3 doses were administered at low and high volumes (10 and 20 mbar) before apnoea. ADC- and  $T_2^*$ -weighted images were acquired with four b-values and four echo times, respectively. Images were masked by discarding pixels with less than 45% of maximum intensity. **RESULTS:** The low/high volume ADC pairs for each rat are ADC = {(0.0969, 0.0907), (0.0940, 0.0888), (0.0847, 0.0803), (0.0942, 0.0876), (0.1054, 0.0992)} cm<sup>2</sup>s<sup>-1</sup>, which, during inflation, leads to an unexpected reduction in ADC from 5.5% to 7.5%. By contrast, the low/high volume  $T_2^*$  values are  $T_2^*$  = {(15.17, 17.05), (15.28, 19.24), (13.87, 16.49), (12.99, 14.42), (13.20, 14.68)} ms. From low to high volume, the  $T_2^*$  increase ranges from 10.1% to as high as 21.6%. **CONCLUSION:** This work shows that ADC measurements remain difficult to interpret whereas  $T_2^*$  measurements are clearly sensitive to lung inflation. In the rat lung at 1.5T,  $T_2^*$  measurements may be a more relevant physical parameter than ADC. In the future, helium-3  $T_2^*$  may be used diagnostically for early detection of diseases which dramatically alter the lung microstructure such as emphysema or pulmonary fibrosis.

#### 1020 Use of time resolved imaging contrast kinetics 3D (TRICKS) in peripheral arteriovenous malformations

Pandya, S., Deeab, D., Khoo, M., Thorning, C., Gedroyc, W., and Dick, E.

*St. Mary's Hospital NHS Foundation Trust, London, UK*

**PURPOSE:** Soft tissue vascular lesions comprise a broad spectrum ranging from haemangioma to vascular malformations. The aim of our study was to define the MRI appearance of peripheral slow to intermediate flow vascular malformations and to highlight the role of time resolved imaging contrast kinetics 3D (TRICKS) in its imaging. **MATERIALS/METHODS:** MRI examinations of 33 patients (age range of 2–36 years) with clinically diagnosed peripheral slow flow vascular malformation (VM) were reviewed retrospectively by 2 radiologists. **RESULTS:** VM were found in the pelvis/lower extremity in 26 pts (upper extremity in 7), with predominant involvement of subcutaneous fat. Extension to muscles was seen in 22 and bone in 2 pts. Size range was 3–60 cm with average size of venous channel at 5 mm. Extension along the neurovascular bundle was seen in 3 pts. Average fat content of the lesion was 25%. The presence of a draining vein was identified in 44% and phleboliths in 43%. TRICKS MRA was of high conspicuity in intermediate flow malformations but in slow flow TRICKS imaging was less conspicuous than on  $T_2$  weighted imaging. TRICKS enabled differentiation of VMS into slow and intermediate flow. **CONCLUSION:** The morphology and topography of VMs is variable.  $T_2$  weighted fat saturated sequences are the most useful sequence for conspicuity of all lesions but no imaging features on  $T_2$  weighted imaging reliably indicated the presence of intermediate or slow flow. TRICKS achieve high temporal resolution without compromising spatial resolution and enable differentiation of slow and intermediate flow VMs.

#### 1030 Intervertebral disc herniation quantification in lumbar spine MRI

Michopoulou, S.<sup>1</sup>, Vlychou, M.<sup>2</sup>, Costaridou, L.<sup>3</sup>, Speller, R.<sup>1</sup>, Panayiotakis, G.<sup>3</sup> and Todd-Pokropek, A.<sup>1</sup>

<sup>1</sup>University College London, London, UK,



<sup>2</sup>University Hospital Larissa, Larissa, Greece,  
<sup>3</sup>University of Patras, Patras, Greece

**PURPOSE:** Multiple MRI studies have shown dramatic changes in the size of intervertebral disc hernias for patients undergoing conservative treatment. Currently, the imaging assessment of disc herniation size relies on simple manual measurements which are user dependent and have low repeatability. This study introduces an image analysis system for the automated quantification of disc herniation morphology from spine MRI. **MATERIALS/METHODS:** A group of 100 intervertebral discs from  $T_2$  weighted sagittal MR images of 20 patients' lumbar spines acquired by a clinical 3T scanner were analysed. An experienced musculoskeletal radiologist reviewed all images and characterized the discs as normal (71) or herniated (29 hernias, 21 protrusions and 8 extrusions). The discs were segmented by a hybrid algorithm combining an atlas based model with fuzzy clustering techniques, requiring 2 user defined landmarks. Next a cubic spline was automatically fitted across the interface of the cerebrospinal fluid and posterior longitudinal ligament. This spline bisected each disc along the normal disc boundary, separating the main disc body from the hernia. Morphological features were extracted from each segmented disc hernia, quantifying its area and perimeter as well as the minor and major axis lengths. **RESULTS:** The disc segmentation algorithm and spline fitting process demonstrated robust behaviour. Quantitative measurements of morphological features values demonstrated high repeatability (Intraclass Correlation Coefficients >0.9). **CONCLUSION:** The proposed image analysis method is proposed as a diagnostic tool for tracking the evolution of disc herniation and monitoring the response to treatment, in a quantitative and repeatable manner.

#### 1040 Double slice reconstruction for image quality improvement in cardiac CT with up to 640 simultaneously slice

Blobel, J.<sup>1</sup> and Mews, J.<sup>2</sup>

<sup>1</sup>Toshiba Medical Systems Europe BV, Zoetermeer,  
 The Netherlands, <sup>2</sup>Toshiba Medical Systems GmbH, Neuss,  
 Germany

**PURPOSE:** New CT image reconstruction algorithms have adapted to the requisite extended cone angles. An advanced 3D reconstruction algorithm doubles the number of slice images in order to improve spatial resolution. We performed phantom test validation to confirm the utility and clinical potential of this reconstruction algorithm in cardiac CTA. **MATERIALS/METHODS:** Using the raw data from all projection angles an infinite three dimensional matrix of volume data is reconstructed. Because of the high density of the three dimensional raw data in cone angle acquisitions the increased number of volume will be generated for reconstruction with double slice mode (DSM). The 3D data matrix for 640 slices is generated with a three dimensional reconstruction. **RESULTS:** Phantom tests were performed on the Aquilion ONETM (Toshiba Medical Systems Corporation, Tokyo, Japan) at the Charité Berlin University Medical Centre. A bore hole test pattern comprising of eight rows of holes with a diameter of 0.31–0.50 mm and hole spacing of 0.30–0.48 mm was mapped microscopically. The separation of the 0.32 mm diameter bore holes with DSM agrees with the 0.49 mm diameter bore holes of Standard Mode (SM) and corresponds with 35% improvement. Patient examples confirm this improvement in image quality, particularly for plaque, stenosis and stent detection. **CONCLUSION:** The image quality is improved and over-blooming effect with its negative impact on stenosis evaluation is substantially reduced. Patient exposure does not have to be increased in DSM, compared with SM.

#### 1050 Pulmonary vasculature fly through and auto-vascular measurement (AVM) tools in CT pulmonary angiograms utilising 64 slice MDCT: technical aspects, current concepts and perspective

Haroon, A., Syed, M. A., and Entwisle, J.  
 University Hospitals of Leicester, Leicester, UK

**PURPOSE/AIM:** To present the utilisation of AVM tool (Vitrea 2-version 4.0) in facilitating the analysis CT pulmonary angiography. Illustrate the simplicity of the technique. Technical aspects of creation

of selected axial, targeted vessel axial and focused longitudinal image of contrast enhanced vessel. **CONTENT ORGANISATION:** Utilising the 2D, 3D feedback and integrating it with selected axial cuts through the specific segment of the vessel of interest. Illustrating the 3D fate of a clot organisation, margination, occlusion and dissolution which may be a contributory factor in future research while planning anti-coagulation strategies. Avoiding the effects of physical memory limitations of the hardware while reconstructing the images. **Figure:** Illustrating selected axial, targeted vessel axial and focused longitudinal image of contrast enhanced vessel from a CTPA study utilising AVM and vessel flythrough tool. Images acquired with 64 slice MDCT. **SUMMARY:** Utilisation of AVM and vessel fly through in CTPA adds to the precise anatomical configuration of a selected vessel. Selected axial cuts through the vessel of interest help to demonstrate the organisation of a clot.

#### 1100 The use of wireless digital detector technology: the implication for workflow and image quality

Watkins, G., Floyd, M. J., and Phillips, S.  
 The Princess of Wales Hospital, Bridgend, UK

**KEY LEARNING OBJECTIVES:** 1.Workflow: Digital wireless technology has increased speed of patient examination for particular categories of patients. 2. Benefits: Digital wireless technology enables examination of a patient with a reduction in exposure factors. 3. Image Quality: The use of digital wireless technology has resulted in an improvement in image quality compared with CR. **DESCRIPTION:** Utilisation of a wireless detector, reduces the number of work steps allowing for an increase in patient throughput with a resulting improvement in service delivery compared with CR. Availability of a preview image within seconds allows for an almost instantaneous decision on image quality. Such an improvement in overall examination time has proven particularly important in the examination of acutely ill patients. The flexibility of the wireless detector allowing imaging within its entire field of view results in greater ease and patient comfort when compared with CR. Exposure factors used have resulted in a reduction in patient dose. Lower exposure factors coupled with improved image quality makes the use of an anti-scatter grid unnecessary for the examination of anatomical areas which previously required a grid. This later development avoids the image degrading effect of grid cut-off and improves objective image quality. **CONCLUSION:** Our experience with a wireless detector has demonstrated a more efficient use of resources within the general radiography department and an accompanying improvement in the method and quality of patient examination.

#### 1015–1145

#### DIHI keynote & scientific session

#### 1015 The current and future contribution of CAD in routine diagnostic imaging

Todd-Pokropek, A. and Michopoulou, S.  
 University College London, London, UK

**PURPOSE:** The acronym CAD has several different meanings, but relevant to diagnostic imaging and radiology the two most important are: Computer Aided Detection, and Computer Aided Diagnosis. **MATERIALS/METHODS:** Many such systems have been designed and tested, often with a noticeable lack of success. The most successful application at present has been for Computer Aided Detection in Mammography in particular the R2 system in the USA, plus some other systems by other manufacturers for breast CT, MRI and ultrasound. Other systems which have been developed by several manufacturers have been for lung nodule detection and tracking on CT images, polyp detection on virtual colonoscopy, CAD for skin cancer, and an application which has been developed by us being CAD for lumbar spine. **RESULTS:** In general the useful paradigm has been for the computer system to act as “an extra pair of eyes” and to flag and label suspect regions especially when the volume of data to be inspected is large. This implies both detection and classification. The major problem has been in the reduction of false positives, particularly

when the system is used for screening. It is suggested that the extraction of quantitative information and the establishment of appropriate (and large) databases can assist in improving clinical performance for example in multi-modality imaging. **CONCLUSION:** The development of such systems is important with respect to diagnostic strategy, tools for assisting with clinical management and in particular transferring the techniques from diagnosis to therapy.

#### 1045 Voice recognition system and typographical errors: a review

Butt, N. A.<sup>1</sup>, Qureshi, M. S.<sup>2</sup>, and Roger, M.<sup>1</sup>

<sup>1</sup>Stirling Royal Infirmary, Stirling, UK, <sup>2</sup>Cambridge University, Cambridge, UK

**PURPOSE:** The aim of this study was to analyse voice recognition based reports, identify and categorise errors and evaluate if such errors are of clinical importance. Communication errors in radiological reporting are a longstanding problem. VR is seen as a potential answer to this problem. **MATERIALS/METHODS:** 10 consecutive, descriptive CT reports by 8 consultant radiologists, with positive findings, during a working week were analysed; making a total of 80 reports. Non-descriptive CT reports with no findings or normal results were excluded. Reports were re-read twice by two readers. Errors identified were assessed and categorised on the basis of possible impact and clinical importance; and were classified into groups on basis of severity of mistakes. **RESULTS:** Voice recognition system is also vulnerable to typographical errors. Of a total of 18 errors identified, 13 were of Grade 1, 4 of Grade 2, 1 of Grade 3 and 0 of Grade 4. Frequent errors being “5” typed as “high” and vice versa, “11” and “7” are typed as “one”, “Known” as “none” or “no”, “No” typed as “Now”. Additionally “the” was as unwanted prefix to many words, e.g. “The These” or “The many”. **CONCLUSION:** Seemingly minor typographical errors can alter the meaning of the radiological reports leading to increased effort in checking and/or mismanagement of patients. VR is not free of such errors. Measures to identify those errors should be employed such as report verification in a separate sitting or at the end of reporting session; double reporting, report templates and re-auditing.

#### 1055 Use of MIRC Electronic Teaching File System to produce automatically generated teaching files from PACS

Benham, J. D.

*City Hospital, SWBH NHS Trust, Birmingham, UK*

**PURPOSE:** The purpose of this project was to develop a system for producing teaching files with minimum effort at the time of reporting using free Medical Imaging Resource Center software (MIRC) produced by the Radiological Society of North America (RSNA). **MATERIALS/METHODS:** MIRC software produced by RSNA was installed on a server connected to the intranet at the author's institution. Automatic anonymisation of DICOM images was enabled in MIRC and the template for producing new documents in MIRC was altered to enable specific data in the DICOM header to be automatically inserted into teaching files. The Scrapbook function in efilm PACS was used to select images for inclusion in teaching files and enter clinical history and diagnosis as additional information. Scrapbook images were sent directly to the MIRC DICOM service, which packages the anonymised DICOM images with data extracted from the DICOM header including patient age, sex and modality as well as the clinical history and diagnosis to automatically create teaching files. **CONCLUSION:** Using this method, electronic teaching files can be produced quickly with minimum disruption to normal reporting workflow at the PACS workstation. MIRC produces an indexed library of teaching files and includes a powerful search engine. Teaching files can be used for teaching, examining or self-assessment with the diagnosis initially concealed. In addition, teaching files can be accessed remotely using a virtual private network (VPN), or encrypted using Secure Sockets Layer (SSL) connections over the N3 NHS network.

#### 1105 Radiology reporting discrepancies: classification by proposed mechanism

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Galloway, H. R.<sup>1,2</sup>

<sup>1</sup>Imaging Partners Online, Sydney, Australia, <sup>2</sup>University of Queensland, Brisbane, Australia

**PURPOSE:** To present the analysis of discrepant teleradiology interpretations of a large series of emergency CT examinations and to attempt to classify the possible causes of discrepancy. **MATERIALS/METHODS:** From a series of 58,113 cases 307 discrepancies were identified through a combination of 2% random over reading and feedback from client sites. 159 cases had sufficient detail for further analysis. **RESULTS:** The data was classified according to the schema of Renfrew. The vast majority of discrepancies were perceptual/cognitive and of these 85% were false negative. Communication was the primary issue in 12% and a small proportion each for misattribution, false negative and technical factors. The most common areas were the brain (60%), of which were 50% involved the posterior fossa. Body CT accounted for 30% and although a small proportion of studies peripheral skeletal studies had a high discrepancy rate more likely to be primary findings. **CONCLUSION:** The most common discrepancies related to findings incidental to the primary pathology or clinical question. This probably represents the poorly characterised “satisfaction of search” phenomenon and efforts to reduce radiology reporting discrepancies rates should be directed to better characterise this phenomenon and devising strategies to minimise its impact.

#### 1115 How satisfied are you... with teleradiology?

Prowse, S. J., Depasquale, R., Jayan, R., and Katti, A.

*University Hospital Aintree, Liverpool, UK*

**PURPOSE:** Teleradiology is a rapidly evolving tool with a multitude of applications. Its potential benefits are enormous. Unfortunately, as with all technology, we are encountering teething problems. At the University Hospital Aintree in Liverpool several problems have been encountered: “It's too time-consuming”, “too many passwords”, “I'm concerned with confidentiality”. Recently we have introduced a new secure remote access system – AppGate – which has provided a near panacea to many of our problems. No longer do we need a specific hospital laptop, nor a multitude of log-ins, and we have a far superior download rate, significantly decreasing “wasted time”. The purpose of this study is to qualify a measurable improvement in the use and satisfaction among radiologists of teleradiology within our department. **METHODS:** We have surveyed the usage of teleradiology by both Consultants and Registrars (26 respondents in total) pre and post introduction of this new software and are presenting our findings. **RESULTS:** Overall there were significant improvements following the introduction of AppGate for several measured questions. These included “log-in time”, “times teleradiology has saved a trip to hospital”, and radiologists “overall satisfaction with teleradiology”. **CONCLUSION:** The introduction of AppGate has improved teleradiology efficiency significantly. This has corresponded to positive Radiologist survey results, particularly in terms of time of log-in and overall radiologist satisfaction with teleradiology.

#### 1125 Overnight teleradiology – a novel approach to managing rising service demands at University College London Hospital

Ahmed, A. A., Steward, M. J., Taylor, M. N., Wong, K., and Brookes, J.

*University College London Hospital, London, UK*

**PURPOSE:** To assess the efficacy of outsourcing overnight CT reporting at University College London Hospital (UCLH), in an effort to meet soaring demands on radiology services, within European Working Time Directive (EWTD) constraints. **MATERIALS/METHODS:** Following the implementation of an overnight international teleradiology pilot scheme at UCLH, all outsourced reports issued over the initial 6 week period were analysed by a consultant-led team and graded for accuracy according to a five point scoring system. Low scoring reports were heavily scrutinised and discrepancies were fed back to the clinical team and reporting teleradiologist as a matter of priority. The following additional data were recorded: patient demographics, examination type, referring specialty, time of scan and time taken to

issue a report. **RESULTS:** During the initial 6 week audit period, 308 CT scans were performed, with the majority of referrals originating from the Accident and Emergency Department. An average of seven scans were performed per night, with an average reporting time of 50 min. 3 of 308 (<1%) teleradiology reports omitted a significant abnormality, but without immediate effect on patient management. There were no cases of serious misinterpretation with consequent threat to life. **CONCLUSION:** Overnight outsourcing of CT reports at UCLH is an innovative system that has proved to be effective in providing a high quality reporting service without compromising patient care. This initiative has allowed UCLH to operate a robust and fully staffed radiology department during working hours, whilst upholding the EWTD, and focus our attention towards junior doctor training and continued professional development.

#### 1135 PACSMail clinical networking

Gatley, S.  
*Sybermedica Ltd, Cambridge, UK*

We report on progress with the development and usage of PACSMail, an innovative clinical networking service that allows clinicians to collaborate via the Internet. The system has solved the problem encountered by clinicians who need to share data securely in order to collaborate in the delivery of multi-disciplinary care. Instead of assuming that they need to share the whole medical record, the system allows the creation and sharing of self-indexing messages – in a similar way to e-mail – which may also contain full diagnostic quality images (CT/MRI etc.). The system incorporates Web 2.0 technology (used to power social networking sites), allowing users to sign up and access the system within minutes. Encryption of all data ensures confidentiality. A standards-based DICOM viewer is built in allowing remote reporting in line with international teleradiology guidelines. The system is accessible on a pay-per-use basis, allowing clinicians to sign up and access the system with no capital outlay. Signing up for an account also requires no IT support, making the system an ideal medium for the development and operation of self-organising multi-disciplinary, multi-regional clinical networks. The success of the system is evidenced by the rapid uptake of the PACSMail service, especially in the area of sports medicine, where it is in regular use by both national and international clinical networks. According to one user “PACSMail has taken teleradiology to a whole new level, allowing the rapid sharing of key diagnostic information between reporting radiologists, club doctors, surgeons and physiotherapists”.

#### 1015–1145

##### A new paediatric imaging strategy

##### 1015 Paediatric imaging – what does the strategy mean for Trusts?

Shribman, S.  
*National Clinical Director for Children, England*

No abstract supplied.

##### 1045 Paediatric imaging – what does the strategy mean for patients and their carers?

Broome, K.  
*Royal Bolton Hospital, Bolton, UK*

No abstract supplied.

##### 1115 Paediatric imaging: why does it need a strategy?

Somers, J.  
*Nottingham University Hospitals NHS Trust, Nottingham, UK*

**PURPOSE:** To highlight the need for a paediatric imaging solution to support general, specialist, interventional, emergency, cancer and non-accidental imaging. **CONCLUSION:** The Department of Health for England and the Royal College of Radiologists have recognised that there is a problem in delivering high quality paediatric imaging

services in all areas. This problem has also been recognised in the USA and across Europe. High profile cases such as the baby Peter case have highlighted serious shortcomings. As a result the DH together with the British Society of Paediatric Radiology (representing the RCR) and the Society of Radiographers has produced a report that describes a network based approach to the provision of paediatric imaging services in England. It is recommended that commissioners work with the SHAs and trust to deliver this model. This talk will explore the need for the proposed model and introduce the contents to the audience.

#### 1030–1145

##### Clinical advances in 3T MRI

##### 1030 Size does matter: 3T MRI is undoubtedly better in neuroradiology

Griffiths, P.  
*Royal Hallamshire Hospital, Sheffield, UK*

No abstract supplied.

##### 1055 3T in musculoskeletal imaging

McNally, E.  
*Nuffield Orthopaedic Clinic, Oxford, UK*

No abstract supplied.

##### 1120 3T in body MRI – when and how?

Lomas, D J.  
*Addenbrooke's Hospital, Cambridge, UK*

This talk will discuss the advantages and disadvantages of using 3T MR systems for body MRI. The history and evolution of the systems will be addressed along with examples of 3T MRI clinical applications.

#### 1200–1245

##### RCR Tesla lecture

##### 1200 What's new in CT–CA?

Krestin, G.  
*Erasmus Medical Centre, Rotterdam, Netherlands*

CT coronary angiography has emerged as the most important non-invasive diagnostic tool for the assessment of coronary artery lesions. Initial limitations and safety issues have been partially solved through rapid technological developments. However, there is still no clear consensus about the role of this technology in the work-up of coronary artery disease in symptomatic patients and even less for the use of the method in screening asymptomatic patients at risk. This overview presentation will tackle some of these questions in view of the most recent technological developments and scientific results.

#### 1330–1500

##### Cardiovascular imaging of the chest: what every general radiologist should know!

##### 1330 What the non-cardiac radiologist needs to know about cardiac CT

Mittal, T.  
*Brompton Hospital, London, UK*

Cardiac CT has emerged as a powerful technique in last few years with faster multislice scanners and possibility of gating the data acquisition with patient's ECG. A non-cardiac radiologist needs to become familiar with technical aspects of cardiac CT scanning, ECG gating methods, ways of reducing radiation dose, and post-processing. It is important to understand under what clinical circumstances cardiac CT is most applicable and when it should not be performed. Finally correct interpretation of cardiac CT performed is essential so that our findings can help in the management of the patients. Understanding of common cardiac pathologies, use of other existing imaging techniques, and close working with a cardiologist go a long way in providing a clinically meaningful service.

**1400 Adult congenital heart disease**

Turner, M.

*Bristol Children's Hospital, Bristol, UK*

Due to the success of paediatric surgical programmes, there are now more adults than children living with congenital heart disease. Although these individuals should have specialist teams caring for their cardiac problems, they access general medical and surgical services in their local hospitals, so familiarity with some of the post-intervention radiological appearances are important for all radiologists. Coarctation of the aorta presents in adulthood with hypertension, but more importantly patients who have undergone previous aortic surgery can be at risk of aneurysm formation and aortobronchial fistula, which must be diagnosed in a timely way. Coarctation in adults is now usually treated percutaneously with a variety of endovascular devices, examples of which will be shown. Abnormalities of the atrial septum such as patent foramen ovale and atrial septal defect are usually treated percutaneously, and awareness of the appearance and appropriate location of these devices is important, to avoid reports such as "there is an unidentified metal object overlying the heart". More complex abnormalities of the atrial septum such as surgical baffles (and stents within them) are also a frequent occurrence. Abnormalities of the ventricular mass are also common and are now also treated percutaneously in some patients. Pulmonary vascular disease can accompany some of these abnormalities. Arterial valves are usually treated both surgically, but can also now be addressed percutaneously, including stenting, valve implantation, and even atrioventricular valves are now a target for percutaneous solutions. Pacing and implantable defibrillator usage is increasing in all cardiac patients and congenital heart disease is no different, however the lead positions may be quite surprising in these patients and a basic understanding of the congenitally abnormal cardiac anatomy is needed to determine the appropriateness of pacing lead locations. As well as recognising the underlying pathology adult congenital heart patients often have appearances that are the consequence of surgical and transcatheter intervention. Adult Congenital Heart services rely heavily on cross sectional imaging, to give both anatomical and functional information. The congenital cardiac radiologist is an absolutely crucial member of the multi-disciplinary team looking after these patients.

**1430 Imaging assessment of pulmonary hypertension**

Morrell, N.

*Papworth Hospital, Cambridge, UK*

No abstract supplied.

**1330–1500**

**Expanding breast screening services**

**1330 Breast screening – the future for the programme**

Patnick, J.

*NHS Cancer Screening Programme, Sheffield, UK*

No abstract supplied.

**1400 Breast screening expanding the service – the experience of a pilot site**

Maxwell, A.

*Royal Bolton Hospital, Bolton, UK*

The Bolton, Bury and Rochdale Breast Screening Service is one of five services piloting the staged implementation of the screening programme expansion. The purpose of the pilot was to assess the feasibility and acceptability of the randomisation of invitation of 47–49 year olds and 71–73 year olds. Screening of women aged 47–49 commenced in January 2009 and randomisation of GP batches to include either the 47–49 year olds or the 71–73 year olds commenced in June 2009. No significant issues have been encountered with the randomisation process. 4214 women aged 47–49 were invited in 2009. Attendance rate was 73% and 14 cancers were detected (4.6 per 1000 screened). 569 women aged 71–73 were invited. 60% attended

and three cancers were detected (9 per 1000 screened). There have been no significant issues with public acceptability, and only two self referrals were received from the women aged 47–49 who were not randomised to be screened. Additional staff have been recruited and screening clinic capacity has been increased by reorganising the timing of appointments and extending the working day. Additional out of hours screen reading has been introduced. Round length has been largely maintained, although screening to assessment times were an issue until an overflow assessment clinic was introduced. Alongside these changes have been the introduction of digital mammography and the expansion of the symptomatic service to meet the "two weeks for all" target. Dealing with the full screening expansion in 2012 will be another challenge.

**1430 Dorset Breast Screening Service – going digital**

Woodgate, C.

*Poole Hospital NHS Foundation Trust, Poole, UK*

In 2007 the Cancer Reform Strategy stated that the Breast Screening Programme would be extended, facilitated by the roll out of digital mammography. The ideal was to start the expansion in 2008 and be completed by 2012, with all breast screening units to have at least 1 full field digital mammography set by 2010. To meet the aims identified a business case was written, agreement from PCT and Trust Board obtained and procurement process entered into. This was then followed by an implementation process in stages. It was essential that all national and local targets be maintained in order to comply with the conditions of the NHSBSP Age Expansion Programme, during the implementation process. The speakers will describe their experience of the process from start to finish looking at the perceived successes, failures and lessons learned.

**1330–1500**

**Paediatric imaging**

**1330 Imaging the paediatric female genital tract and assessing puberty**

Allan, R.

*St George's Hospital, London, UK*

No abstract supplied.

**1400 Paediatric sports injuries**

Irwin, G.

*Royal Hospital for Sick Children, Glasgow, UK*

No abstract supplied.

**1430 Non-accidental injury**

Halliday, K.

*Nottingham University Hospital, Nottingham, UK*

**PURPOSE:** This presentation will be aimed at the non-specialist department where skeletal surveys for suspected non-accidental injury are carried out. The aim is to present an overview of the skeletal aspects of non-accidental injury. Characteristic features of common and less common fractures will be discussed. Mechanisms of injury and dating will be covered. Commonly missed injuries, mimics and normal variants will be illustrated. The importance of high quality radiography and the role of the local radiologist in relation to forensic requirements during subsequent legal proceedings will be emphasised.

**1330–1530**

**MR advances**

**1330 State of the art MRI contrast agents**

Dawson, P.

*University College London Hospitals, London, UK*

No abstract supplied.

**1400 Tensor imaging – mapping the brain, or just pretty pictures?**

Barker, G. J.  
King's College London, London, UK

Diffusion tensor imaging (DTI) data can be processed to give maps of parameters such as fractional anisotropy (FA) and mean diffusivity (MD) or mean apparent diffusion coefficient (ADC). Such maps reflect the structural integrity and coherence of the tissue being imaged. When processed using appropriate analysis procedures ("tractography"), DTI data can also produce spectacular representations of the major of white matter tracts, allowing so called "virtual *in vivo* dissection". The clinical utility of the simple diffusion weighted imaging (DWI) in stroke, where the so called "diffusion perfusion mismatch" can reveal the area potentially salvageable tissue surrounding an infarct, is clear; the value of diffusion imaging in other disorders is less clear, and the utility of more complex DTI data acquisition and processing techniques has yet to be fully proven. Are such techniques truly mapping the brain, or just providing pretty pictures? In an attempt to address this question, this talk will review acquisition and processing techniques for diffusion imaging data, including newer approaches which give quantitative results with a more direct physical interpretation.

#### 1430 Arterial spin labelling in clinical practice

Golay, X.  
University College London, London, UK

**PURPOSE:** The aim of this presentation is to show the utility of arterial spin labelling (ASL) as a method to measure quantitative and territorial perfusion in clinical practice. **MATERIALS/METHODS:** ASL uses magnetically labelled water protons as an endogenous tracer. The basic scheme in ASL consists in two subsequent acquisitions: a labelling one, during which the arterial water spins are inverted proximally to the region of interest; and a so-called control acquisition, during which the arterial water magnetization is left untouched. The difference between both images produces a signal proportional to the perfusion. **RESULTS:** ASL has some benefits over the more commonly used dynamic susceptibility contrast (DSC) perfusion method in that it is truly non-invasive and quantitative. As such, ASL can be repeated over time, *e.g.* for measuring signal changes due to functional or pharmacological challenges, and can be used in patients where the use of gadolinium chelates might be restricted, such as in children, in patients undergoing chemotherapy or with kidney insufficiency (risk of nephrogenic systemic fibrosis). Potential other neurological indications for ASL include stroke, dementia, neuro-inflammation, and neuro-oncology. In atherosclerotic diseases in particular, ASL has the possibility to provide estimates of the perfusion territories of individual arteries, which is not the case for DSC or any other method of measurement of perfusion. **CONCLUSION:** In summary, ASL provides an interesting alternative to DSC for the measurement of perfusion, and can be actually implemented in a rather easy way into any clinical protocol, only requiring an additional few minutes.

#### 1500 The role of MRI in radiotherapy treatment planning

Brunt, J. N.  
Clatterbridge Centre for Oncology, Merseyside, UK

In recent years, MRI scans have played an increasing role in Radiotherapy Treatment Planning (RTP) – our centre has used MRI, co-registered with CT, for RTP in several anatomical areas, with more than 800 brain tumour patients, and more than 200 patients with pelvic tumours, planned to date. Advantageous properties of MRI for RTP include excellent soft-tissue discrimination, with a range of tissue contrasts available by choice of MR sequence, and absence of the bony artefacts that hamper CT. Combining MR with CT can circumvent MR's disadvantage of being unable to provide electron density information, but the possibility of MR spatial distortions and artefacts can make such combination non-trivial. This talk will consider various practical aspects of optimising the role of MR in RTP, including patient positioning/immobilisation, scanning protocols, methods of co-registering CT and MR images, and quality assurance of scanning and image registration.

## 1400–1530

### Trauma II: The axial skeleton

#### 1400 Cervical Spine Injury

Harris, J.  
Salford Royal NHS Foundation Trust, Salford, United Kingdom

No abstract supplied.

#### 1430 Thoraco-lumbar spine injury

Hughes, R.  
Stoke Mandeville Hospital, Buckinghamshire, UK

The thoraco-lumbar junction (T11–L2) is a common site of spinal injury, accounting for approximately 40% of all spinal fractures. Thoracic (T1–T10) fractures account for a further 10–20% while mid/lower lumbar fractures are relatively rare. These injuries may be challenging to diagnose and classify radiographically, particularly in the acute context within the Emergency Department. Advanced imaging modalities (CT, MRI) are very useful in assessing the extent of bony injury and associated damage to the spinal cord/conus and in guiding further management. In this presentation, we will review normal variants mimicking thoraco-lumbar fractures. The concept of spinal stability will be reviewed with reference to common fracture patterns and classification schemes. This will focus on the "3-column" concept which is particularly useful around the thoraco-lumbar junction. Thoracic fracture patterns will be separately considered with case examples. The respective roles of radiographs, CT and MRI will be covered during the talk. We will also briefly consider MRI assessment of acute injury to the spinal cord and conus.

#### 1500 Trauma to the pelvis

Ahmad, M.  
Barts and the London NHS Trust, London, UK

**PURPOSE:** Bony trauma to the pelvis is common in high impact blunt injuries. Injuries that involve the pelvic ring have a high morbidity and significant mortality. The lecture will review the anatomy of the bony pelvis and pelvic contents. The common fracture patterns seen in pelvic trauma will be described. The different imaging modalities used to assess pelvic trauma will also be reviewed. Brief discussion of the main areas to review on imaging and what the orthopaedic surgeon wants to know will be covered.

## 1400–1530

### Fundamentals of Computerised Radiography (CR)

#### 1400 The basics of the digital image and CR

Doyle, P.  
Forster Green Hospital, Belfast, UK

No abstract supplied.

#### 1430 Radiography practice with CR

Jones, T.  
Swansea NHS Trust, Swansea, UK

**PURPOSE:** The change from conventional film to CR was not simply a change in materials. It also involved a shift in the examination process as a whole. The examination now starts well before a radiographer meets the patient. This is not a talk aimed at explaining how CR works, but rather a view on how CR should be utilised from a radiographer's perspective. **OUTCOME:** By understanding the workflow of the radiographic exposure using CR and then applying this awareness the radiographer will have an appreciation of the examination as a whole whilst identifying the common errors that can be found at the various stages.

#### 1500 Resolving your CR (and DR) issues: questions and discussion

Oakley, J.

No abstract supplied.

## 1530–1700

### Emerging technology in cardiac CT

#### 1530 Purchasing a cardiac CT scanner: what the radiologist needs to know

Lewis, M.

St George's Hospital, London, UK

Imaging of the coronary arteries presents a challenge to CT technology, requiring fast volume coverage, and high spatial and temporal resolution. It can also be associated with a high radiation dose. The first few years of this century saw the era of the "slice wars" in CT, with all manufacturers eventually offering true 64 detector-row scanners. Increasing z-axis coverage and faster gantry rotation times have resulted in improvements in sensitivity and specificity for coronary CT angiography (CCTA) and lead to the acceptance of CT as a modality for diagnosing coronary artery stenoses. The paths taken by manufacturers in technological developments have now diverged, making comparison of systems less straightforward. One route is to continue increasing the number of detector rows, ultimately allowing whole organ imaging in a single rotation. Another direction is towards high, heart-rate independent temporal resolution, using dual-source technology to "freeze" cardiac motion more effectively. A third path is the development of a detector material with a faster response time, with higher sampling rates for improved spatial resolution, as well as reconstruction algorithms with improved dose efficiency. All manufacturers are driving down radiation doses in CCTA using a variety of techniques, and doses are now lower than for standard abdomen examinations. Developments continue in dual-energy CT for improved tissue differentiation. Functional cardiac CT imaging is another area of progress, potentially leading to CT becoming a "one-stop shop" for investigations of coronary disease. Recent technological developments in CT will be presented and their implications on cardiac imaging discussed.

#### 1600 Low dose cardiac CT: is it a clinical reality?

Roobottom, C.

Derriford Hospital NHS Trust, Plymouth, UK

Cardiac CT angiography has traditionally been viewed as a high dose examination. However, there have been significant advances in technique and equipment that have seen massive dose reductions. Five years ago a typical DLP for a cardiac CT would be 1800, now in our institution DLPs below 100 are commonplace. The following techniques will be discussed: Patient specific protocols; The use of aggressive prospective gating; The use low low kV techniques; The value of iterative reconstruction techniques. At the end of the presentation the audience will be made aware of the importance of dose reduction and how to achieve it in routine clinical practice.

#### 1630 Mega-slice CT promises anatomy and function – has it delivered?

Bull, R.

Royal Bournemouth Hospital, Bournemouth, UK

Since the turn of the century, CT detector width has progressively increased from 4 to 16 and then to 64-detector technology. These machines remain the "workhorses" of most radiology departments. With conventional multislice technology, images of the heart and coronary arteries have to be built up from multiple rotations acquired over multiple heart beats (using either prospective or retrospective techniques). Although good images can be obtained in many patients, there can be problems with relatively high radiation doses and also issues with the robustness of the technique with "step" artefacts commonly seen. This is a particular problem in patients with multiple ectopic beats or irregular heart rhythms (e.g. AF). Toshiba introduced the Aquilion One CT system in 2007. This has an ultra-wide detector width of 320 × 0.5 mm, and has the first "mega-slice" detector which

is wide enough to cover the entire heart in a single rotation in a single heart-beat with no need for patient motion during the scan. The ability to acquire a complete isophasic dataset of the entire heart and coronary arteries in a single rotation allows very low dose robust anatomical imaging to be performed in all patients, regardless of heart rhythm. Unlike single and multiple tube 64-detector systems, this single beat prospective technique allows reliably excellent results at low dose to be obtained in atrial fibrillation which has conventionally been considered a contraindication to cardiac CT. The Aquilion One's ultra-wide detector also allows for functional data to be acquired throughout the entire cardiac cycle in a single heart beat. As this is a prospective technique, this allows functional assessment of cardiac and valvular function with no "step" artefacts and at low radiation dose without the substantial oversampling inherent in retrospective spiral techniques. The major impact of this mega-slice technology has been on the speed and ease of our cardiac scanning due to the simplicity and robustness of the system. All 16 of our radiographers are now able to scan cardiac cases as quickly and easily as any other part of the body. We are now able to provide reliably excellent low-dose images in a 15 min time slot, which has led to a huge increase in patient throughput and has allowed us to cope with a 10-fold increase in demand for cardiac CT within a "general" CT department. Since purchase of the Aquilion ONE system in April 2009, our cardiac CT service has grown from rather a "niche" service into one of the largest services in the UK.

## 1530–1650

### The National Breast Screening Programme and PACS keynote & scientific session

#### 1530 National Breast Screening into PACS: where are we?

Sellers, S.

NHS Cancer Screening Programme, UK

In December 2007 the Cancer Reform Strategy (CRS) [1] was published. This set out the future expansions of the service and reinforces the government's commitment to the breast screening programme. When this expansion is fully implemented it is expected that an additional 400,000 women will be invited for screening. Alongside expansion to the age range, there was also an expectation in the CRS that high priority should be given to moving from film based screening systems to digital as this would provide opportunities for improving the workflow and increasing the services capacity. Workflow improvements, and other efficiencies, can only be achieved when systems are completely digital and fully integrated with PACS. It was expected that the existing PACS infrastructure would be utilised [2, 3]. This presentation will provide an update on the work being done nationally to enable screening programmes to link digital systems used in the breast screening to PACS. REFERENCES: 1. Cancer Reform Strategy; Department of Health; page 47; December 2007. 2. NHS Breast Screening Programme; Achieving the Cancer Reform Strategy commitments; Advice to the NHS; January 2009. 3. The Operating Framework for 2010–2011 for the NHS in England; DH; December 2009.

#### 1600 The impact of breast compression on mammographic image quality: initial findings

Mercer, C. E.<sup>1</sup>, Hogg, P.<sup>2</sup>, and Diffey, J.<sup>3</sup>

<sup>1</sup>Royal Bolton Hospital, Bolton, UK, <sup>2</sup>University of Salford, Salford, UK, <sup>3</sup>Christie Hospital, Manchester, UK

PURPOSE: As part of mammography, compression is applied to reduce breast thickness. It is considered that compression reduces radiation dose and improves image quality. No guidelines exist on how much pressure should be applied for different breast types and volumes, consequently for "similar patients" there is variation in imaging practice. This research seeks to establish whether any relationship exists between compression and image quality. Other significant factors are also considered. MATERIALS/METHODS: Ethical approval was given to assess 2000 mammographic images (500 patients). Image quality analysis was determined by "NHSBSP Image

Assessment Tool" (IAT). The following parameters were recorded: applied pressure (Newtons); breast type; radiation dose, breast thickness, breast volume. Pilot study assessed IAT operator variability. Inferential statistical tests (*e.g.* ANOVA, *t*-test, regression) were applied to the data. RESULTS: Pilot study found good correlation between five film readers using the IAT; on this basis one reader was selected to continue performing quality analysis of the remaining 2000 images. 200 of the 2000 images have been analysed so far (initial findings). Analysis reveals no relationship between breast compression values and image quality score in all density categories; Pearson Correlation of 0.509, -0.230, -0.096 and -0.198. CONCLUSION: Initial findings (200 images) suggest no correlation between breast compression and image quality above a certain applied pressure. We intend to complete the analysis of the 2000 images and present our final results in this paper.

#### 1610 Breast cancer risk prediction using breast composition measured at mammography

Kotre, J.<sup>1</sup>, Leaver, A.<sup>2</sup>, Kaye, B.<sup>2</sup>, McLean, L.<sup>2</sup>, and Pearce, M.<sup>3</sup>  
<sup>1</sup>Freeman Hospital, Newcastle-upon-Tyne, UK, <sup>2</sup>Royal Victoria Infirmary, Newcastle-upon-Tyne, UK, <sup>3</sup>University of Newcastle-upon-Tyne, Newcastle-upon-Tyne, UK

PURPOSE: Visual gradings of breast density at mammography are known to be linked with the risk of subsequent breast cancer. In this study a quantitative measure of breast composition measured at mammography is used as a risk predictor. MATERIALS/METHODS: Three breast screening mammography units were calibrated to measure thickness of glandular and adipose tissue traversed by the X-ray beam using methods previously described. A retrospective study was carried out in which the glandular thickness was extracted from the mammograms of 148 cancer cases and a set of matched controls. The values were compared with a normal population of 13,000 results to allow the calculation of a normalised Z-score matched to age and breast thickness. RESULTS: The initial findings show a consistent elevation of the Z-score for women who were subsequently diagnosed with breast cancer. CONCLUSION: Breast composition measures derived from film-screen and digital mammograms show promise for the identification of higher risk individuals in the breast screening population.

#### 1620 Missed breast cancers: how tired is your radiologist?

Kumar, A.<sup>1</sup>, Gurujala, R.<sup>1</sup>, Anosike, C.<sup>1</sup>, Williams, A.<sup>1</sup>, Weller, D.<sup>1</sup>, Ravi, R.<sup>1</sup>, Penn, G.<sup>2</sup>, Meacock, D.<sup>1</sup>, and Yeang, H. A.<sup>1</sup>  
<sup>1</sup>Arrowe Park Hospital, Wirral, UK, <sup>2</sup>Clatterbridge Hospital, Wirral, UK

PURPOSE: Studies estimate that 10–32% of breast cancers are overlooked in mammograms. One of the important causes of missed breast cancer (including perception and interpretation errors) is caused by fatigue and loss of concentration. The purpose of this study is to investigate errors caused by fatigue and loss of concentration. There is a possibility that the likelihood of fatigue increases with the duration of a reporting session and therefore these errors are more likely to occur towards the end of the mammography roller viewer. MATERIALS/METHODS: We conducted a retrospective study on interval breast cancers from a 2-year period which identified 90 histopathologically proven breast cancers. Each missed cancer was assigned into one of three categories on retrospective radiological review as defined by the NHS Breast Screening Programme: Category 1: Normal/benign; Category 2: Uncertain; Category 3: Suspicious. Each case was then analysed further to correlate the Interval Categories with their position on the mammography roller viewer (1–100). RESULTS: Of the 90 missed cancers, 51 (56%) were Category 1, 14 (16%) were Category 2 and 17 (18%) were Category 3. Further analyses revealed the presence of clinical significance between Category 3 cases and their position in the mammography roller viewer. CONCLUSION: Fatigue is an important factor responsible for missing breast cancer. The recommendation from this initial study is that it may be prudent for breast screening mammograms to be first read forwards

from the start of a session and second read backwards from the end of a session.

#### 1630 Pathological correlation of MRI-visible only breast lesions undergoing MRI guided vacuum assisted biopsies

Ng, F., Bhattacharyya, M., O'Brien, J., and Teh, W.  
 Northwick Park Hospital, Harrow, UK

PURPOSE: To correlate pathological outcomes of MRI vacuum biopsies on MRI visible only breast lesions. MATERIALS/METHODS: Retrospective analysis of 163 patients referred for MRI guided vacuum biopsies of impalpable breast lesions visible only on MRI. All patients had a minimum follow up period of 11 months. MRI biopsies were undertaken on a 1.5T magnet using a minimum of 12 passes vacuum assisted biopsies. The pathological findings including surgical outcomes were correlated against BI-RADS appearances and time-enhancement characteristic of the lesions and against the clinical indications for MRI examination. RESULTS: A total of 155 vacuum biopsies were undertaken. Forty nine were malignant (31.6%) of which 69.4% of masses and 30.6% non-masses. Only 2 malignant lesions had a Type 1 curve (8%) compared with malignant lesions with Type 2 (27.4%) and Type 3 curves (50%). All of the malignant lesions with Type 1 curve had a suspicious morphology. Malignant outcomes were higher in patients with known or previous breast cancers (49.2%) than women being screened for breast cancer (18.8%). Non-malignant lesions with Type 3 enhancement included lymph nodes, fibroadenomatoid hyperplasia, papillary lesions, fibrocystic change and lobular neoplasia. CONCLUSION: Evaluation of the lesion morphology and time-enhancement curve can be used to develop an algorithm to help direct appropriate biopsy of MRI detected lesions. We recommend that in the absence of suspicious morphology, only lesions with Type 2 and Type 3 curves should be subjected to MRI guided biopsy.

#### 1640 Precise removal of breast microcalcification with minimal samples using direct frontal biopsy needle (Spirotome)

Harries, R.  
 Northern Lincolnshire and Goole Hospitals NHS Foundation Trust, Grimsby, UK

PURPOSE: Guidelines for microcalcification assessment propose the use of vacuum assisted biopsy instead of stereotactic core biopsy, which are considered inappropriate because of the small tissue samples. Even with macrobiopsies at least six samples are required for optimal sensitivity, requiring 360° sampling to ensure the microcalcification is sampled adequately. Some clinicians take more than 20 biopsies. Increasing the number of biopsies can limit breast conservation surgery in up to 30% of cases due to difficulty in assessing free margins because of disruption of local architecture. In addition, haematoma formation may disperse cells to larger volumes and can cause clip migration. Haematomas can be troublesome requiring readmission and evacuation. To reduce the number of macrobiopsies without decreasing sensitivity, direct frontal systems have been developed. Samples are taken at the tip of the device under stereotactic guidance allowing accurate positioning and minimising the number of samples. MATERIALS/METHODS: 45 patients had breast microcalcification biopsied using the Spirotome needle over 22 months. Patients completed a simple acceptability questionnaire after the procedure. RESULTS: Microcalcification was successfully removed in 44 (98%) with an average of less than 4 samples per patient. 82% had 4 samples or less and none had more than 6. There were no haematoma complications and 93% yielded a clear histological diagnosis. Patients rated their experience on a scale of 1:5 as 2.4 for "fear", 2.2 for "pain" and 3.0 for "overall experience". CONCLUSION: Direct frontal biopsy using the Spirotome needle successfully removes microcalcification with high sensitivity, minimal complications and good patient acceptance.

#### 1650 The expanding role of digital tomosynthesis: the clinical benefits and challenges

Eckloff, K. and Phillips, S.



Digital tomosynthesis (DTS) is a technique that has demonstrated the potential to modify service delivery in several areas within the radiology department. As an emerging technology, users are developing imaging strategies in which DTS can be used to benefit patients. **KEY LEARNING OBJECTIVES:** 1. Describe the technique of DTS. 2. Illustrate the clinical application of DTS. 3. Compare the doses from DTS with other imaging investigations. 4. Demonstrate where DTS is utilised to modify patient pathways. **DESCRIPTION:** DTS is an X-ray technique, which removes overlying structures providing superior anatomical detail. The technique has been used for a variety of applications in the radiology department. The applications have been analysed and compared with both conventional and specialised imaging. **CONCLUSION:** DTS has been utilised for imaging the chest, urinary system and musculoskeletal problems. DTS has the potential to benefit both the patients and the workload of the department by saving imaging time and preventing further imaging investigations.

### 1530–1630

#### Paediatrics

##### 1530 Paediatric central nervous system tumours: early presenting features, pathways for imaging and follow-up

Dineen, R.

Nottingham University Hospital, Nottingham, UK

No abstract supplied.

##### 1600 Investigating the child with developmental delay

Stoodley, N.

Frenchay Hospital, Bristol, UK

Developmental delay encompasses a wide variety of presenting features. The affected developmental domains are varied as is the degree to which individuals may be affected. Unsurprisingly the range of neuroimaging abnormalities seen in cases of developmental delay is wide and often non-specific. This presentation will discuss indications for imaging in this group of patients and highlight the important imaging aspects of the most important subgroups through analysing a systematic approach to image interpretation.

### 1600–1730

#### Trauma III: Imaging in major trauma

##### 1600 7/7 bombings: managing a major incident

Power, N.

Barts and the London NHS Trust, London, UK

Managing the London Bombings: The London transport bombings of July 2005 were a true major incident and tested fully the capacity and coping skills of all the hospitals and radiology departments involved. This talk will highlight the impact of this mass casualty event on the radiology department of the Royal London Hospital. The strategies in place in advance will be listed as well as a discussion of the successful measures, the expected and unexpected problems encountered and most importantly the lessons learned and changes to practice instituted. The ultimate goal of the talk is to increase the preparedness of the audience for dealing with a major incident at local level.

##### 1630 CT evaluation of the bleeding trauma patient

Sampson, M.

Southampton General Hospital, Southampton, UK

No abstract supplied.

##### 1700 Bleeding cessation in trauma: urgent interventions

Nicholson, T.

Leeds General Infirmary, Leeds, UK

No abstract submitted.

### 1600–1645

#### CoR Welbeck Memorial lecture

##### 1600 Bash, bash, bash (it almost fits perfectly now)

Hogg, P.

Salford University, Salford, UK

We are indeed privileged because within our well-funded healthcare system there is opportunity to purchase high specification leading edge medical imaging technologies. We find ourselves lured into these technologies by good marketing strategies that highlight the improvements in patient management and care that they can bring. Consequently many of our imaging departments boast a broad range of advanced imaging solutions. Aside the often hilarious physical fitting of ever larger technologies into small hospital spaces there is the serious side of needing to change the way we think and the way we work, and it is here that our important challenges lie. Examples of the challenges include: the potential initial lack of quality published evidence on which to base practice; the changes to patient pathways, including the consequences of accelerated diagnosis; the controversy surrounding incidental detection of pathology on image data “that was never intended for diagnostic imaging purposes”; the potential for “spiralling” patient radiation burdens; the increased volumes of image data to analyse and interpret; and the clash of cultures and Regulation when different technologies are brought together in hybrid environments. As advanced imaging technologies are introduced, basic and advanced competencies for all professional groups need to be defined and redefined. For instance, for many years we have observed radiographers roles expand into areas of other professionals, most notably the medical profession. Now hybrid systems which involve CT have given the potential for others to extend their professional responsibility into that of radiography; this has been the focus of significant debate in the USA, Canada and other countries. CT aside, the combination of two imaging modalities into one image dataset acquired during one session has added significantly to the complexity of interpretation and diagnosis. Multimodality image fusion requires an analytical understanding of pathology, patho-physiology, anatomy and physiology as well as an understanding of the physical principles of image formation for each modality. Such advances in imaging technology have challenged the medical, scientific and radiographic communities and as a cohesive team we need to rise and meet the challenges that are set. This talk will identify and explore some of the challenges faced by the introduction of advanced imaging technologies. Where possible solutions will be suggested; albeit in some cases problems will only be raised as it might be that no solution, as yet, exists.

### 1645–1715

#### Service delivery scientific session I

##### 1645 Impact of a clinical governance programme on reporting standards in MRI: findings of the national service in outsourced MRI

Golding, S. J.<sup>1</sup>, Webster, P.<sup>2</sup>, and Dixon, A. K.<sup>3</sup>

<sup>1</sup>University of Oxford, Oxford, UK, <sup>2</sup>Department of Health, London, UK, <sup>3</sup>University of Cambridge, Cambridge, UK

**PURPOSE:** To evaluate the impact on the clinical performance of radiologists from an extensive clinical governance programme carried on a national contract of outsourced MRI examinations over a 5-year period. **MATERIALS/METHODS:** 386,567 MRI examinations carried out for brain, spine and musculoskeletal applications underwent a clinical governance programme consisting of independent double reading of cases with monitoring of discrepancies, supplemented over 3 years by an annual independent audit lead by the Department of Health Clinical Guardian. All examinations were evaluated on a five point scale for each of technical quality, language of the report and quality of the clinical opinion. The discrepancy monitoring used a similar scoring scheme. Findings were regularly fed back to reporters. **RESULTS:** There were consistently acceptable scores for reporting standards throughout the programme; the incidence of minimal scores



never exceeded 0.04% and maximal scores were seen for technical quality and language of report in more than 90% of cases. Some movement was observed between score levels, attributable to the effects of the programme. In particular, scores for quality of language of report showed a 14.5% increase over the period. Clinical Guardian audit showed increases over 3 years of 11.7%, 24.0% and 25.6% for scores in technical quality, language and clinical opinion, respectively. CONCLUSION: Audit of MRI on a national scale is both practicable and robust. The clinical governance programme reassures purchasers and users of the quality of the service and has a significant enhancing impact on the performance of clinical reporting.

#### 1655 Using audit data to improve reporting precision and demonstrate performance development

Preece, R. and Seear, T.

*4 Ways Healthcare, Hemel Hempstead, UK*

PURPOSE: To demonstrate the impact of continual audit on reporting precision and radiologist performance. METHODS: Radiologist reporting was independently audited by colleagues with the relevant sub-specialty interest and expertise. A 10% sample of all reporting was randomly selected on a weekly basis. Clinically relevant discrepancies were discussed as they arose between the auditor and reporter. All results were feedback to reporting radiologists on a monthly basis and key audit findings and interesting cases discussed at quarterly discrepancy meetings. To monitor trends discrepancy rates were collated each quarter to make sure that rates were based on a large number of audited cases and minimise fluctuations due to low numbers. RESULTS: Seven radiologists had more than 200 reports audited providing trend data for periods up to 3 years. A further six radiologists had more than 100 reports audited and provide additional trend data. The audit data show rapid improvements in reporting precision in the first quarter of audit followed by sustained improvement with reporting precision as audit feedback continued. There were marked reductions in non-clinical discrepancies (*e.g.* typographical errors). The overall clinical discrepancy rates were in

any case low, but there was still a clear trend to improved precision. CONCLUSION: Continual audit with feedback to radiologists reduces discrepancy rates and improves clinical performance. To our knowledge this is the first time that the compelling evidence of the positive impact of audit on radiologist performance has been demonstrated in the UK.

#### 1705 MRI in metastatic spinal cord compression

Bano, F., Joseph, F., Nakhuda, Y., and Kelly, G.  
*Royal Blackburn Hospital, Blackburn, UK*

PURPOSE: Audit based on NICE guidelines 2008. To audit key times in initial management, including from symptom presentation to admission and admission to steroids and MRI scan and referral to neurosurgery or oncology. METHODS: Done retrospectively. Names of patients who had an MRI in last 4 months collected from radiology department. 25 case notes obtained and data collected. RESULTS: Out of 25 patients of suspected spinal cord compression, 9 were diagnosed to have SCC out of which 8 had metastatic cord compression and 1 secondary to trauma. Time from symptom onset to referral to neurosurgery was between 1 and 5 days, mean 2 days. Time from request of MRI to MRI carried out ranged from 1 h to more than 48 h, mean 12–24 h. Time from symptom onset to MRI from 12 h to more than 6 weeks, mean 7 days. Time from admission to MRI from 1 h to 3 days, mean 12–24 h. Only 8 patients were given steroids. Time from admission to steroids 1–3 days, mean 2 days. CONCLUSION: Time from symptom onset to referral, MRI scan, starting steroids and definitive treatment are all too long. Recording of time scales is poor. RECOMMENDATIONS: The Neuroradiology need to review its SCC imaging service according to volume of referrals and NICE recommendations. Improved patient education and need for early hospital admission. Development of a referral protocol/guideline for medical and surgical specialities and distribution of this to the relevant Hospitals including steroid management advice. Proforma to ensure the accurate recording of key times.

# Scientific programme abstracts Tuesday 8 June

## 0830–0930

### Body MRI school: Hepatobiliary

#### 0830 Imaging the biliary tree and pancreas

Amin, Z.

*University College London Hospital, London, UK*

No abstract supplied.

#### 0900 Imaging the liver on MR

Koh, D.

*Royal Marsden Hospital, Sutton, UK*

MRI of the liver is now part of the routine diagnostic workflow for the detection and characterization of focal liver lesions. Prior to contrast administration, in and out of phase  $T_1$  imaging; as well as  $T_2$  weighted imaging (dual echo time) are useful. Contrast enhanced MRI is then usually undertaken. Low molecular weight gadolinium contrast media are still the most widely used for disease assessment and lesion characterisation is based upon the rate and pattern of lesion contrast enhancement. However, liver specific contrast media and hepatocyte selective contrast media can add confidence towards disease detection and characterisation. New functional techniques such as diffusion-weighted MRI, perfusion MRI, MR spectroscopy and MR elastography are showing substantial potential for improving the evaluation of diffuse and focal liver diseases.

## 0830–0930

### Imaging for low back pain

#### 0830 The investigation of low back pain

Teh, J.

*Nuffield Orthopaedic Hospital, Oxford, UK*

Nearly half the adult population in the UK suffers from back pain lasting at least 24 h at some time every year. The impact of back pain on society is considerable and is associated with an enormous economic burden. Low back pain most commonly affects the 30–50 year age group, with the prevalence peaking during the sixth decade. Young people are more likely to have brief, acute episodes of back pain, whilst chronic pain tends to occur in older people. There is an equal sex distribution. There are many causes of back pain with a complex inter-relationship between anatomical, pathological and psychological factors leading to the eventual clinical presentation. A careful history and physical examination remains the mainstay of assessment of back pain. Imaging is not necessary in most cases of back pain because of the high rate of spontaneous remission within 6–8 weeks. Furthermore, the use of early imaging does not appear to alter management in most patients. There are however certain features or “red flags”, that should suggest serious pathology and prompt early imaging. The Royal College of Radiologists has drawn up guidelines for the investigation of back pain. The application of these recommendations will depend on many factors including local expertise, financial resources and availability of MRI. It is recognised that plain radiographic evaluation of back pain in the absence of trauma is of limited value. Broadly speaking there are four main clinical scenarios: Acute non-specific back pain, which usually resolves spontaneously within 6–8 weeks. Chronic back pain without sinister features, which is usually related to degenerative disease. Back pain with sciatica. A condition usually caused by disc prolapse. Possible serious pathology or cauda equina syndrome. This group encompasses various conditions such as tumour, infection and inflammatory disorders. Of these conditions, the first two do not usually warrant imaging. In patients suffering from sciatica, the cause is usually a prolapsed disc, and those who have had a failed period of conservative therapy may require imaging. In patients with possible serious pathology, urgent specialist referral and MRI are both indicated.

#### 0840 Imaging of spondyloarthropathy and spinal infection

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Teh, J.

*Nuffield Orthopaedic Hospital, Oxford, UK*

**INFECTION:** Spondylodiscitis accounts for up to 4% of cases of osteomyelitis. The well vascularised endplates are often the starting point for haematogenous infections. Spread occurs into the adjacent disc, vertebra and soft tissues. Pathogens that produce proteolytic enzymes, such as *S. Aureus*, spread rapidly into the disc. Pathogens such as *M. tuberculosis* that do not produce proteolytic enzymes tend to spread more slowly, often sparing the disc until late in the disease process. Imaging allows confirmation of spondylodiscitis and helps guide biopsy. MRI provides the highest sensitivity and specificity. In the acute phase of infection, there may be little or no radiographic abnormality. With spread into the disc, there is rapid diminution of disc space, with loss of definition of the vertebral endplates, followed by progressive vertebral destruction. On MRI, the findings include low  $T_1$  signal in the disc and adjacent vertebral bodies, with poor delineation of the disc-endplate interface. Typically, the affected portions of the vertebrae and disc will enhance. On corresponding  $T_2$  weighted/STIR images there is increased signal within the disc and adjacent endplates. Abscesses and phlegmons appear as extradural masses, which are hyper-intense on  $T_2$  weighted/STIR sequences. The late sequelae of spondylodiscitis include vertebral collapse, kyphoscoliosis and interbody fusion. With TB, disc involvement is limited compared with vertebral body involvement. Large paravertebral abscesses may develop, which appear disproportionate to the degree of vertebral body involvement. Bony destruction may lead to vertebral collapse and a gibbus deformity. Seronegative spondyloarthropathy: The seronegative spondyloarthropathies are a group of multisystem inflammatory conditions linked by a variety of genetic, clinical and radiological features. Included are ankylosing spondylitis (AS), inflammatory bowel disease, psoriatic arthritis, Reiter's syndrome and reactive arthritis. Although plain radiographs are often the first line of imaging investigation, they are insensitive for demonstrating the early changes of enthesopathy and sacroiliitis. MRI is the best modality for evaluating spondyloarthropathy. The upper two-thirds of the sacroiliac joint is fibrous and the inferior third is synovial. The synovial part of the joint develops erosions earlier than the upper fibrous part but the whole joint is eventually involved. The imaging features of AS in the thoracolumbar spine arise due to enthesitis. The spine is particularly affected at the discovertebral junction, the apophyseal joints, the costovertebral joints, the posterior ligament attachments and the atlantoaxial articulation. Erosions at the superior and inferior margins of the vertebral bodies occur at the site of attachment of the anterior longitudinal ligament (Romanus lesions). In the early active phase on MRI they are high on  $T_2$  weighted/STIR. Erosions may occur at the discovertebral junction (Andersson lesions). The fused spine is at risk of fracturing with minimal trauma. CT is useful in the context of trauma.

#### 0900 Imaging of vertebral collapse and pars defects

Toms, A. P.

*Norfolk and Norwich University Hospital, Norwich, UK*

No abstract supplied.

## 0830–0920

### Chest and cardiac scientific session

#### 0830 MDCT vs TOE for the assessment of aortic annulus dimension in transcatheter aortic valve implantation

Kaneria, S. S., Ariff, B. B., Sen, S., Mikhail, G. W., Wright, A. R., Hamady, M., Sutaria, N., and Juli, C. F.

*Imperial College Healthcare NHS Trust, London, UK*

**PURPOSE:** Transcatheter aortic valve implantation (TAVI) represents an alternative treatment for patients with severe symptomatic aortic stenosis considered high risk for conventional surgery. TAVI

case selection requires confirmation of a tricuspid aortic valve and accurate measurement of the aortic annulus (AA) dimension. Transoesophageal echocardiography (TOE) is the standard for this assessment, but is not without risks and only assesses the sagittal AA dimension. Multi-detector computed tomography (CT) provides detailed information about AA shape, calcification and relationship to coronary artery ostia, all of which affect patient selection. We evaluated the correlation between annular dimensions obtained from CT with TOE. MATERIALS/METHODS: 52 patients (28 female, median age 82, range 61–94 years) referred for TAVI underwent CT (Brilliance 64-slice, Philips Medical Systems) and 2D TOE. CT sagittal (CTS) and coronal (CTC) AA views were reconstructed using the Philips workstation (Version 2.1, Phillips Medical Systems). Data were analysed using Wilcoxon signed rank test. RESULTS: There was no significant difference between the sagittal AA diameter measured with CT or TOE (mean difference 0.4 mm (95% CI -0.04, 0.93)  $p=0.07$ ). CTC measurements were significantly larger than TOE (mean difference 2.1 mm (95% CI 1.56, 2.68)  $p < 0.0001$ ). Both CT and TOE identified 2 bicuspid valve cases. CONCLUSION: CT is an alternative to TOE in the assessment of AA dimension for TAVI. CT provides a comprehensive assessment of the AA, providing sagittal and coronal dimension, visualisation of annular calcification and valve morphology and aids procedural planning with peripheral vascular assessment in a single study.

#### 0840 Reperfusion haemorrhage – the downside of primary angioplasty

O'Regan, D. P., Ariff, B., Durighel, G., Hajnal, J. V., and Cook, S. A.  
*Imperial College, London, UK*

PURPOSE: Post-ischæmic reperfusion may have a profound effect on the extent of myocardial microvascular obstruction (MVO). Myocardial haemorrhage is a validated marker for severe ischaemia-reperfusion injury which can now be accurately mapped with  $T_2^*$  cardiac magnetic resonance (CMR) imaging. The present study aimed to examine whether the region of myocardial no-reflow showed evidence of reperfusion injury following primary coronary intervention (PCI). MATERIALS/METHODS: The study population consisted of 50 patients with acute ST-elevation myocardial infarction (STEMI) who had received PCI to the culprit coronary artery. Each subject had infarct characterization and assessment of left ventricular function using CMR. Haemorrhage was detected with  $T_2^*$  mapping and compared with the extent of necrosis and MVO on both early and delayed contrast-enhanced sequences. RESULTS: MVO was present in 29 (58%) patients. The regions of haemorrhage and MVO were consistently co-localised to the same areas of myocardium. The area of haemorrhage showed a strong correlation to the corresponding area of late MVO ( $r^2=0.87$ ,  $p<0.001$ ), but a weaker correlation with the larger area of early MVO ( $r^2=0.30$ ,  $p<0.003$ ). Total infarct volume was significantly greater when haemorrhage was present ( $25.9\pm 8.5$  vs  $12.7\pm 5.6$ ,  $p<0.01$ ), as were the end diastolic volume index (EDVI;  $80.5\pm 22.2$  vs  $63.3\pm 11.3$ ,  $p<0.01$ ) and end systolic volume index (ESVI;  $45.4\pm 23.1$  vs  $27.9\pm 9.0$ ,  $p<0.01$ ). CONCLUSION: Haemorrhagic ischaemia-reperfusion injury occurs in the majority of patients following PCI and is co-localised to myocardium with microvascular obstruction. No-reflow may therefore represent a potentially avoidable reperfusion injury.

#### 0850 A review of CTPA as imaging modality of choice for suspected PE with respect to age

Deshpande, A., Fung, R., Jepson, S., and Entwisle, J.  
*University Hospitals of Leicester, Leicester, UK*

PURPOSE: BTS guidelines do not have age as part of the criteria for modality selection in patients with suspected PA. Hypothesis is that the increased risk of increased radiation dose of CTPA over VQ scan is offset by higher pick up rate of significant incidental findings. Positive alternative diagnosis for patients' chest symptoms is more likely to be made in an older age group. Indeterminate rate for VQ scan is likely to be higher in an older population. MATERIALS/METHODS: CXR and CTPA reports of 310 patients obtained retrospectively from RIS,

from April to May 2009. RESULTS: 256 (82.5%) had CXR prior to CTPA. Abnormal CXR reported in 124 (48.4%), normal in 132 (51.5%). Patients grouped as  $< 50$  (76), 50–70 (95),  $> 70$  (139). PE diagnosed in 6 in the  $< 50$  group (7.8%), 27 in 50–70 (28.4%) group, 27 in  $> 70$  group (19.4%). Alternative diagnosis to explain symptoms in negative CTPA included infection, heart failure etc. 31 patients had alternative diagnosis in  $< 50$  group (44.2%), 32 in 50–70 group (47%), 51 in  $> 70$  group (45.5%). Significant findings in patients with negative CTPA, included newly diagnosed cancer, ILD, heart failure not diagnosed on CXR and TB. There were 7.14% in the  $< 50$  group, 13.3% in 50–70 group, 18.8% in  $> 70$  age group. 6 patients  $> 50$  had incidental nodule. Results show that CTPA pickup of incidental significant findings is higher in the older age bracket (7.1% in  $< 50$  group vs 18.8% in  $> 70$  group). CONCLUSION: We recommend CTPA as routine investigation over 50 (even if suitable for Q scan) for suspected PE. Perfusion scan should be first line investigation under 50 unless contra indication.

#### 0900 Review of indications for CT chest referrals from primary health care physicians and to propose guidelines

Deshpande, A. and Entwisle, J.  
*University Hospitals of Leicester, Leicester, UK*

PURPOSE: Assess indications for CT chest referrals from primary health care physicians and to propose guidelines. MATERIALS/METHODS: Retrospective study. Patients were identified from RIS system from 05/2004 to 04/2009. Demographics, CXR report, CT result and outcome were obtained. RESULTS: 271 patients. 147 (m), 124 (f). 215 (79.3%) patients had CXR prior to CT thorax. 56 (20%) had no CXR prior to CT. 7 (2.5%) CXR were reported normal. CT was performed on the basis of chest radiograph in the following categories: bulky hila (24), ILD (40), bronchiectasis (22), TB (7) and to exclude cancer (39). CT thorax prevented referral in 127 cases (46.8%). Significant findings were found in 114 (42%), including cancer 12, TB 1, ILD 31, bronchiectasis 23, PE 1, lung metastases in 2. 24 patients were referred to lung MDT, 27 referred to respiratory physician, 1 admitted with PE. Incidental significant findings resulting in referrals were 8 (including descending thoracic aortic aneurysm, left atrial tumour, schwannoma, anterior mediastinal mass). Findings were considered minimal (e.g. pleural plaques, atelectasis, emphysema) in 113 (41.6%). In 7 patients, CT was performed for nodule follow up (6 stable, 1 disappeared). 1 CT picked up an incidental nodule. CT was reported as negative in 44. CONCLUSION: We recommend a CXR in the first instance to triage patients. In a normal CXR with concerning clinical symptoms (e.g. haemoptysis, weight loss), a negative scan would avoid referral or admission (Prime minister proposes legal guarantees for patients to be treated with in target times; BMJ 11 Nov 2009). CT in an equivocal CXR (e.g. bulky hila, possible ILD, bronchiectasis) would clarify presence of disease and need for referral. Abnormal CXR (suspicious for cancer, TB, metastases) warrants CT imaging to ensure appropriate triage and referral. CT thorax may lead to pick of incidental findings such as nodules, which may require subsequent CT follow up.

#### 0910 Pre-surgical methylene-blue "targeting" of small intrapulmonary nodules in patients with haematological malignancy: preliminary experience

Jaffer, O. S., Lung, P. F., Ceesay, M. M., Marrinan, M. T., Deshpande, R. P., Mulholland, N., Pagliuca, A., Mufti, G. J., and Desai, S. R.  
*King's College, London, UK*

AIM: The diagnosis of intrapulmonary nodules in patients with haematological malignancies is problematic; such lesions are often small and impalpable and "non-targeted" surgical biopsy is difficult. The aim was to evaluate the utility of image-guided "targeting" of small pulmonary nodules with methylene-blue before video-assisted thoracoscopic (VATS) biopsy. MATERIALS & METHODS: Eight patients (M:F = 6:2); mean age = 41 years  $\pm$  11.7) with haematological malignancy (lymphoma,  $n=5$ , AML,  $n=1$ , ALL,  $n=1$ , Castleman's disease,  $n=1$ ) were referred for VATS biopsy. Using CT guidance,

0.8–2.0 ml of methylene-blue (with an equal volume of iodinated contrast) was injected in the vicinity of the target lesion and along a track (including the pleural surface and the overlying chest wall), using a 20G needle. The platelet count, diameter of targeted nodules, “perpendicular” distance from the pleural surface and complications were recorded. Patients were transferred to surgery from the CT suite. Results: The mean platelet count was  $30^3 \times 10^9 \text{ l}^{-1}$ . The mean diameter of targeted nodules was  $12.5 \pm 7.2$  mm and these were at a mean distance of  $14.0 \pm 9.4$  mm from the pleural surface. Minor complications occurred in 4 of 8 (50%) patients (pneumothorax,  $n=3$ , pain,  $n=1$ ). A definitive histopathological/microbiological diagnosis was achieved in 7 of 8 (87%) patients and included: organising pneumonia ( $n=2$ ), respiratory bronchiolitis ( $n=2$ ), Kaposi’s sarcoma ( $n=1$ ), mycobacterium fortuitum infection ( $n=1$ ) and chronic graft-versus-host disease ( $n=1$ ). There were no instances of angioinvasive aspergillosis. CONCLUSIONS: The preliminary data suggest that pre-biopsy methylene-blue targeting of intrapulmonary lesions is a safe and promising technique for the diagnosis of indeterminate lung nodules in patients with haematological malignancy.

## 0830–0930

### Service delivery scientific session II

#### 0830 Making the 2008 National Stroke Strategy happen in the management of TIAs, in a busy DGH

Rajayogeswaran, B., Lawrence, E., Mahmood, S., and Hoskins, C.

Mayday NHS Trust, Croydon, UK

**PURPOSE:** The May 08 National Stroke Strategy requires rapid assessment of TIAs, including imaging within 24 h presentation for high ABCD2 scoring patients and within 7 days for the rest. This is because stroke risk in the first week after a TIA is 10% or 30% in the highest risk clinical groups. The EXPRESS study indicates therapy commencement within 24 h results in 80% stroke reduction at 90 days from 10% to 2.1%. The DOH Imaging Pathways include access to MR/DWI brain and carotid imaging. We audit our performance pre and post the implementation of this National Strategy in a busy DGH. **METHODS:** 2007–8 TIA Service data is compared with data from a 1 month audit of our new rapid assessment “walk in” TIA Clinic. **RESULTS:** In 2007 mean referral to assessment time was 4.8 days, and mean referral to CT time was 12 days. Mean assessment to Carotid Doppler time was 9.7 days. We then had no access to DWI. In October 2009 50 patients were assessed at the “walk in” clinic of whom 40 required imaging for suspected TIA/minor stroke. 24 of 29 CTs, 9 of 18 DWI MRIs and 10 of 32 carotid Dopplers were performed on the same day. All patients had their imaging within 1 week. Imaging Criteria diagnosed 8 positive TIAs and 2 positive TIA patients had >70% carotid arterial occlusions. **CONCLUSION:** Although the DOH National Stroke Strategy May 08 Guidelines for rapid imaging seemed daunting at the time, it was possible to implement them in a busy DGH.

#### 0840 The impact of radiographer immediate reporting on patient outcomes and service delivery within the emergency department

Hardy, M.<sup>1</sup>, Snaith, B.<sup>2</sup>, Wyton, C.<sup>1</sup>, Jones, H.<sup>3</sup>, and Barker, P.<sup>4</sup>

<sup>1</sup>University of Bradford, Bradford, UK, <sup>2</sup>Mid Yorkshire Hospitals NHS Trust, Wakefield, UK, <sup>3</sup>Royal Liverpool & Broadgreen NHS Trust, Liverpool, UK, <sup>4</sup>Pennine Acute Hospitals Trust, Oldham, UK

**PURPOSE:** Radiographer reporting has been successfully introduced across the UK and is now seen as an essential, rather than additional, image reporting service within many hospitals, particularly in relation to trauma. However, despite the introduction of immediate reporting of trauma radiographs being advocated to reduce image interpretation errors within the emergency department (ED) and inform patient management, an immediate radiographer reporting service is rarely routinely available. In order to establish the impact of a radiographer immediate reporting service on patient outcomes and service costs, a randomised controlled trial was undertaken.

**MATERIALS/METHODS:** Patients attending 5 hospitals across the North of England with musculoskeletal injuries were recruited and randomly assigned to immediate or delayed reporting arms on X-ray registration. Assuming a 5% difference in ED recall rates between the 2 groups, a total sample of 1242 (90% power) was required. Patient journey time, ED patient recall rates and self re-presentation for the same injury were recorded. Health status was evaluated using the EQ-5D questionnaire and statistical analysis and economic evaluation were undertaken. **RESULTS:** This is an ongoing study and initial findings will be presented describing patient attendance and recall statistics across the study arms. Preliminary findings related to errors in image interpretation and their impact on patient management and service delivery will also be explored. **CONCLUSION:** The immediate reporting of trauma radiographs is a natural extension to the current scope of radiographer reporting practice in the UK. However, implementation must be justified and supported by research evidence and resourced appropriately.

#### 0850 Skills mix in CT brain interpretation

Hoskins, C M., Geoghegan, A., and Carpenter, M.  
Mayday NHS Trust, Croydon, UK

**PURPOSE:** Skills mix allows efficient use of staff groups to provide quality, cost effective, timely care, ensuring radiologists focus on more complex workload. The joint 2008 document produced by the Royal College of Radiologists and College of Radiographers mandates ongoing audit for this service development. We report the results of an audit in our acute General Hospital and discuss this service innovation. **MATERIALS/METHODS:** We wrote guidelines for CT head radiographer reporting, in addition to general Skills Mix guidelines, and put a senior CT radiographer through the Canterbury Christ Church University head CT 1 year course. We then compared his CT head reports ( $n=32$ ) against Radiologist’s reports. A US study of CT heads found 95% agreement between radiologists and neuroradiologists reports. We accept that DGH Radiologist’s reports are Reference Standards not Gold Standards. We used the Radpeer Grading System. **RESULTS:** Out of 32 reports, 19 matched the radiologist’s report and 11 showed no clinically significant difference (Radpeer Grading 1/2). 2 reports showed a report difference (Radpeer grade 3). Of these 2, review showed that in one the radiographer was correct and in one the radiologist was. **CONCLUSION:** there is good agreement between radiologists and radiographer reports in this audit cycle. With fast MDCT scanning, the rate limiting step to capacity in our hospital is reporting time not scanning time and radiographer head reporting supports rapid report turnarounds, timely care, and the night time scanning service. We have plans to train more CT head radiographer reporters.

#### 0900 Outsourcing to meet night CT demand: one year’s experience in an acute District General Hospital

Hoskins, C. M. and Carpenter, M.  
Mayday NHS Trust, Croydon, UK

**PURPOSE:** We review a year’s experience of overnight outsourced CT reporting with reference to costs, scan parts, clinical governance and IT/RIS issues. **METHODS:** To comply with the European Working Time Directive Mayday NHS Trust outsourced night time CT reporting from 10pm to 7am, using Medica Nighthawk Teleradiology – an independent service provider. The Hospital has approximately 120,000 A&E attendances per year. Only Registrars and above can refer for overnight CT. **RESULTS:** An average of 32 scans per month were reported overnight, 84% being heads. This represented a substantial increase on the 12–13 overnight scans per month performed in the year pre outsourcing, although other factors such as implementation of NICE Head Injury Guidelines impacted on this. Costs varied from £2888 (22 scans) to £7981 (52 scans) per month. Peak Scanning times were 2300–2400 h, then 2200–2300 h, then 0200–0300 h. In about 20% cases the 1 h target of scan to RIS report time was missed, and there were some IT problems with image transfer to the Medica Server. A small number of “Case Discrepancies” were accepted by Medica and reviewed in the Departmental Errors

meeting. **CONCLUSION:** The outsourced service has allowed Mayday to comply with the EWTD law and improved Radiologist Quality of Life! "Discrepancies" involved well known "review areas" like the pituitary fossa and infra-orbital floor, so it is important to insist on transfer of thin slices and multiplanar image review. The high number of pre-midnight scans suggest potential for cost saving by delaying the start time to midnight.

#### 0910 The transformation of an orthopaedic radiology pathway using Lean

Martin, A. J.<sup>1</sup>, Hogg, P.<sup>2</sup>, and Mackay, S.<sup>2</sup>

<sup>1</sup>Royal Bolton Hospital NHS Foundation Trust, Bolton, UK,

<sup>2</sup>University of Salford, Salford, UK

**PURPOSE:** The aim of the study was to identify and implement change within the orthopaedic radiology service at a large DGH, through the application of lean methodologies. The current pathway was unacceptable due to the location of the department in relation to clinic and the length of time that patients spent waiting for their examination. Staff perception was that patient flow was poorly managed and patients complained about their waiting times. As efforts were focused on the 4 h operational target for patients attending the A & E department, those patients from Clinic were kept waiting for up to 2 h for their imaging examination as the A & E patients were given priority. **METHOD:** Lean was used to identify the extent of the problems within the pathway and potential solutions. Over a series of events, data was analysed, staff and patients were consulted and a proposal was presented to develop an orthopaedic radiology unit directly within the patient pathway. Mixed methods were used to evaluate the new service and to compare it with the old service in order to test the lean principle that by reducing waste and improving flow, there will be a positive influence on the patient journey, and also on patient and staff satisfaction. **RESULTS:** 6 months into the delivery of this service, evaluation has identified a dramatic reduction in patient journey time and an increase in staff and patient satisfaction. **CONCLUSION:** The use of lean is successful when used to transform radiology services.

#### 0920 Service improvement: sustainability and continuous improvement-rhetoric or reality

Wilson, P. R.

County Hospital, Hereford, UK

**PURPOSE:** To see whether the results from Service Improvement (S.I.) projects was sustained, and to find evidence of Continuous Improvement (C.I.). **MATERIALS/METHODS:** We reviewed four Radiology S.I. projects which had taken place in the past 5 years. Waiting times were tracked over that period as a measure of sustainability. If patient satisfaction scores had been performed then a rise in scores over time was used as a measure of C.I. Three of the pathways were critically reappraised to see whether further improvements were possible. **RESULTS:** Increasing workloads and changing referral patterns has made assessment of sustainability and C.I. difficult, but there is evidence of sustainability from all four projects. C.I. has been harder to demonstrate, but reworking the pathways has shown many potential opportunities for improvement. **CONCLUSION:** We have been guilty of being content with sustainability rather than pushing for C.I.

#### 0830-0930

### Imaging Services Accreditation Scheme (ISAS): One year on!

#### 0830 Improving service delivery through accreditation

Glean, E.<sup>1</sup> and Beaumont, J.<sup>2</sup>

<sup>1</sup>The Royal College of Radiologists, London, UK, <sup>2</sup>UKAS, London, UK

No abstract supplied.

#### 0850 Learning from participating in ISAS

Richards, J.

Plymouth Hospitals NHS Trust, Plymouth, UK

No abstract supplied.

#### 0905 Being an ISAS assessor

Hiorns, M.

Great Ormond Street Hospital, London, UK

The Imaging Services Accreditation Scheme is now established and the first imaging departments are now midway through the first assessment round. Accreditation falls into four domains, these being "clinical", "facilities, resource and workforce", "patient experience", and "safety" which comprise a total of 31 standards. The standards are patient focused, cover the functions and systems of a whole diagnostic imaging and interventional radiology service, and address the dimensions of quality while supporting quality improvement. The first cohort of assessors has been trained and is embarking on the assessment process. This presentation will give a brief overview of the accreditation scheme, explain what is required of an assessor (or future assessors) and explain what organisations applying for accreditation may expect of the assessors and the accreditation process.

#### 0930-1030

### Consultant Practice in Radiography

#### 0930 Training requirements for Breast Consultant Radiographers

Rees, Z.

Poole Hospital NHS Trust, Poole, UK

The post of a consultant radiographer is structured around 4 core functions that exemplify the role:

- Expert practise
- Professional leadership and consultancy
- Practise and service development
- Education and training.

Consultant Radiographers work as part of a multidisciplinary team bringing innovative solutions to patient care. Examples include:

- Changing patient flow through the clinics so that patients are not waiting around all morning. Telephone appointments which has resulted in a 93% attendance at clinics as opposed to 70-80% attendance.
- Introducing new practises such as: patient specific directives, setting up a family history clinic for women familial risk of developing breast cancer, creating a PACS and Digital team to filter information to all staff about new equipment and departmental changes.
- Liaison between all disciplines. A point of contact with excellent communication skills.
- Consultant Radiographers have come up through the ranks (worked on the 'shop floor') so are able to grasp quickly any difficult problems/situations that arise and deal with them.
- Important, as the lead radiographer, to have a positive, energetic, professional approach which inspires others and creates a positive attitude for the team.

The role defines professional development and influences at strategic level. As such the consultant radiographer plays a pivotal role in the integration of clinical practise, education and research findings. They need to be able to initiate clinical service developments and deliver improved patient care pathways. A consultant radiographer needs to be a creative thinker who advances research and education, and who can work across boundaries providing leadership to other practitioners by engaging in clinical supervision and activities that support them in their role. They need to have developed mature, clinical reasoning skills underpinned by practise experience and relevant education. They need to develop strong inter disciplinary links across all related professions and staff grades both internally and externally and this will provide good networking potential, ultimately supporting service improvement and modernisation based on evidence based best practise, to enable continuity of service to be provided for patients. This presentation will be giving the personal experience, training needs, progression and perspectives of a trainee breast consultant for example:

- Gaining confidence in new procedures such as: Ultrasound - now have own lists. Ultrasound guided wire localisations etc.
- Assisting in a radiologists clinic - to running ones own assessment list - or symptomatic ultrasound lists.

- Ensuring that you work within your competency, and not be afraid to ask for help or a rescan of an area you are unsure of. This works both ways as one can also be asked by the radiologist for your opinion - good teamwork.

However, with only slight variation in training needs this would probably also encompass other radiology disciplines such as gastro intestinal, ultrasound & therapy. It will focus on the 4 core functions that define the role of a consultant radiographer, but also give an insight into problems encountered, difficulties in gaining protected time for research & audit, the various challenges that cross ones desk, the confidence that is needed to take on leadership/autonomy, and the immense satisfaction gained from taking on a relatively new role within the profession and making it work.

#### 0950 Training for interventional procedures

Lewis, C. A.

*Breast Screening Unit, Coventry, UK*

**RATIONALE:** With the introduction of the four tier system of service delivery in 2001, the Department of Health (DOH) in collaboration with the Society of Radiographers introduced Occupational standards, so that members of staff working in any of the four tiers of service delivery would receive adequate training, following set protocols, to achieve competencies necessary for the optimum care of the patient and comply with Clinical Governance. Radiographers progressing into advanced practice towards Consultancy have to follow set training protocols for interventional procedures so that they, as practitioners, are safe, fulfil Clinical Governance, and receive Trust and Society Insurance cover, so that the patient receives optimum care. This complies with the Knowledge and Skills Framework dimensions. The protocols include observation, direct and indirect supervision until competency has been achieved - minimum set numbers have been given for each stage, but it is dependant on each trainee, and they do not progress onto the next stage of training until they are deemed ready. When Specialist Radiological Registrars rotate through departments during their training, we initiate them in undertaking interventional procedures under x ray and ultrasound guidance. Many have never seen any of these procedures, and therefore a structured training program, to comply with Occupational standards and maintain the optimum care of the patient is also advisable. This has been introduced in our department where this type of training has been shown as very safe and effective, and ensures the highest level of care of our patients. **CONCLUSION:** We believe that a structured training programme for interventional procedures following set patterns is a better method to maintain safe practise and achieve optimum care of the patient. We have implemented training protocols in our unit for both advanced practitioners and trainee radiologists and this has ensured our patients care has not been compromised as both are trained to the same standards. The trainees have been trained by the Consultant Radiographer in the department in collaboration with the Radiologists. We believe that other departments might benefit from our experience.

#### 1010 Let's ask the consultant radiographer

Gidlow, R.

*Leicester General Hospital, Leicester, UK*

**KEY LEARNING OBJECTIVE:** How the role of the Consultant Radiographer influences and contributes to the wider healthcare agenda. **DESCRIPTION:** Since 2000\* government initiatives to ensure a world class health service and improve patient care have highlighted the need to challenge the boundaries that have traditionally existed between professions. Consultant Radiographer roles have developed, often in isolation, across a wide range of specialities. There are some posts that are clearly defined with focus where it is possible to measure the benefits these roles have made to all service users. The consultant role was designed to integrate leadership, education and research within expert clinical practice and increase the capacity and quality of clinically based research. The author will illustrate how the Consultant Radiographer role can and is being used nationally and locally to influence and contribute to healthcare delivery despite the broad remit of the post, through individual examples and personal reflection.

**CONCLUSION:** The appointment to a Consultant radiographer role is only the beginning. The different strands of work undertaken by Consultant radiographers, whilst not unexpected, are increasing; its place within the healthcare workforce is established, it is now important be visible to a wider audience.

\*The NHS plan, A plan for investment. A plan for reform Department of Health, July 2000.

#### 1000-1130

### Imaging in patients with complications of cancer treatment

#### 1000 CNS complications and manifestations after cancer treatment

Quaghebeur, G.

*John Radcliffe Hospital, Oxford, UK*

Cranial imaging is often requested in patients with cancer for evaluation of neurological symptoms and signs or encephalopathy. Instinctively the radiologist will search for manifestations of the tumour – metastases/recurrence – but it is important to be aware of the numerous complications of cancer therapy that can lead to this clinical presentation; and the imaging findings that may result. The spectrum of CNS toxicity that radiotherapy and chemotherapy can produce ranges from subclinical white matter changes to overt brain necrosis. Grey matter changes can also result; as can pathology of the intracranial vessels. Adjuvant therapies and intrathecal administration compound the effects. These changes may be progressive and chronic and may occur years after the initial therapy; effects are compounded if therapies are applied to the immature brain. Previously there was the opinion that the CNS was relatively refractory to these toxic effects due to the relatively quiescent turnover of neurones and glia; but widespread use of MRI has shown that this is not the case. This talk will aim to provide an overview of the more common therapy induced complications that the radiologist needs to look for and recognise in these patients; and suggest optimal imaging strategies for this. The absence of “tumour” does not mean the scan is normal.

#### 1030 Pulmonary complications following treatment of haemato-oncological malignancy

Desai, D.

*King's College Hospital, London, UK*

No abstract submitted.

#### 1100 Complications in the HPB system and abdomen

Hulse, P.

*Christie Hospital NHS Trust, Manchester, UK*

No abstract submitted.

#### 1000-1125

### Neuroradiology keynote lectures & scientific session

#### 1000 Imaging the ageing brain: How? What do I put in my report?

Rich, P.

*St George's Hospital, London, UK*

This talk will include conditions commonly diagnosed on brain imaging in older people and a discussion of background age-related changes.

#### 1025 Which patient with a stroke (or suspected stroke) needs more than a plain brain scan

White, P.

*Western General Hospital, Edinburgh, UK*

No abstract submitted.

#### 1055 Dilemmas in neuroimaging – incidentalomas on MRI in “normal” research volunteers

Kulkarni, T. G.<sup>1</sup>, Adams, V.<sup>2</sup>, Kemp, G.<sup>2</sup>, Niven, S.<sup>1</sup>, and Das, K.<sup>1</sup>  
<sup>1</sup>Walton Centre for Neurology and Neurosurgery, Liverpool, United Kingdom, <sup>2</sup>Magnetic Resonance and Image Analysis Research Centre (MARIARC), Liverpool, UK

**PURPOSE:** To determine rates of incidental findings on brain MRI performed for research and compare with reported population incidence. To evaluate information provided to general practitioners and recommendations for referral or further imaging. **MATERIALS:** 383 subjects underwent brain MR for research purposes at MARIARC in association with WCNN. The volunteers were screened for relevant pre-existing illness. In accordance with University of Liverpool policy "diagnostic-quality"  $T_1$  and  $T_2$  weighted images from all subjects were read by neuroradiologists, and unexpected incidental findings were communicated to the general practitioner with clear guidance as to critical nature and need for follow-up. **RESULTS:** There were 29/383 unexpected findings (incidence 7%), an incidence similar to that reported in the general population. Three critical findings (2 aneurysms, 1 suspected aneurysm) needed referral to neurosurgery. One subject was diagnosed with multiple sclerosis. Other findings included 4 venous malformations, 6 cystic malformations (1 pineal cyst, 2 arachnoid cysts, 2 prominent peri-vascular spaces, 1 developmental callosal cyst) and 1 pituitary adenoma. The remaining 14 were diagnoses of old infarct, some suspected to be peri-natal ischaemic events. Diagnosis communicated to the general practitioner included recommendations on clinical referral (14/29) and additional imaging (9/29), or explicit advice that further investigation was unnecessary (15/29). **CONCLUSION:** Incidental pathology may be seen on research MR brain scans. At our institution scans are reported as an ethical duty to volunteers. The handling of unexpected incidental findings in research volunteers is the topic of international debate, and clear communication of relevant findings is essential.

#### 1105 Extra thoracic manifestations of sarcoidosis: a pictorial review of common presentations

Sahu, A., Chaganti, S., Sankaye, P., Maviki, M., Adams, W., Jones, J., and Mukonoweshuro, W.  
 Plymouth Hospitals NHS Trust, Plymouth, UK

**LEARNING OBJECTIVES:** 1. To look at the extra thoracic abnormalities noted on MRI in patients with sarcoidosis. 2. To correlate any changes in imaging findings during follow-up and their prognostic significance. **DESCRIPTION:** Neurosarcoidosis (CNS involvement) is seen in approximately 25% of patients with systemic sarcoidosis, although it is subclinical in most of these cases. It is associated with diverse neurological manifestations and neuroimaging findings. In the head and spine, the most typical imaging appearance is thickening and enhancement of the leptomeninges, vasculitis, hydrocephalus and mass effect but sarcoidosis. It may involve bone, dura mater, nerve roots, leptomeninges, and parenchyma, individually or in combination. Hydrocephalus is the most common secondary effect even in subclinical patients. Spinal neurosarcoidosis can cause an array of imaging findings, which include intramedullary, intradural extramedullary, extradural, vertebral, and disc space lesions. We review the imaging findings of CNS and other extra thoracic manifestations of sarcoidosis, using clinical cases from our centre. **CONCLUSION:** Clinical presentations and imaging findings in neurosarcoidosis are quite varied.  $T_2$  hyperintense parenchymal lesions are the most common imaging finding followed by meningeal enhancement. MRI may be also useful in the evaluation of sarcoidosis of the bone, muscle, heart, and intrathoracic. MRI is sensitive in the detection of CNS inflammation but lack specificity, making the ascertainment of neurosarcoidosis a clinical challenge. This exhibit will enhance knowledge of the multimodality imaging findings of extra thoracic manifestations of sarcoidosis and its potential sequelae.

#### 1115 The role of cranial CT in the investigation of meningitis

Nagra, I., Srivastava, S., Bernard, W., Short, J., and Banerjee, A. K.  
 Birmingham Heartlands Hospital, Birmingham, UK

**PURPOSE:** Requesting cranial CT prior to LP (lumbar puncture), in patients with a diagnosis of meningitis is becoming routine. Our previous audit of 110 patients, showed a high use of CT (61%) prior to LP, despite yielding limited information. We assess whether there has been any change in practice and whether patients fulfil criteria for CT (*i.e.* reduced or deteriorating consciousness, seizures, focal neurology or papilloedema). **MATERIALS AND METHODS:** Adult patients between September 2006 and September 2009 with a diagnosis of meningitis at Heart of England Foundation Trust, Birmingham were identified. Case notes, radiological requests and microbiology reports were reviewed. All CT scans were performed on a 64-slice Toshiba Aquilion scanner. **RESULTS:** 47 patients were diagnosed with meningitis in the 3-year period (25 female; 22 male). The mean age was 37 years (range 18–87). 37 patients had viral meningitis, 4 had bacterial meningitis, 1 had unspecified meningitis and 5 had normal LPs. 37 patients underwent cranial CT (78%) and all LPs were performed after CT, except in one case. The majority were requested by junior doctors (53%), with 65% not fulfilling the stated criteria for CT. Of 37 scans, 31 were normal (86%) and 5 abnormal; the major finding was opacified sinuses (5 patients) and one patient had mild ventricular dilatation, therefore no LP was performed. **CONCLUSION:** A larger proportion of patients are undergoing CT prior to LP. CT is being requested routinely and is not indicated in uncomplicated patients.

#### 1000–1130

##### BSTI Chest imaging session

##### 1000 Superior vena cava obstruction

Philips-Hughes, J.

John Radcliffe Hospital, Oxford, UK

**PURPOSE:** SVCO is most often caused by intra-thoracic malignancy, although it may also result from benign disease such as fibrosing mediastinitis and from iatrogenic causes related to central venous catheterisation. Symptoms depend on the rate of onset of SVCO, but can be very distressing and debilitating. Treatment depends on the primary cause and the severity of symptoms, and may involve radiotherapy/chemotherapy and/or endovascular procedures such as stenting. The differential diagnosis, imaging appearances and treatment options will be discussed, along with the indications, technique and results of SVC stenting.

##### 1030 Lung cancer screening – implications for radiology

Baldwin, D.

Nottingham City Hospital, Nottingham, UK

Screening for lung cancer is potentially an important way to improve mortality although research studies have not yet conclusively shown this. Research is ongoing into markers for both increased risk of lung cancer and early diagnosis of lung cancer. Risk models derived from epidemiological studies currently identify those at risk for screening studies that involve CT. The design of these studies is complex so as to take into account the various benefits and harms of screening. The very performance of a well publicised study can have important implications for the practicing radiologist as patients may seek to be screened. It is important that radiologists are aware of the value of CT screening when vetting such requests. If screening programs are eventually introduced, the patients suitable for screening will become clearer but the additional workload very much greater. Screening itself will require radiologist and radiographer time but the follow-up of indeterminate lesions, biopsy of suspicious lesions and diagnosis, advice and follow-up of other abnormalities detected will be a huge challenge. Lung cancer remains the cancer that kills more people each year than breast and bowel combined, so the potential increase in workload for radiology may have a really worthwhile impact on cancer mortality.

##### 1100 Evaluation of the suspected malignant unilateral pleural effusion

Entwisle, J.

Glenfield Hospital, Leicester, UK

The trigger event for patients is often a chest X-ray showing a unilateral pleural effusion and or thickening. The referral source may be primary or secondary care. The differential includes malignant disease (including MPM, lung cancer and metastatic disease) and benign disease (including benign asbestos pleural disease, TB and empyema). Review of old films is important to look at temporal changes. The need for referral should be based on both the radiological findings and clinical details. Sometimes this may be picked up initially on CT rather than chest X-ray. The radiology report on patients with unexplained unilateral pleural disease should suggest referral to the appropriate lung cancer team or pleural services. CT should be performed early in the patient journey and can help to differentiate benign from malignant disease using recognised criteria. Indicators of malignant disease are circumferential pleural and nodular pleural thickening, parietal pleural thickening greater than 1 cm and mediastinal pleural involvement. Modification of the normal lung cancer staging technique can improve the quality of the scan. This can be used for diagnostic, pre-treatment and follow up scans. The exact protocol will depend on the scanner and department. The pleural fluid does not need to be drained prior to the CT. Suggested protocol: 150 ml of 300 mg dl<sup>-1</sup> @ 3 ml s<sup>-1</sup> at 60 s delay. Coverage thoracic inlet to iliac crest (inferior aspect of liver). Add pelvis if past history of abdominal malignancy or suspected GI or gynaecology primary. Collimation needs to be less than or equal to 2 mm to allow reconstructions. There is considerable overlap between the spectrum of MPM and other malignant pleural disease and pathological confirmation is normally required. Supportive evidence of MPM is rind like pleural thickening >1 cm, associated plaques (seen in approximately 20% patients). Identified primary, metastases at initial diagnosis and female patients make other malignant diagnoses more likely. Because of the risk of chest wall "seeding" the number of interventional procedures should be kept to a minimum. Simple aspiration may give a cytological diagnosis. Thoracoscopy is now the mainstay of sampling and allows biopsy and drainage of the effusion. REFERENCES: Leung AN, Muller NL, Miller RR. CT in differential diagnosis of diffuse pleural disease. *Am J Roentgenol* 1990;154:487-92. Benamore RE, O'Doherty MJ, Entwistle JJ. Use of imaging in the management of malignant pleural mesothelioma. *Clin Radiol* 2005;60:1237-47. Review. Mesothelioma framework – Advice for the NHS on how to organise services for Malignant Pleural Mesothelioma (MPM) patients to improve quality of care across the country (DOH), 2007. British Thoracic Society Standards of Care Committee. BTS statement on malignant mesothelioma in the UK, 2007. *Thorax* 2007;62(Suppl\_2):ii1-ii19.

### 1000–1130

#### Open all hours

##### 1000 Can we really do same day reporting across the board?

Smith, L.

*NHS Improvement, UK*

No abstract submitted.

##### 1030 Why wait?

Beale, A. M.

*Great Western Hospital, Swindon, UK*

No abstract submitted.

##### 1100 Making weekends work!

Seymour, R.

*Torbay NHS Trust, Torquay, UK*

Increasing demand, cost pressures, the drive to improved quality and efficiency, then need to reduce bed days, 1 week cancer targets, 18 week/6 week targets, patient-responsive access times, stroke strategy requirements for CT and MR 24/7... How can we cope? More than ever before it is clear that we should be running our services on a 7-day basis. In this presentation the speaker will discuss his local experience of "7-day radiology" that has been successfully employed for many years. In addition to being a DGH radiologist the speaker is also a National Clinical Lead in service improvement and will draw on this

experience to discuss the challenges and opportunities in delivering routine services at the weekend.

### 1000–1140

#### Radiation protection keynote and scientific session

##### 1000 Mortality and cancer risks following occupational radiation exposure

Muirhead, C.

*Health Protection Agency, Didcot, UK*

There has long been interest in the risks from protracted or low dose radiation exposures. The National Registry for Radiation Workers (NRRW) was set up in 1976 to address this topic and is the largest study of UK radiation workers. The organisations that participate in the NRRW are in the nuclear, research and industrial sectors. The most recent analysis is based on a cohort of 174,541 persons, followed to the end of 2001 for mortality and cancer incidence. Mortality has been compared with national rates and, within the cohort, trends in mortality and cancer incidence with external radiation dose have been estimated for major disease groupings and specific causes. This analysis provides the most precise estimates to date of mortality and cancer risks following occupational radiation exposure and strengthens the evidence for raised risks from these exposures. The cancer risk estimates are consistent with values used to set radiation protection standards and – both for leukaemia and for all other cancers combined – exclude the possibility of radiation risks being more than a few times higher than existing estimates. ACKNOWLEDGEMENTS: This analysis was funded by the Health and Safety Executive. HPA wishes to thank all of the organisations and individuals participating in the NRRW for their cooperation. REFERENCE: Muirhead CR, O'Hagan JA, Haylock RGE, Phillipson MA, Willcock T, Berridge GLC, Zhang W. Mortality and cancer incidence following occupational radiation exposure: third analysis of the National Registry for Radiation Workers. *Br J Cancer* 2009;100:206-12. [www.nature.com/bjc](http://www.nature.com/bjc).

##### 1030 Over-utilisation of abdomino-pelvic CT: what percentages of emergency examinations are justified?

Kannappa, L. K., Ilangovan, R., and Remedios, D.

*Northwick Park Hospital, Harrow, UK*

INTRODUCTION: Increased utilisation of CT has been paralleled by increased concern about the radiation dose and, in particular, increased risk of cancer. In 2008–2009, 3,365,221 CT examinations were performed out of 34,835,343 total diagnostic examinations in England. Although CT only accounts for ~10–15% of all radiological procedures, it contributes around 50% of the collective dose to the population arising from diagnostic radiology. The objective of this study is to identify the percentage of abdominal CT examinations performed for the Emergency Department which are justified according to RCR Guidelines and to compare with data from North America. MATERIALS AND METHODS: 100 consecutive abdomino-pelvic CT examinations requested by the Emergency Department were retrospectively analysed for justification according to RCR Referral Guidelines and grade of justifying radiological practitioner. Using clinical information from request cards, a consultant radiologist retrospectively justified the requests according to RCR Guidelines. RESULTS: Of the 100 CT requests, 95 of them were for suspected renal colic and the rest were for acute abdominal pain. 14 were originally justified by a consultant and 86 by radiology registrars. Of the 100 requests 98 were retrospectively justified. Of 2 unjustified requests, one had insufficient history and the other should have had ultrasound instead. DISCUSSION AND CONCLUSION: 98% of emergency abdomino-pelvic CT scans are justified according to guidelines. This compares favourably with 56% in an American study. The use of Referral Guidelines and IRMER regulations have ensured patients safety and avoided over-utilisation of CT in the UK.

##### 1040 Advanced reconstruction filter processes for noise and dose reduction in chest and cardiac CT



Blobel, J. and Mews, J.  
Toshiba Medical Systems GmbH, Neuss, Germany

**PURPOSE:** The development of CT resulted in a widening of the lateral radiation field. These increase image-effective noise in relation to the input signal and the potential of structured noise caused by bones. Two filter algorithms within the reconstruction software for three-dimensional noise reduction was developed, with the goal that contrast structures in chest and cardiac CT should be maintained. **MATERIALS/METHODS:** The smoothing filter (QDS) reduces pixel noise and preserves edges of the contrast details. The second algorithm (Boost3D) reduces beam-hardening noise and avoids artefacts. The combination of these algorithms initiates three parallel mathematical processes on the input image raw data: edge detection and analysis, image smoothing and edge enhancement. In a patient study 4 ROIs were replicated on anatomical landmarks in a single axial thoracic location, to measure the pixel noise and to calculate the dose reduction using each algorithm and the combination of both. **RESULTS:** The QDS filter reduced pixel noise by 16.9% in aorta. The B3D filter reduced pixel noise between 9.5% and 29.6% with mean 14% in the posterior thorax. Both filters combined facilitated a 25.4% (mean of 4 ROIs) noise reduction and 45.2% reduction in effective radiation dose in chest images. **CONCLUSION:** We present the principle of both methods and a quantitative analysis of image quality that confirms the utility of dedicated processing filter algorithms in potentiating substantial reductions in image noise and radiation dose. The application of this supplementary QDS and Boost3D filter combination halves patient exposure without losing of image quality.

#### 1050 A bespoke patient shielding device for CT: dose measurements

Iball, G. R. and Brettell, D. S.  
Leeds Teaching Hospitals NHS Trust, Leeds, UK

**PURPOSE:** Patient radiation protection products have been used in radiology for many years but it is surprising that such products have not been used routinely in CT. The purpose of this study was to evaluate a bespoke radiation protection product in terms of organ and effective dose savings during chest CT scans. **METHODS:** TLDs were used to measure doses throughout the abdomen/pelvis during CT scans of the chest of a RANDO phantom. Dose measurements were made with no shielding, with lead aprons and with a bespoke shielding product around the abdomen/pelvis in order to quantify the organ and effective dose reductions. **RESULTS:** Average dose savings in the 10 phantom slices ranged from 5–74% with the highest point dose saving being 92%, at the level of the male gonads. The dose to the non-pregnant uterus was reduced by 35% when the bespoke shield was used. Significant dose savings were found in the liver, colon and stomach which contributed to an effective dose saving of approximately 10%. It is anticipated that similar effective dose savings could be achieved by protecting the chest during head or abdomen scans. The device presents further benefits for pregnant patients as it conforms to patient shape/size throughout pregnancy, thereby delivering consistent patient dose savings alongside significant foetal dose reductions. **CONCLUSION:** A bespoke patient protection product has been shown to yield significant organ and effective dose savings for all patients. Therefore it is recommended that such products should be used on all patients undergoing CT scans.

#### 1100 Radiation dose reduction in cervical spine multidetector CT – Phase I: in vitro phantom work

Meeson, S., Turnbull, S. D., Bailey, D. I., Patel, R., and Golding, S. J.  
University of Oxford, Oxford, UK

**PURPOSE:** To investigate potential dose reductions for cervical spine examinations using multidetector CT (MDCT) without reducing fracture detectability. The first phase of the study concentrates on *in vitro* phantom work to avoid unnecessary patient exposure. **MATERIALS/METHODS:** Phantoms with artificial features were constructed using human cervical vertebrae. The bones were scanned

suspended inside tissue equivalent material. To reduce air within the dry bones they were vacuum prepared before being scanned using both a LightSpeed 16 and LightSpeed VCT 64-slice scanner (GE Healthcare Medical Systems, Milwaukee, WI). The phantom was scanned using a series of increasing tube current (mA) settings and constant tube voltage, before being scanned using automatic tube current modulation (TCM). Images were checked and reported before being passed to an expert panel of experienced radiologists. **RESULTS:** As expected the visual noise in the images increased as the mA was reduced. The TCM tube current table ranges were found to be set to high values, therefore extra TCM exposures were also made with lower minimum values. Preliminary indications are that image reporting with a high degree of confidence can be achieved with the radiation dose reduced by a factor of two. **CONCLUSION:** There is clear latitude for reducing dose while preserving image quality, since we have so far demonstrated using a phantom that images of adequate quality for identifying artificial features can be obtained using a lower radiation dose.

#### 1110 The impact of CR on patient dose – back to the 70s?

Peet, D., O'Doherty, J., Pryor, M., and Tyler, N.  
Royal Surrey County Hospital, Guildford, UK

**PURPOSE:** To review the impact on dose and exposure techniques of CR. **MATERIALS/METHODS:** In support of the routine patient dose programme, focus sessions were set up to review the exposure techniques and resultant doses arising from the introduction of CR into the NHS and private sectors. Data was collected in the normal way in line with the National Dose protocol for PA chest, abdomen, pelvis, lumbar spine and knee examinations. **RESULTS:** Results were collated on a group by group basis and were opened up to discussion with the professionals involved and the CR companies. A significantly high proportion of sites exceeded national diagnostic reference levels. Wide ranges in kVs were seen, particularly for the chest examination. The CR software was set up at commissioning and many radiographic staff were unaware of the impact their selection of exposure factors and techniques might have on the displayed image quality. Some centres abandoned the use of AECs and there appeared little initial cooperation between CR companies and X-ray manufacturers to match equipment. Training was reported to be minimal at many sites. **CONCLUSION:** Doses are generally higher than they were with film and have returned at some sites to levels last seen in the 1970s in the early days of rare earth screens. Others report no change in dose and acceptable image quality. Optimisation at most sites is required on an examination by examination basis. More training and update training is required.

#### 1120 Radiation dose and image quality optimisation in the neonatal intensive care unit

Sawyer, L. J., Makepeace, C., Mistry, T., and Starritt, H.  
Royal United Hospital, Bath, UK

**PURPOSE:** A process of optimisation was performed to reduce radiation doses to neonates, whilst ensuring good diagnostic image quality. **MATERIALS/METHODS:** Following the introduction of Carestream CR into the Neonatal Intensive Care Unit (NICU), it was proposed that exposure factors should be increased from 50–56 kV to 60–64 kV, with the primary intention of reducing skin doses. The proposed exposure factors were within the "European Guidelines on Quality Criteria for Diagnostic Radiographic Images in Paediatrics" and in line with other hospitals using CR in NICU. Lung doses, entrance surface doses, and effective doses were calculated for a range of kV and mAs values, and initial images were acquired with lung doses similar to those delivered previously. The mAs was then gradually reduced to a minimum value which delivered the required exit dose to the CR cassette. Throughout the optimisation process, clinicians performed regular image analysis to ensure that diagnostic quality was maintained. **RESULTS:** Changes to exposure factors resulted in lung dose reductions between 26% and 40%, with the greater reduction for the smallest weight group. Entrance surface doses were reduced by an average of 44%. Visual grading analysis

was used to compare image quality at the beginning and end of the optimisation process and no reduction in quality was perceived. **CONCLUSION:** Significant dose reductions were achieved in NICU without adverse affects to image quality. This was achieved with the help of a multi-disciplinary team of radiologists, paediatricians, radiographers, and physicists.

**1130 Have the current RCR lumbar spine imaging guidelines led to a reduction in radiation burden to the population as anticipated?**

Paliwalla, M., Dattani, M., Weldon, J., and Remedios, D.  
*Northwick Park Hospital, Harrow, UK.*

**PURPOSE:** Guidelines now state that lumbar radiography for lower back pain is indicated in 2 specific circumstances: fracture and spondyloarthropathy. It was anticipated that this would dramatically reduce radiation burden. Has this been realised? **METHOD:** Consecutive GP requests for lumbar spine radiographs and lumbar spine MRI were reviewed for 3-month periods before and after the introduction of 2007 RCR guidelines. 100 consecutive radiographs and all 47 MRI examinations from the period following the introduction of the guidelines were reviewed in detail. Extrapolation of these figures enabled an estimation of the number of radiographs justified according to the guidelines. **RESULTS:** Pre-guidelines, 1016 radiographs and 8 MRIs were performed in 3 months. Post-guidelines, MRIs increased to 47, but surprisingly radiographs also increased to 1192. Of 100 radiograph requests only 10% were justified using current guidelines. Extrapolating this figure, only 119 of 1192 radiographs were fully justified following guideline introduction. This is a potential saving of more than 1 Sievert of population effective dose in this 3-month period alone. Furthermore, clinically relevant diagnostic yield was 8% for radiography and 89% for MRIs. **CONCLUSION:** There has been no reduction in radiograph requests, presumably due to limited uptake of guidelines and/or their inadequate dissemination. The value of MRI for low back pain is clear, with 11 times the diagnostic yield compared with radiographs alone. Formulation of a local policy for distributing guidelines as well as insertion of text within reports of incompletely justified requests referring the clinician to the guidelines is suggested. Unjustified lumbar radiographs must stop.

**1200–1245**

**IPEM John Mallard lecture**

**1200 Diffraction assisted imaging**

Rogers, K.

*Cranfield University, Bedfordshire, UK*

Since the discovery of X-rays, their exploitation has followed two almost independent, distinct disciplines; *imaging*, based upon material absorption properties and *crystallography*, based upon characteristics of scattering. Recently, these fields have been brought together to provide the potential for new imaging modalities with tissue type discrimination. Within the medical context, X-ray scattering can provide valuable information concerning the molecular structure of biological tissues at atomic and supramolecular scales. Soft tissues have well defined X-ray scattering patterns that are characteristic of particular tissue and status. Two scatter measurement regimes have become distinct, wide angle X-ray scattering (WAXS) where atomic scale structures are characterised and small angle X-ray scattering (SAXS) where features of supramolecular structures are determined. The ability of X-ray coherent scatter to provide such molecular information from a range of tissues has recently lead many researchers to investigate the possibility of exploiting this radiation as a diagnostic tool and a route to molecule specific imaging. This presentation will consider the clinical value of information carried by coherent scatter. It will also review technical progress in this field and discuss the various emerging options for the practical measurement of scatter signatures.

**1300–1345**

**BIR AGFA Mayneord lecture**

**1300 Healthcare and Innovation**

Darzi, A.

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*St Mary's Hospital, London, UK*

No abstract submitted.

**1400–1530**

**GI Keynote and scientific session**

**1400 Imaging metastatic disease in the liver: CT, MRI and DWI**

Koh, D

*Royal Marsden Hospital, Sutton, UK*

Metastatic disease to the liver is common. Most liver metastases are hypovascular, although hypervascular metastases typically arise from neuroendocrine tumours. In colorectal cancer, patients with liver metastases that can be completely resected by surgery have a better long term survival compared with those with irresectable disease. Thus, imaging plays a central role in defining the presence, burden and distribution of liver metastases for treatment selection. Contrast enhanced CT in the portovenous phase is widely used to evaluate liver metastases. However, its sensitivity for metastases may be diminished in the presence of fatty change. MRI has superior soft tissue contrast to enable lesion detection and characterization. Furthermore, the use of liver selective or specific contrast media can improve the detection and assessment of smaller (<1 cm in diameter) metastatic lesions. More recently, diffusion-weighted MRI (DWI) has also been shown to improve the detection of liver metastases, either alone or in combination with contrast enhanced MRI.

**1430 A retrospective audit of 1244 CT colonography (CTC) studies performed to exclude colorectal cancer (CRC) in symptomatic patients**

Tomas Hernandez, S. Badiani, S. Roy-Choudhury, S., and Karandikar, S.

*NHS Heart of England, Birmingham, UK*

**PURPOSE:** CTC is being increasingly used in place of barium enema for the radiological evaluation of colorectal symptoms. Most CTC studies have been reported in colorectal screening. We aim to assess the role of CTC excluding CRC in symptomatic patients. **METHODS:** This is a retrospective audit of 1244 CTC studies performed (March 2002–December 2007). CTC studies referred for staging and proximal synchronous lesion detection were excluded. Demographics, clinical presentation, outcomes, findings and experience of reporting radiologist were identified from electronic records. Gold standard was sigmoidoscopy and/or colonoscopy within 1 year supplemented by clinical, endoscopic and radiological follow-up. Patients not diagnosed as having a CRC on imaging were assumed as true negatives if they did not feature on the cancer registry at 18 months. **RESULTS:** Indications were change in bowel habit (32.7%), abdominal pain (13.5%), anaemia (12.4%), rectal bleeding (12.1%) and others (29.3%). 1200 (96.4%) examinations were diagnostic. 68 (5.6%) invasive colon cancers were diagnosed. Median follow up was 38 months. 3 cancers were missed and were detected during follow up, all which were visible in retrospect: one 30 mm sessile polyp in caecum, a 20 mm plaque lesion in the descending colon and a short annular lesion in the ascending colon. The sensitivity, specificity, positive predictive value and negative predictive value for colonic cancer were 95.7%, 98.2%, 77.2% and 99.7%, respectively. **CONCLUSION:** CTC has a high negative predictive value in excluding a colorectal cancer in patients with colorectal symptoms. CTC can provide a reliable alternative for the investigation of patients with colorectal symptoms.

**1440 CT staging of colonic cancer: a radiological versus histopathological comparison**

Rodriguez, C. L., Lee, E. Y., Bleehen, R. E., and Yong, A. A.

*University Hospital of Wales, Cardiff, UK*

**PURPOSE:** To assess the accuracy radiological T- and N-staging of colonic cancer compared with histopathological staging. **METHODS:** Patients presented at the local colorectal cancer multidisciplinary team meeting from December 2007 to November 2008 were included. Rectal tumours, patients not treated surgically and non-carcinomatous tumours were excluded. Staging CT scans were prospectively reviewed

by a consultant radiologist. A second consultant radiologist who was blinded to histological stage independently reviewed the same scans retrospectively. The imaging was evaluated according to TNM criteria and patients stratified into "good" or "poor" prognostic groups based on T- and N-stage. RESULTS: 64 patients with histologically confirmed colonic cancer were included. The accuracy of stage-for-stage prediction of T-stage and N-stage was 59% and 47%, respectively. When stratified into prognostic groups, the accuracy was 78% for T-staging and 61% for N-staging. Inter-observer agreement for T-stage prognostic group was 86% ( $\kappa=0.71$ ). 5 cases were understaged as Tx, T1 or T2; these were T2 or T3 tumours with an average of 1.5 mm of muscularis propria invasion. CONCLUSION: CT is routinely used for staging colonic tumours. Although the accuracy (59%) for predicting the exact histopathological T-stage is somewhat suboptimal, the accuracy (78%) improves significantly when it comes to stratifying patients into prognostic groups, with a positive predictive value of 78%. These figures compare favourably with other studies. This is of value in the recognition of poor prognosis tumours that may benefit from preoperative neoadjuvant therapy. Nodal staging is known to have its own difficulties and our figures reflect this.

#### 1450 Radiographer led real time review of CT colonography – initial experiences

Moore, R., Mullan, D. P., Healey, P., and Hughes, M.  
*Royal Liverpool University Hospital, Liverpool, UK*

PURPOSE: To evaluate and report our experience of role extension for radiographic advanced practitioners (gastrointestinal) in CT colonography techniques. MATERIALS/METHODS: Barium Enemas have been superseded by CT colonography in our institution. This reduced fluoroscopic workload could lead to "de-skilling" of radiographic advanced practitioners (GI) who are trained to Masters level, with several years of specific experience. In our institution we have utilised the expertise of advanced practice GI radiographers to improve our CT colonography service. Dedicated CT colonography lists are performed with a separate CT and GI radiographer in attendance. The GI radiographer assesses the adequacy of bowel prep, performs PR examinations, and continually analyses the quality of pneumocolon. There is focused real time review of the first acquisition of images whilst the patient is prepared for the subsequent acquisition. If a tumour is discovered on real time review, the GI radiographer will justify and perform a concurrent CT Thorax for completion imaging. RESULTS: 223 studies were performed with real time review between 1/8/9 and 1/12/9. This led to same day CT thorax studies in 12 cases of previously undiagnosed colorectal tumours. Diagnostic quality pneumocolon was achieved in 96% of cases. CONCLUSION: Real time review of CT colonography by an advanced practice GI radiographer leads to concurrent performing of CT thorax in appropriate cases. This leads to timely full body staging and reduces delays in definitive management. Understanding of colon anatomy and pathology allows the GI radiographer to safely achieve diagnostic quality pneumocolon in the majority of cases.

#### 1500 Pictorial review of benign pancreaticobiliary lesions on MRI

Sriharan, M., Mehta, R., Rana, K., and Khan, N.  
*Chelsea and Westminster Hospital NHS Trust, London, UK*

KEY LEARNING OBJECTIVES: 1. Outline the MR sequences used in imaging the pancreas and biliary tree. 2. Showcase the variety of benign pathologies involving the pancreas, gall bladder and biliary tree. 3. Highlight the distinguishing characteristics of the various lesions, in particular, how to decide if they are most likely to be benign. 4. Show how MRI can be used to help with characterisation and differentiation. DESCRIPTION: MRI is increasingly used to image the pancreas and biliary tree. Various benign pathologies exist which have very different therapeutic outcomes. It is important for the radiologist to be aware of the characteristic and distinguishing MR features of these lesions so that the right diagnosis or suitable alternative differential is given to aid management. CONCLUSION: A variety of benign lesions affect the pancreas and the biliary tree. MRI is a useful modality to characterise and evaluate these lesions so that the right management course is chosen for the patient.

#### 1510 Qualitative and quantitative evaluation of time-resolved flow analysis of portal venous hemodynamics of liver cirrhosis patients and volunteers

Stankovic, Z., Csatai, Z., Deibert, P., Euringer, W., Eggerking, S., Blanke, P., Abdullah Zadeh, Z., Langer, M., and Markl, M.  
*University Hospital Freiburg, Freiburg, Germany*

PURPOSE: Current parameters for the portal vein diagnostic in ultrasound are limited to simple regional flow parameters. The aim of this study was to visualize and quantify portal vein haemodynamics using a flow-sensitive 4D MRI at 3T for an improvement of diagnostic information in liver cirrhosis patients. MATERIALS/METHODS: 3-dimensional MR velocity mapping at 3T (spatial resolution =  $1.6 \times 2.1 \times 2.4$  mm) with 3-directional blood flow encoding employing adaptive respiration (navigator gating of the spleen-lung interface) and ECG-synchronization was applied in a group of 12 liver cirrhosis patients (age =  $55.1 \pm 10.2$ ), 20 young volunteers (age =  $27.8 \pm 0.5$ ) and 20 age matched volunteers (age =  $58.6 \pm 0.5$ ). In addition to 3D venous flow visualization (3D stream-lines, time-resolved 3D particle-traces), direct vessel segmentation and flow quantification was applied in the portal venous system. Results were compared with the reference standard ultrasound. RESULTS: 3D streamline and particle trace visualization in the complete portal venous system (mesenteric and splenic vein, portal vein, intrahepatic right and left portal vein branch) could successfully be performed for almost all subjects. Our results demonstrated a persistent reduction of the peak velocities in the portal venous system between patients and different age group volunteers. Analysis showed significant correlation for peak and mean velocities between MRI and ultrasound measurements. CONCLUSION: 3D MR velocity mapping at 3T revealed a qualitative and quantitative evaluation of comprehensive 3D flow haemodynamics in the portal system of liver cirrhosis patients in correlation to the standard ultrasound. A limitation was related to the low spatial resolution occasionally preventing clear separation of the portal vein and surrounding vessels.

#### 1520 Long-term tunnelled peritoneal catheters in the management of malignant ascites – initial experiences and cost effectiveness

Mullan, D. P., Jacob, A., Puro, P., and Laasch, H.  
*The Christie Hospital, Manchester, UK*

PURPOSE: Recurrent malignant ascites is traditionally treated with inpatient paracentesis. We describe our initial experience of long term tunnelled "PleurX" catheters in the management of recurrent ascites. Advantages, efficacy, complications and cost analyses are described with comparison to traditional paracentesis. MATERIALS AND METHODS: Patients presenting within 2 weeks of repeated previous paracentesis with recurrent ascites were selected for insertion of a 15.5Fr "PleurX" tunnelled peritoneal catheter. Patient and procedure data on prior conventional paracentesis and subsequent "PleurX" drainage was obtained from clinical notes. A successful outcome was defined as relief of symptomatic ascites with no catheter related complications requiring hospital admission. RESULTS: 22 patients had 24 tunnelled peritoneal catheters inserted between 18/3/08 and 18/11/09. All procedures were technically successful with no procedural complications. All patients were successfully palliated until death. One catheter became dislodged due to inadvertent removal of the anchoring suture and one catheter became blocked with fibrin deposition. Both were successfully replaced and loculations resolved with intraperitoneal streptokinase. Cost analysis performed with the hospital finance department, and compared with conventional inpatient paracentesis shows follow on cost savings of £2700–£3700 per patient per month. In addition, 10–15 inpatient bed days were freed per patient per month. No significant complications were encountered. CONCLUSION: Long-term tunnelled peritoneal catheters are safe, well tolerated, and achieve significant cost savings compared with conventional paracentesis. A significant number of inpatient stays and outpatient attendances are reduced. No morbidity due to device placement was recorded in this series. One case of loculated ascites was successfully managed with streptokinase.

**1400–1530**

**How to investigate headaches**

**1400 The investigation of acute severe headache**

Pretorius, P.

*John Radcliffe Hospital, Oxford, UK*

**PURPOSE:** To provide a rational approach to the imaging investigation of acute severe headache as well as practical tips for image interpretation. **SCOPE OF THE LECTURE:** The emphasis of the lecture is on cranial CT in the acute setting. “Red flag” clinical features pointing to significant pathology in acute severe headache will be discussed with reference to the mnemonic “TEASE-First” The lecture will also cover: 1. Thunderclap headache; 2. Suspected venous sinus thrombosis; 3. Parenchymal haemorrhage; 4. Certain intracranial infections; 5. The pitfalls in relying on symmetry as an indication of normality in CT head scans.

**1430 Chronic headache and migraine**

Jaros, J.

*King's College Hospital, London, UK*

No abstract submitted.

**1500 How do I investigate a patient with a possible brain tumour? Do I need to follow-up this patient?**

Coley, S.

*Royal Hallamshire Hospital, Sheffield, UK*

Approximately 1 in 1000 patients presenting to their General Practitioner with headaches will have a brain tumour. This potentially represents a massive burden upon imaging departments unless “high risk” patients can be identified. This presentation will discuss current clinical guidelines for investigation of patients presenting with a suspected brain tumour and will consider the pros and cons of radiological investigation. Imaging protocols will be suggested, with particular reference to the likely pathologies that may mimic an intracranial mass lesion.

**1415–1515**

**Dying for health**

**1415 Walk-in CT scanning: justified and optimised?**

Slack, K.

*Health Protection Agency, Oxfordshire, UK*

No abstract submitted.

**1445 The return of deterministic radiation injury**

Rogers, A.

*Nottingham University Hospitals NHS Trust, Nottingham, UK*

It is well documented that interventional procedures are both increasing in frequency and also in complexity. Interventional radiology is increasingly used in the major trauma setting where the benefit of the intervention is continued life. In cardiology now we see heart valves being replaced using a catheter and a minimally invasive approach. Some postulate that these factors have led to an increase in the number of patients receiving doses above deterministic effect thresholds and that we are seeing a rise in the number of such injuries. This talk, in the current context, attempts to present latest evidence on both dose, risk and prevalence. To achieve this, the latest literature on levels of skin dose along with the uncertainties in the measurement will be discussed, along with methodologies for skin dose assessment. Suggestions for practical implementation of surveillance strategies will be presented, along with issues around consent. Finally, ideas will be put forward as to the place of these strategies in the on-going medical management of patients at most risk.

**1430–1545**

**Imaging sports injuries**

**1430 Groin strain – the golden rules**

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Grainger, A.

*Leeds Teaching Hospitals, Leeds, UK*

No abstract submitted.

**1455 Tendon/muscle injury: ultrasound or MRI?**

Bradley, M.

*North Bristol NHS Trust, Bristol, UK*

The aims of this talk are to illustrate the relative merits of these imaging modalities for sporting injuries, particularly related to the muscle and tendon injuries predominating in professional and amateur sports men and women. The advantages of ultrasound include its high spatial resolution and its ability to examine multiple regions with comparison of normal anatomy using both static and dynamic assessment. There is no ionising radiation and it can be applied within the Radiology department or localised to the sporting activity. Its limitations include a small field of view. MRI has excellent contrast resolution imaging for a variety of sports injuries with the ability to create a much larger field of view to identify a more overall picture of the local anatomy. There is no ionising radiation but it is not a transportable imaging medium to the sporting event. It has less capability of multiple comparison sites and is generally a more expensive imaging modality. It is also less practical for use for multiple follow up scans to aid the rehabilitation process. It may however be better at identifying the other associated injuries that are part of the injury mechanism to give a fuller overall picture of the extent of injury. This talk will go into greater detail of these advantages and disadvantages with the relative merits of the imaging of specific anatomical areas but also with particular relevance of its functionality and inter relationship with the varying types of soft tissue injuries seen in these athletes. Discussion will also be around how ultrasound can lend itself to Interventional techniques to resolve the injury as quickly as possible in order to maintain maximum performance. The talk will be illustrated with a range of clinical cases identified in most common and some less common sporting injuries.

**1520 Stress fractures**

Lee, J. C.

*Chelsea and Westminster NHS Trust, London, UK*

Stress responses are a common cause of loss of activity in the athletic population occurring in up to 10% of asymptomatic athletes. This lecture will discuss the biomechanics and aetiology of bone stress in the fused and unfused skeleton and illustrate the range of imaging findings in this condition. The main aim in management of bone stress responses is to prevent progression to stress fracture. The role of imaging in prognostication and patient management will be considered.

**1430–1545**

**Delivering interventional radiology services fit for the 21st century**

**1430 The evidence for why**

Gaines, P. A.

*Sheffield Vascular Institute, Sheffield, UK*

No abstract submitted.

**1455 Responsibilities of departments and individuals**

Watkinson, T<sup>1,2</sup>

*<sup>1</sup>Royal Devon and Exeter Hospital, Exeter, UK, <sup>2</sup>The Peninsula Medical School, Exeter, UK*

The RCR publication in 2009 “Standards for providing a 24-h interventional service” was clear in its recommendations to NHS trusts, departments and individuals. Despite this document only a minority of UK hospitals provides 24/7 cover. In the majority delivery of IR services is varied from none to a system based on good will. The document recommendations (see below) will be discussed. Recommendations: Individual departments and trusts: 1. Recognition that in the absence of provision of IR services

patients will be placed at risk. 2. There should be clarity within the trust and among referring clinicians and service commissioners about what interventional radiology services are available and when they are available. 3. Clear pathways should be in place for treating patients appropriately when the interventional radiology service is not available. 4. Out-of-hours service provision must be subject to a formal rota. 5. There should be recognition of the resource implication of supporting a 24-h interventional service in terms of diagnostic imaging and manpower. 6. Onward referral pathways must be clear. **RECOMMENDATIONS:** Individual radiologists: 1. All doctors are bound to adhere to General Medical Council (GMC) guidance and must comply with the principles and values set out in GMC Good Medical Practice. 2. Radiologists should not normally carry out procedures with which they are unfamiliar. 3. Radiologists should recognise that ad-hoc on call rotas are not in the best interest of patients. 4. It is the duty of the radiologist to report any risk management concerns to the trust's clinical governance committee.

### 1520 Models of delivery

Nicholson, T.

*Leeds General Infirmary, Leeds, UK*

Interventional radiology is a subspecialty of radiology. Though very important to patient management, there is insufficient requirement for all trusts to run elective services with a workforce large enough to staff local emergency services. The latter are vital and all patients should have access in an equitable NHS. In this respect IR is no different to many other specialities like neurosurgery or interventional cardiology. There is no one solution in the provision of 24 h interventional radiology. This talk will focus on possible solutions using models from other countries and other specialities. The audience may have ideas not thought about yet.

### 1545–1730

#### Molecular imaging for the radiologist

1545 PET

Nunan, T.

*St Thomas' Hospital, London, UK*

No abstract submitted.

1610 SPECT

Mohan, H.

*Guy's and St Thomas' NHS Foundation Trust, London, UK*

No abstract submitted.

1640 The exotic modalities: MRI and ultrasound

Schaeffter, T.

*King's College London, London, UK*

Classically, medical imaging modalities like MRI, ultrasound provide structural information of patient's bodies. The images obtained by these modalities have high spatial resolution and good/excellent temporal resolution. Furthermore, MRI is capable of measuring a wide range of endogenous contrast mechanisms. In contrast to this, nuclear imaging like PET or single photon emission computed tomography (SPECT) provide functional information by measuring the spatial distribution of radionuclides in the body. Recent advances in molecular biology and chemistry have resulted in the development of targeted contrast agents, which carry a recognition element for binding to a certain molecule. Imaging the distribution of these targeted agents can highlight specific molecules or molecular processes. Although the main developments for such "molecular imaging" approach have been achieved in PET and SPECT, targeted agents have also been developed for MRI and ultrasound. In addition to the development of the targeted agents there is also ongoing research on new MR and ultrasound techniques for the sensitive detection and quantification of contrast agents. In this presentation, MR and ultrasound techniques will be described to detect and to estimate small concentrations of contrast agents and *in vivo* applications will be given. In particular, the sensitivity of both imaging modalities will be discussed. Finally, the development of new hybrid systems (PET-MR and MR-ultrasound) and their applications will be presented.

### 1705 Looking ahead: the future of molecular imaging tracers

Blower, P.

*King's College London, London, UK*

Imaging tracers have come far in the last half-century. Many of the early radiopharmaceuticals, developed more by happy accident than by design, are still used routinely. Some may be reclassified from functional to molecular agents since we now know something about the mechanism by which they are taken up in their target tissue. For example, imaging with radioiodine may now be described as molecular imaging of expression of the sodium/iodide symporter (which was undiscovered at the time of the first thyroid scans) rather than "thyroid function". Increased knowledge of mechanism of both molecular disease processes and the pharmacology of tracers, coupled with improved methodology for making tracers, is the basis for widening applications beyond those where molecular imaging is now routine. The complementarity of different imaging modalities provides a rationale for combining them in productive ways. PET/CT and SPECT/CT are now established, but PET/MR and PET/ultrasound are on their way and present new opportunities for multimodality tracer design for new purposes, especially using nanoparticulate constructs. The involvement of more chemists, and better communication between them and other disciplines (medicine, physics, biology) is leading to better understanding of what problems need to be solved and what features are required of good tracer, and in turn to better sensitivity, specificity and availability. If this now vigorous interdisciplinary research is allowed to flourish and translate to clinical application under the increasingly onerous regulatory burden, patients will see the benefit in terms of better availability, more accurate diagnosis and more rapid drug development.

### 1600–1730

#### Focus on pancreatic imaging

1600 Cystic masses in the pancreas

Amin, Z.

*University College London Hospital, London, UK*

No abstract submitted.

1630 Pancreatic carcinoma: refresher on imaging techniques and staging

Sheridan, M.

*St James's Hospital, Leeds, UK*

No abstract submitted.

1700 The role of imaging and intervention in pancreatitis

Fotheringham, T.

*Bart's and the London NHS Trust, London, UK*

**KEY LEARNING OBJECTIVES:** Why, when, how and who to image. Use of ongoing imaging and interventions in severe pancreatitis. **DESCRIPTIONS:** Appropriate imaging with ultrasound, CT, MR plays a vital role in the diagnosis of pancreatitis. The management of pancreatitis and its complications (collections, abscesses, haemorrhage and biliary obstruction) involves many interventional procedures, both non vascular and vascular interventions. Managing the complications using percutaneous interventions significantly reduces the need for surgery. The radiologist needs to be involved in the clinical management to ensure that the correct imaging is undertaken and there is optimal management of percutaneous drains. **CONCLUSION:** Imaging and interventions play a vital role in the management of acute pancreatitis. Patients with severe pancreatitis frequently require multiple visits to the imaging department for percutaneous interventions.

### 1600–1730

#### BAMRR session

1600 MRI of the "epilepsy" patient

Bigley, J.

*University of Sheffield, Sheffield, UK*

This talk reviews the 2004 NICE guidelines for MRI in epilepsy with the main distinction being between generalised tonic clonic epilepsy and focal epilepsy. We will consider the criteria adopted locally in Sheffield in order to determine whether patients have a standard brain MR scan or a dedicated epilepsy scan. An overview of the sequences used for the dedicated epilepsy protocol on the 3T scanner at the University of Sheffield will follow along with the reasoning behind the selection of these sequences. This includes whole brain  $T_2$  weighted and  $T_1$  volumetric imaging, high resolution imaging of the hippocampi and  $T_2$  relaxometry of the head of the hippocampi. Additional sequences and advanced imaging techniques such as spectroscopy and functional imaging are also considered. A small selection of images that demonstrate the many types of pathology that can cause epilepsy such as hippocampal sclerosis, heterotopia and cortical dysplasia will be shown.

#### **1630 Low grade glioma imaging: a clinical protocol for 3T MRI**

Darwent, G.

*University of Sheffield, Sheffield, UK*

**INTRODUCTION:** A recent review paper in neuroradiology discussed whether low grade tumour behaviour could be predicted from imaging features and concluded that it is now possible for specific imaging techniques to allow some prediction of low grade tumour behaviour. **AIMS:** This talk will describe the MRI protocol routinely used on a Philips Intera 3T MRI scanner in the University of Sheffield MRI Unit for imaging patients with low grade gliomas, discuss why this protocol is used and describe the imaging features associated with this type of pathology on the MR sequences selected. **OUTCOMES:** This talk will give an appreciation of the 3T MRI protocol used and why and briefly discuss if a protocol performed on a higher field strength scanner can help predict low grade glioma behaviour.

#### **1700 MRI safety update 2010**

Condon, B.

*Institute of Neurological Sciences, Glasgow, UK*

Safety in the MR environment is a rapidly evolving subject and the lecture will attempt to deal with up-to-the minute issues and concerns. At the time of writing of this abstract these are envisaged to include: The EU Physical Agents Directive; Lessons to be learned from recent adverse incidents; Construction of a freely accessible implant safety database for common UK implants; How "local" must Local Rules be: do we need to keep re-inventing the wheel?

#### **1615–1730**

##### **Musculoskeletal tumours**

##### **1615 Back to basics: plain films appearances of benign and malignant bone tumours**

O'Donnell, P. G.

*The Royal National Orthopaedic Hospital, Middlesex, UK*

This talk will attempt to explain an approach to the analysis of the plain film appearances a focal bone lesion. By assessing the individual features of the lesion (pattern of bone destruction, the edge of the lesion, the periosteal response, the type of cortical reaction and the presence of an extra-osseous mass), some conclusions about the rate of growth, and therefore likelihood of local aggression, can be reached. Slow growth usually suggests a benign or slow-growing non-neoplastic lesion, whereas rapid growth more usually suggests a malignant or aggressive non-neoplastic lesion. Mineralization of the matrix allows determination of the tissue of origin, but may not help to determine if the lesion is benign or malignant. Non-radiographic features, such as the age of the patient and the location of the lesion (which bone, location within that bone) will narrow the differential diagnosis even before the plain film is examined.

##### **1640 Malignant tumours of bone: integrating ultrasound, MRI and PET/CT**

James, S. L. J.

*The Royal Orthopaedic Hospital NHS Foundation Trust, Birmingham, UK*

Primary malignant tumours of bone are rare and encompass a broad spectrum of diagnoses as outlined by the World Health Organization (WHO) in 2002. It is important to recognise that whilst this provides a seemingly clear demarcation between pathological processes no system is all encompassing. When considering a potentially neoplastic lesion of bone one needs to consider other conditions which can present clinically and resemble radiologically a primary bone malignancy. This will on occasion include traumatic or stress related injury, reactive and infective lesions. A logical approach is therefore required and can aid greatly in the formulation of a differential diagnosis that allows recommendations for further imaging and biopsy to be made. In some instances, certain imaging characteristics are sufficiently diagnostic for a benign or non-neoplastic lesion that radiographs suffice and further more complex imaging is not indicated. Often, however, both radiological and histological examination is required and it is vital that both assessments are performed in conjunction rather than taken in isolation. The aim of this lecture is to review the imaging features of malignant tumours of bone. There are clearly a number of imaging modalities available to the radiologist when investigating any lesion however radiographs still provide the mainstay in diagnosis and are mandatory in all cases. This will have been addressed in the previous lecture. The role and relative value of ultrasound, CT, MRI, bone scintigraphy and PET in both diagnosis and staging is presented.

#### **1705 Evaluation of soft tissue masses**

Raby, N.

*Glasgow Western Infirmary, Glasgow, UK*

What is the "Whoops" lesion and why is it still alive and well in 2010? Why are the NICE guidelines wrong and why do they perpetuate serious errors in management of soft tissue tumours. Which patients should be referred to the sarcoma service and which can be safely managed locally? This talk will address the above issues. The aim will be to advise and inform the general radiologist how to undertake safe evaluation of soft tissue lesions. Common errors will be described with a simple algorithm for safe patient management.

#### **1615–1715**

##### **Service delivery keynote & scientific session III**

##### **1615 Please help us put out fires!**

Jenkinson, D.

*The Royal Bournemouth & Christchurch Hospitals NHS Trust, Bournemouth, UK*

Timely and effective imaging is key in the management of transient ischaemic attack and acute stroke. Both the National Stroke Strategy and the Guidelines from the National Institute for Health and Clinical Excellence contain a framework for the performance of such imaging. The guidance is clear, challenging and, in some instances, inconsistent. In this presentation the standards will be rehearsed, national performance will be described, challenges and opportunities will be presented and examples of innovative and productive imaging practice will be outlined.

##### **1645 12 months experience of a formal interventional radiology on call service in a DGH setting**

Macanovic, M., Leonard, A., Isaacs, J., Seymour, R., and Kember, P.

*South Devon Healthcare NHS Foundation Trust, Torbay, UK*

**PURPOSE:** Recent report by the Department of Health has identified interventional radiology (IR) as "a key component of an emergency service in an acute hospital". Many NHS trusts remain unable to provide an out-of-hours service. We report on our experience of setting up a formal on call IR service at Torbay Hospital, a District General Hospital serving a population of 280,000. **MATERIALS/METHODS:** Service started in April 2009 and is staffed by 3 Interventional Radiologists who no longer participate in the general on-call rota. We describe the process of setting up the service and compare our activity following introduction of the service with the activity data for the preceding 12-month period. For each case we have asked clinicians to comment on

whether they thought the patient would have been suitable for transfer to a nearby unit had a network service been organised. **RESULTS:** In the initial 7 months, our on call activity increased three-fold. The service had an added effect of increasing the demand for interventional procedures during working hours. A significant proportion of on call cases have been deemed haemodynamically unstable for transfer to another unit within a potential network. The full 12-month results are awaited. **CONCLUSION:** A formal IR on call service leads to a significant increase in the out-of-hours interventional workload and raises clinicians awareness of the role of IR. Despite the high frequency of on call, the workload has proved manageable in the short term, but the long-term sustainability of the service remains uncertain.

#### **1655 Day case lower limb angioplasty is safe: time to set up a radiology interventional out patient service**

Galea, A.

*Peninsula Radiology Academy, Plymouth, UK*

**PURPOSE:** To evaluate the incidence and timing of complications and their predictors after peripheral vascular interventions with a view to changing current practice and performing these cases on an outpatient basis. **MATERIALS/METHODS:** 117 angioplasty procedures in 114 patients were analysed retrospectively. All procedures were performed by two experienced interventional radiologists. Incidence and timing of complications were documented. Patient risk factors and angioplasty determinants vs complication rate were analysed using logistic regression. **RESULTS:** The total complication rate was 25% (29/117). There were four deaths (3%). 15/29 (52%) of complications were evident before the patient had left the intervention suite; 6/29 (21%) were evident within 0–4 h; 2/29 (7%) within 4–24 h and 6/29 (21%) after 24 h. There were significantly more complications in smokers'  $p$ -value 0.027; in patients referred with critical ischaemia  $p$ -value 0.016 and in procedures where a sheath size of 6Fr or larger was used  $p$ -value 0.039. **CONCLUSION:** The majority of complications, 73% occurred within 4 h of the procedure. Only 2 complications occurred within 4–24 h and there was no significant morbidity in this group. These results suggest that it is safe to perform lower limb angioplasty on a day case basis with 4 h monitoring post procedure in a suitable unit. Our study highlighted an increased risk of complications in smokers, patients with critical ischemia and procedures where a large sheath size was used. These patients need closer monitoring post-procedure.

#### **1705 Can radiographers stretch to bridge the gap in interventional radiology?**

Parker, D.

*Selly Oak Hospital, Birmingham, UK*

**KEY LEARNING OBJECTIVES:** The number of patients undergoing interventional vascular procedures and MRA for diagnostic

procedures is increasing annually. Following a protracted vacancy for an interventional radiologist post, it was proposed to train a radiographer to carry out diagnostic angiography and angioplasty. This was undertaken with the aim of reducing patient waiting time and to increase service flexibility. **DESCRIPTION:** Under the supervision of interventional radiologists an experienced radiographer was trained to carry out angiography. Following an audit of the diagnostic cases, training was then extended to angioplasty. The results of these cases were audited and compared to results achieved by consultant interventional radiologists, registrars and to The Royal College of Radiologists Guidelines. It was then decided to further this extended role to include the insertion of both stents and vascular closure devices. During the period of this role extension, the radiographer carried out examinations on over 800 patients and undertook interventional procedures in over 450 of these cases. **CONCLUSION:** A suitably experienced and trained radiographer has acquired the necessary skills to carry out diagnostic angiography, angioplasty and stenting. As a result this has directly increased the responsiveness, productivity and flexibility of the service.

#### **1645–1700**

#### **Rock and roll radiology – Two years experience of bringing radiology to the Glastonbury Music Festival**

#### **1645 Rock and roll radiology – two years experience of bringing radiology to the Glastonbury Music Festival: an update**

Regi, J.

*Severn Radiology School, Bristol, UK*

**DESCRIPTION:** In 2008 we set up an imaging service at the Glastonbury festival as part of the medical provision supplied by Festival Medical Services (FMS). This included access to digital radiography and ultrasound 24 h a day for the doctors treating the 200,000 festival goers. We reported our experience last year at the UKRC. In 2009, the imaging team was invited back to provide an expanded service. This year we increased the number of Radiographers and there was a 50% increase in the number of plain films examinations taken and reported. We expanded our ultrasound service with Toshiba providing us with a Viamo portable ultrasound system. We doubled the number of ultrasound examinations, providing O&G scanning for the first time to deal with the increasing numbers of pregnant patients attending the festival. **CONCLUSION:** After 2 years the imaging service is now an integral part of the medical provision at the Glastonbury Festival. The ultrasound service is still underutilised but we expect our increased profile will lead to more requests. We expect a further 50% increase in requests next year and are looking into further service provision.

# Scientific programme abstracts Wednesday 9 June

## 0830–0930

### Body MRI school: Prostate and bladder

#### 0830 Imaging the prostate

Patel, U.

*St George's Hospital, London, UK*

NICE guidelines advocate MRI staging only for those with high risk prostate cancer – higher PSA ( $>20$  ng ml<sup>-1</sup>), Gleason 4 architecture or suspected T3/4 disease. Thus not all men with prostate cancer would benefit from MRI of the prostate. Much has been written regarding newer MRI techniques such as diffusion weighted MRI or dynamic enhanced MRI but most MRI staging is carried out using 1.5T machines and standard  $T_1$  weighted and  $T_2$  weighted sequences. If there is no post biopsy artefact, this is adequate. Post biopsy artefact, believed to represent haemorrhage is a constant confounder, and studies should be delayed for  $>3$  weeks or longer (some studies have shown some artefact even 3 months after biopsy). Studies carried out too early are only good for nodal staging. In the authors view, the basic studies necessary are high definition  $T_1$  weighted and  $T_2$  weighted axial and coronal views of the prostate and axial studies of the pelvis; but sagittal views also have value. Why these are essential will be demonstrated, and a stepwise analytically method described. The specific signs of extra-capsular spread and how their reliability will be illustrated. The diagnostic accuracy of standard MRI techniques will be discussed and the method of conveying the diagnostic certainty will be explained. There is a growing interest in pre-biopsy MRI. In the authors view this is where the use of DWI and/or DCE are of most promise, and again a step wise analytical method will be described and how to convey the geographical information for biopsy targeting.

#### 0900 Imaging the bladder

Sahdev, A.

*Barts and the London Hospital, London, UK*

Bladder cancer is the 7th most common cancer the UK and accounts for 10,000 new cases annually. 70% of bladder cancer is transitional cell carcinoma (TCC), superficial and non-invasive at presentation and these patients do not require routine MRI as part of their management. Invasive bladder TCC has a poor prognosis and requires MR staging prior to treatment. MRI has better staging accuracy compared to CT. This presentation aims to demonstrate the typical MR appearances of invasive and advanced bladder cancer. The accuracy of MR signs and appearances at various stages of the cancer is described. MRI is also used in detecting early recurrent disease following surgery and the common appearances of such recurrent disease are demonstrated. Assessment of tumour response to adjuvant chemo-radiotherapy when used to downstage the cancer prior to surgery introduces pitfalls in the assessment of residual tumour stage. Common pitfalls encountered during routine MR staging and at restaging are demonstrated and techniques overcoming these pitfalls and improving the staging accuracy are included in the presentation. The MR appearances of rarer bladder tumours which alter the patients' management are briefly discussed to alert the reporting radiologist thereby preventing inappropriate surgery. The evolving use of novel techniques including diffusion weighted imaging and dynamic contrast enhanced MRI is discussed with emphasis on future benefits these techniques may offer in the management of bladder cancer.

## 0830–0930

### A guide to PET/CT in the MDT

#### 0830 Indications for PET/CT and principles for optimal images

Johnston, C.

*St James's Hospital, Dublin, Ireland*

PET/CT examinations form an integral part of the staging investigations for many cancer patients. Non-nuclear radiologists

involved in oncology MDTs are often reluctant to provide an opinion on PET/CT examinations. This session is aimed at providing an overview of the current indications for PET/CT in oncology, with a brief overview of how images are acquired and interpreted. Patient variables and system variables that can be modified in order to provide optimal image quality will be described. The utility of the technique as a problem solving technique in atypical clinical scenarios will be shown with examples.

#### 0900 Principles of interpretation of PET/CT within the MDT: pitfalls and perils

Wong, W. L.

*The Paul Strickland Scanner Centre, Hertfordshire, UK*

No abstract submitted.

## 0830–0930

### Non-invasive autopsy

#### 0830 Imaging the deceased adult

Traill, Z.

*Oxford Radcliffe Hospital, Oxford, UK*

No abstract submitted.

#### 0900 Imaging the deceased child

Taylor, A.

*UCL Institute of Child Health & Great Ormond Street Hospital for Children, London, UK*

Despite the indisputable benefits of post-mortem assessment, there has been a global reduction in autopsy rates over the last two decades. This decline has been primarily due to parental refusal, but other issues relating to the scandal surrounding organ retention and legislation with regard to the Coroners' and Human Tissue Act have also contributed. Less invasive autopsy using post-mortem imaging (MRI and CT) has been proposed as an alternative to conventional autopsy. Several hospitals and HM Coroners' now offer post-mortem MRI, to parents/next of kin who refuse conventional autopsy, particularly in cases where there are religious reasons for refusal. A new subspecialty of post-mortem (forensic) imaging has been proposed and experts have called for wider uptake of less invasive autopsy methods. This presentation will focus on the role of less-invasive imaging for the post-mortem assessment of foetuses, neonates and children, and will: Review the literature that has accumulated over the last decade for post-mortem MRI as an alternative to conventional autopsy; Present data from recent studies on consent issues for research in HM Coroners' cases; the use of high field (9.4T) MRI for assessment of foetuses; and the use of 3D data to provide accurate measured of organ mass and build 3D models; Present preliminary data, from a blinded study, on the accuracy of post-mortem imaging in the assessment of foetuses, neonates and children compared with conventional autopsy; Present possible scenarios for a comprehensive and accurate approach to less invasive post-mortem assessment.

## 0830–0930

### Fundamentals of Digital Radiography (DR)

#### 0830 The basics of the digital image and DR

Kotre, J.

*Freeman Hospital, Newcastle-upon-Tyne, UK*

No abstract submitted.

#### 0900 Radiography practice with DR

Dash, R.

*Teeside University, Middlesbrough, UK*

No abstract submitted.



0830–0930

**Education & training scientific session****0830 How sonographers break bad news: the temporal nature of prenatal ultrasound**

Cantlay, N.

*University of Cumbria, Lancaster, UK*

**PURPOSE:** To investigate how sonographers break bad news of foetal abnormalities during prenatal ultrasound scans. Ultrasound has become a routine part of prenatal care offered to all pregnant women in the UK. Over the past decade sonographers have become the most likely health professionals to break bad news of foetal abnormalities detected during routine obstetric scans. Much research has been carried out from the patient's perspective, but little has been undertaken from that of the sonographer. There is consequently a lack of advice specifically tailored to help sonographers break bad news. **MATERIALS/METHODS:** An Interpretative Phenomenological Analysis (IPA) study ( $n=12$ ) was carried out using in-depth interviews with experienced female sonographers. Interview transcripts were analysed thematically using a hermeneutic approach. **RESULTS:** Time emerged as a unifying theme in all the participants accounts of breaking bad news. The scan could be divided into five temporal segments: First impressions, control, discovery, disclosure and closure. The sonographers' approach during each segment affected the way bad news was ultimately delivered and how they felt the patient had coped with it. Practical elements emerged from each segment which were geared to opening up a disclosive space in which time could flow freely. The latter allowed both practitioner and patient to move forward throughout the experience. **CONCLUSION:** Understanding the structure of a "bad news" scan and identifying practical solutions may assist in training and advising sonographers in the future.

**0840 Film viewing in the classroom: feeling our way through**

Adams, C.

*Cardiff University, Cardiff, UK*

**PURPOSE:** The College of Radiographers stipulated that, by 2010, image interpretation knowledge and skills must be embedded in all undergraduate diagnostic radiography degree programmes, yet in the same year it was declared that we still do not understand the process of learning that underpins becoming a good reporting radiographer. This tension between expectation and provision became one of the drivers for this doctoral research project. An accompanying driver was the Dearing Report of 1997 that proposed lecturers should have a core pedagogic knowledge of their own discipline. **DESCRIPTION:** Qualitative methods are not commonplace when researching medical image interpretation; however the researcher chose an inductive (auto-ethnographic and ethnographic) approach to explore classroom interactions during film viewing and related image interpretation sessions. Data were collected at a micro-level within one diagnostic radiography undergraduate programme and over a period of 2 years. Tools used were class room observations, field notes and DVD recordings. Participants included neophyte and experienced student radiographers, radiography lecturers and clinical specialists. **FINDINGS:** The original aims of the project were set around unpicking skills and tacit knowledge involved in image interpretation, yet analysis of data moves the original research question away from how radiographers learn to see to the surprising spheres of embodiment, gesture and touch. These findings have important implications for how our students could be educated, how we interact with the media of our images and ultimately our ability in image interpretation.

**0850 Junior doctors' knowledge of diagnostic imaging techniques – a five centre audit**Mullett, R.<sup>1</sup>, Chawla, S.<sup>1</sup>, Thomson, E.<sup>2</sup>, Hanlon, R.<sup>1</sup>,  
Mirsadraee, S.<sup>2</sup>, and Tolan, D.<sup>2</sup><sup>1</sup>*Aintree University Hospitals NHS Trust, Liverpool, UK,*<sup>2</sup>*Leeds Teaching Hospitals NHS Trust, Leeds, UK*

**PURPOSE:** To determine the level of knowledge of common diagnostic radiological investigations amongst FY1s across five centres in West Yorkshire and Merseyside. **MATERIALS/METHODS:** A questionnaire was devised to audit knowledge of 12 common investigations (plain film, CT, MRI, fluoroscopy studies, bone and V/Q scans) to determine: Which investigations our cohort had requested/observed; The level of knowledge of: Safety issues, *e.g.* radiation dose, contraindications; Practical procedural aspects, *e.g.* preparation, contrast use. **RESULTS:** Of our 106 responses, the cohort had ordered an average of nine different investigations but only observed four. Radiation dose knowledge was poor with the doctors knowing the correct dose for 14% of the investigations, most underestimating dose. Most (93%) identified some important safety considerations (pregnancy, renal impairment and contrast allergy) in CT. Only 59% recognised the possibility of adverse effects from Metformin use. Concerning MRI, 45% thought metallic joint replacement was a contraindication and 28% did not recognise pacemakers as contraindicated. The cohort recognised the pre-procedure preparation for 68% and the usual patient position for 64% of the procedures. 34% thought that abdominal radiographs were usually performed erect. All those questioned recognised a need for further teaching about these investigations. We have started to implement teaching sessions to meet this need. **CONCLUSION:** This audit demonstrates a lack of basic knowledge of radiological investigations amongst FY1s. This may reflect lack of exposure and training in medical school and during FY1. Having implemented a change to improve this, we will re-audit at an appropriate time interval.

**0900 Radiographer reporting of routine CT examinations of the head: a measure of agreement between appropriately trained radiographers and consultant radiologists**Clarkson, L.<sup>1</sup>, Atherton, G. M.<sup>2</sup>, and Arnold, P.<sup>2</sup><sup>1</sup>*University of Bradford, Bradford, UK,* <sup>2</sup>*University of Leeds, Leeds, UK*

**PURPOSE:** The purpose of this study is to measure agreement in CT head reporting between appropriately trained radiographers and consultant radiologists. **METHOD:** The assessment portfolios of 57 students from a CT head interpretation course in the North of England were analysed. Each portfolio consisted of a minimum of 200 cases where a routine head CT scan had been double reported by a radiographer and a consultant radiologist. The radiologist reviewed the radiographer's report and identified minor errors, (not affecting patient management) and major errors (affecting patient management). The total number of double reported cases included in the study was 11,517. The radiologist reported 5,975 of these cases as abnormal and 5,542 cases no radiological abnormality was reported. Radiographer and radiologist findings were recorded as into a contingency table as nominal data (normal and abnormal). Agreement was measured using Cohen's kappa ( $\kappa$ ). Only major errors were recognised as significant. Relative sensitivity, specificity and overall agreement were also measured against the consultant radiologist standard. **RESULTS:** Sensitivity and specificity (95%CI) for the radiographers were 98.22% (97.68 to 98.76) and 99.15% (98.82 to 99.48), with mean accuracy 98.70% (98.34 to 99.06). Observed agreement between radiographers and consultant radiologists was:  $\kappa=0.97$  (0.938 to 1). **CONCLUSION:** These findings suggest that, with appropriate training, radiographers can report both normal and abnormal radiological appearances on CT head scans to a standard comparable with consultant radiologists. Further research is needed to analyse the minor differences between radiographer and radiologist reports to allow a more complete comparison.

**0910 Back to basics: implicit vs explicit questions and their impact on a focused report**Haroon, A.<sup>1</sup> and Matthew, A.<sup>2</sup><sup>1</sup>*University Hospitals of Leicester, Leicester, UK,* <sup>2</sup>*Queen Margaret Hospital, Dunfermline, UK*

**OBJECTIVE:** To study the impact of implicit and explicit questions on radiology reporting and to assess how and whether the question

has been answered. We also aimed to address the factors in a request which alter a focused report. **METHODOLOGY:** We retrospectively reviewed 100 requests sent to the radiology department for plain film imaging. We assessed whether an identifiable question has been asked? If yes, what is the question? Whether the question is implicit or explicit and whether that question has been answered in the report. **RESULTS:** Out of 100 request cards, a total of 49 stated an identifiable question. A total of 48 were implicit and 47 were explicit question. We were unable to put 5 requests into any category due to the wording of the request. Out of 100 reports, 89 reports answered the question. The question was addressed in 99 reports. Of the 47 explicit questions all of those were answered and addressed. The implicit questions (48) were answered and addressed in 40 and 48 reports, however 8 were not answered at all. **CONCLUSION:** An identifiable question should be asked in a request. An explicit question is more likely to be addressed and answered. An implicit question affects a focused report more than an explicit question. An identifiable question is a key for better communication between a clinician and a radiologist.

#### **0920 The radiologist's report – what the clinician likes to see**

Chaudhry, M. A.<sup>1</sup>, Chawla, S.<sup>1</sup>, Mullan, D.<sup>2</sup>, Katti, A.<sup>1</sup>, and Nedumaran, A.<sup>1</sup>

<sup>1</sup>University Hospital Aintree, Liverpool, UK, <sup>2</sup>Royal Liverpool University Hospital, Liverpool, UK

**KEY LEARNING OBJECTIVES:** Radiologists aim to provide the clinician with the highest quality of radiology reports as this is the key manner in which information is conveyed between the two. These reports can take different formats namely a paragraph or bullet point layout with a summary/conclusion usually mentioned in both cases. **DESCRIPTION:** A prospective survey over a 2-week period (November 2009) was conducted to evaluate clinician preferences for the format and content of the radiology reports. All clinician grades at University Hospital Aintree were invited to complete a questionnaire comprising of ten parts. Currently, there are no published standards. There were 60 respondents. 12 (20%) preferred paragraphs and 48 (80%) bullet points. 26 (43%) liked to read descriptive reports and 34 (57%) concise reports. 56 (93%) felt a conclusion was beneficial whereas 4 (7%) did not. The overall clarity and satisfaction with reports was deemed on average to be 3.4 (1–5 scale) for both parameters. **CONCLUSION:** Our survey concluded that the bullet points format is the primary choice. A conclusion was seen to be overwhelmingly beneficial and the overall satisfaction with reports was of a high standard. It is important to structure the report in a format which will maximise information transfer from the radiologist to the clinician. Knowing the clinicians' preferences in this area will help maintain clear communication between the two hence benefiting the patient. Future intention includes establishing standards and re-surveying at an appropriate time interval.

### **0900–1140**

#### **Musculoskeletal ultrasound workshop**

##### **0900 Ultrasound of the wrist and live demonstration**

Dunn, A. J. and Hifz, A.

*Royal Liverpool University Hospital, Liverpool, UK*

**PURPOSE:** Understand the technique of routine ultrasound examination of the wrist, including basic dynamic scanning manoeuvres. Identify normal variants, common pathology and sonographic pitfalls. **MATERIALS/METHODS:** The wrist is a complex anatomical region that is well suited to ultrasound evaluation. A detailed knowledge of anatomy, anatomical variants and sonographic pitfalls is key to providing an accurate, reproducible examination. Ultrasound is the modality of choice for the assessment of most extrinsic soft tissue pathology in the wrist such as tendonopathy, synovitis and some ligamentous injuries. Many soft tissue tumours and tumour-like conditions of the wrist are also accurately assessed with ultrasound. Evaluation of the triangular fibro-cartilage complex, osseous structures and intrinsic wrist ligaments is best performed with

MRI. This session describes an anatomical, systematic ultrasound technique for assessing the wrist and hand and will incorporate some basic dynamic techniques used to evaluate particular structures such as the ulnar collateral ligament of the thumb and the flexor tendon pulley system. Some sites of common sub-clinical sonographic lesions will be described in addition to covering examples of commonly encountered pathology of tendons and peri-articular soft tissue structures. The anatomy of the major neural structures will be demonstrated along with the potential sites for nerve entrapment in the wrist. **CONCLUSION:** A systematic and dynamic sonographic examination of the wrist and hand provides a rapid, accurate and reproducible method for evaluating the majority of extrinsic soft tissue pathology. A detailed knowledge of the complex anatomy and sonographic variants is essential.

#### **0940 Ultrasound of the shoulder and live demonstration**

Hifz, A. and Dunn, A.

*Royal Liverpool University Hospital, Liverpool, UK*

**PURPOSE:** To understand the technique of routine shoulder ultrasound examination and to identify common lesions of shoulder on ultrasound. **MATERIALS/METHODS:** Shoulder is most mobile joint in the body and rotator cuff tendons are the main stabilizers of the joint. After the age of 40, main cause of shoulder pain and limited movement are adhesive capsulitis and shoulder impingement with or without rotator cuff tear. Rotator cuff tear occur due to combination of intrinsic and extrinsic factors. Intrinsic factors include tendon degeneration due to reduce vascularity. Extrinsic factors are acromial shape, subacromial spur or acromioclavicular joint impinging osteophyte. Supraspinatus tendon is most commonly affected. Early diagnosis for the presence of cuff tear is important as delayed diagnosis may lead to retracted fixed tendon which is difficult to reconstruct. Ultrasound is the investigation of choice for rotator cuff lesions. It is well tolerated and cost effective. However, its efficiency is reduced in obese patients and patients with limited shoulder mobility. In expert hands, ultrasound can used to diagnose cuff tendon abnormalities like, tendinosis, partial or full thickness tears and calcific tendinosis. Subacromial subdeltoid (SASD) bursa, long head of biceps and acromioclavicular joint can also be well visualized. Ultrasound can also be used to perform guided injections into the SASD bursa, acromioclavicular and glenohumeral joint. We present technique of ultrasound examination of shoulder and how common shoulder pathologies appear on ultrasound. **CONCLUSION:** In expert hands ultrasound is investigation of choice to diagnose rotator cuff tendons lesions.

#### **1020 Ultrasound of the knee and live demonstration**

Elias, D. and Groves, C.

*King's College Hospital, London, UK*

No abstract submitted.

#### **1100 Ultrasound of the ankle and live demonstration**

Groves, C. and Elias, D.

*King's College Hospital, London, UK*

No abstract submitted.

### **1000–1200**

#### **Keynote: Testis ultrasound & GU scientific session**

##### **1000 Ultrasound of the painful scrotum**

Sidhu, P.

*King's College Hospital, London, UK*

Acute scrotal pain is a common urological emergency for which epididymo-orchitis is the most common cause. The most important diagnostic distinction to be made in patients presenting with acute scrotal pain is between acute spermatic cord torsion and the other causes of acute scrotal pain. The treatment for acute spermatic cord torsion is urgent surgical exploration to maintain viability of the testis and avoid testicular infarction. Diagnostic accuracy is therefore

imperative in order to identify those patients that require immediate surgical intervention as well avoiding unnecessary surgery in patients with a non-surgical cause for acute testicular pain. In the emergency setting, the ready availability of greyscale ultrasound, with the ability to assess testicular vasculature on colour Doppler, allows ultrasound to remain as the imaging modality of choice. Clinical examination can be notoriously inaccurate in distinguishing the causes of acute scrotal pain. In particular, the clinical discrimination between acute epididymo-orchitis and spermatic cord torsion can be virtually unachievable; imaging may play an important role. Familiarity with the ultrasound features of common causes of acute scrotal pain is therefore a necessity for the emergency on-call radiologist in order to provide complementary information for the clinical team to aid accurate diagnosis in these patients.

### 1030 Diffusion weighted magnetic resonance imaging (DW-MRI) in the assessment of tumour response to novel targeted therapies in metastatic renal cell carcinoma (mRCC)

Bharwani, N., Miquel, M., Sahdev, A., Powles, T., Reznick, R. H. and Rockall, A.

*Barts and The London NHS Trust London, UK*

**PURPOSE:** DW-MRI has been proposed as a potential biomarker for assessment of treatment response. Our aim was to evaluate the role of DW-MRI in the semi-quantitative assessment of mRCC response to sunitinib. **MATERIALS/METHODS:** 9 patients (66±9 years; 7 male) with mRCC were recruited in a prospective study. 1 died before completion. Analysis performed on 8 patients. DW-MRI (Philips Achieva 1.5T) and CT staging were performed prior to sunitinib and following 3 cycles. Patients underwent pre-treatment biopsy followed by nephrectomy at completion of treatment. 2 readers independently measured the mean apparent diffusion coefficient (ADC) of primary tumour, metastatic deposits, involved nodes, normal contralateral kidney and spleen. Inter-observer variability of ADC values was calculated. **RESULTS:** All patients had clear cell RCC. All primary tumours were heterogeneous on MRI. Mean tumour ADC (10–3 mm<sup>2</sup> s<sup>-1</sup>) was 1.35±0.25 pre- and 1.47±0.31 post-treatment (non-statistically significant difference). There was a good agreement between readers for percentage change in ADC (within 3.5%); differences in absolute tumour ADC between readers were probably due to tumour heterogeneity. Normal renal parenchyma had a mean ADC of 1.89±0.18 pre- and 1.91±0.21 post-treatment. 7 patients with stable disease by RECIST criteria, had a small reduction in tumour size (~5%), 1 patient with partial response on staging CT had a 20% tumour size reduction on MR. **CONCLUSION:** Initial data, on a small sample size, show stability of ADC values in patients with stable disease clinically and by RECIST criteria. Our results show reproducibility of measurements between observers.

### 1040 Accuracy of MRI staging of prostate cancer, with correlation to radical prostatectomy pathology specimens

Kwong, Y., Ahmad, R., and Lloyd, J.

*Nottingham University Hospitals, Nottingham, UK*

**PURPOSE:** MRI is used for the local staging of prostate cancer. It has a role in identifying patients suitable for curative and targeted treatments by differentiating between organ-confined and extra-capsular disease. Recent literature on the accuracy of MRI has focused on the use of an endorectal coil. It is generally agreed that the sensitivity of MRI staging is poor, but good specificity and accuracy can be achieved. The aim of this study was to assess the local performance of MRI using a body coil. **MATERIALS/METHODS:** This was a retrospective study of 43 consecutive patients, who had prostate MRI prior to radical prostatectomy. The tumour stage on MRI was compared with pathologic stage of the histological specimen. The sensitivity, specificity and accuracy of MRI in identifying extra-capsular invasion were calculated. **RESULTS:** MRI correctly identified 28 cases of organ-confined disease and 3 cases of extra-capsular spread, yielding good accuracy of 72% (literature: 51–83%). A high specificity was achieved at 100% (literature: 68–95%). The sensitivity was low as expected, at 20% (literature: 14–84%). **CONCLUSION:** MRI using

a body coil performed favourably compared to endorectal coil. The sensitivity of MRI is limited by its inability to detect microscopic capsular invasion, as no imaging modality can resolve to such level. The significance of microscopic capsular invasion is also debatable, as it may not affect surgical cure. However, we achieved high specificity of 100%. This is important as it indicates that there were no false-positives, and no patients were deprived of potentially curative surgery.

### 1050 Prostate cancer: preliminary evidence of altered texture on CT

Ganeshan, B.<sup>1</sup>, Rajjopat, M.<sup>1,3</sup>, Young, R.<sup>2</sup>, Chatwin, C.<sup>2</sup>, Tremlett, J.<sup>3</sup>, Robinson, A.<sup>3</sup>, and Miles, K.<sup>1,3</sup>

<sup>1</sup>Brighton and Sussex Medical School, Brighton, UK,

<sup>2</sup>University of Sussex, Brighton, UK, <sup>3</sup>Brighton and Sussex University Hospitals NHS Trust, Brighton, UK

**PURPOSE:** This pilot study assessed whether prostate cancer exhibits alterations in texture on CT and the prognostic potential of CT texture. **METHODS:** Texture analysis was retrospectively performed on CT images from 42 patients with prostate cancer. T<sub>2</sub> weighted axial MR images demonstrating areas of tumour and normal prostate were selected for each patient and used to locate corresponding CT images. Texture was assessed on CT in regions of interest manually constructed over the whole prostate gland and distinct areas of tumour and normal prostate tissue, using MR images as a guide. Texture analysis comprised band-pass image filtration to highlight image features at different spatial frequencies between  $\sigma=0.5$  (fine detail) and  $\sigma=2.5$  (coarse features) with quantification of mean grey-level intensity (MGI) in the filtered images. Receiver operating characteristics (ROC) curves assessed the diagnostic potential for CT texture to predict tumour from normal prostate tissue. Gleason score (GS) was used to categorise patients into low (GS < 6, n = 14) and high (GS > 7, n = 27) risk groups. The Mann-Whitney test was used to distinguish low from high risk groups based on whole prostate texture. **RESULTS:** Texture was significantly different between tumour and normal prostate tissue, particularly an MGI of medium texture features ( $\sigma=2.0$ ) below 1.4 predicted the presence of tumour with an area under the ROC curve of 0.875,  $p=0.0001$ , sensitivity of 83% and specificity of 91%. This texture parameter quantified from the whole prostate tissue also distinguished low from high risk patients ( $p=0.0128$ ). **CONCLUSION:** Prostate cancer is associated with altered texture on CT and can potentially provide prognostic information.

### 1100 Ketamine-associated destruction of the urinary tract: a new radiological challenge

Mason, K.<sup>1</sup>, Cottrell, A. M.<sup>2</sup>, Corrigan, A.<sup>1</sup>, Timoney, A. G.<sup>2</sup>, Gillatt, D. A.<sup>2</sup>, and Mitchelmore, A. E.<sup>1</sup>

<sup>1</sup>North Bristol NHS Trust, Bristol, UK, <sup>2</sup>Bristol Urological Institute, Bristol, UK

**PURPOSE:** Ketamine is a short-acting dissociative anaesthetic whose hallucinogenic side effects have led to an increase in its illicit use amongst club and party goers. There is a general misconception amongst users that it is a safe drug with few long term side-effects. However, ketamine abuse is associated with severe urinary tract dysfunction. Presenting symptoms include urinary frequency, nocturia, dysuria and haematuria. **MATERIALS/METHODS:** We describe the radiological findings found in a series of ten patients, all with a history of ketamine abuse who presented with severe lower urinary tract symptoms. Imaging techniques used included ultrasound, intravenous urography (IVU) and CT. These examinations were retrospectively reviewed to identify common imaging findings. All patients had also undergone cystoscopy and bladder wall biopsies. **RESULTS:** CT revealed marked generalised bladder wall thickening, mucosal enhancement and perivesical inflammation. Ureteric wall thickening and enhancement were also observed. In advanced cases ureteric narrowing and strictures were identified using both CT and IVU. Correlation of clinical history, radiological and pathological findings

was performed to confirm the diagnosis. **CONCLUSION:** This case series illustrates the harmful effects of ketamine on the urinary tract and the associated radiological findings. Delayed diagnosis can result in irreversible renal tract damage requiring surgical intervention. It is important that radiologists are aware of this emerging clinical entity as early diagnosis and treatment are essential for successful management.

**1110 The anterior tunnelled percutaneous nephrostomy (ATPCN) – a new procedure to improve quality of life**

Naisby, G., Alkoussayer, O., Harris, M., Scullion, H., Riley, G. T., Gowda, R., Chadwick, D., and Whiteway, J.  
*James Cook University Hospital, Middlesbrough, UK*

**PURPOSE:** ATPCN is a novel technique to improve quality of life in patients with malignant or benign ureteric obstruction by permitting improved independence and comfort. **MATERIALS/METHODS:** Prospective review of case notes (March 2008 to December 2009), diagnosis, previous interventions and complications were recorded. We measured procedure time, pain score, immediate and delayed complications, repeat procedures, nephrostomy replacements and patient survival. Patient “quality of life scores” and “Karnofsky performance status” were collected by nurse specialists immediately after the procedure and at 3-monthly intervals. **RESULTS:** 43 ATPCNs were performed in 26 patients, 38 considered primary (initial procedure as anterior tunnelled) and 5 secondary (converted from traditional posterior PCN). 21 had malignant and 5 benign diagnoses. 19 had failed ureteric stent treatments prior to ATPCN. No significant early complications (defined as significant haemorrhage, septicaemia, visceral damage, urinoma, clot obstruction). Delayed complications included tube blockages (two at 2 months; two at 4 months). Three patients were treated for urinary infection. Patients with secondary ATPCN converted from traditional PCN reported significant improvements in quality of life and independence. **CONCLUSION:** Where ureteric stent placement has failed or is not possible, long term ATPCN should be considered attractive in patients unsuitable for surgical urinary diversion. Long term ATPCN is a safe procedure with improved quality of life scores compared to traditional posterior PCN.

**1120 Mortality and frequency of nephrogenic systemic fibrosis**

Roditi, G.<sup>1</sup>, Collidge, T.<sup>1</sup>, Thomson, P.<sup>1</sup>, Mark, P.<sup>2</sup>, Simpson, K.<sup>1</sup>, Morris, S.<sup>1</sup>, and Traynor, J.<sup>1</sup>  
<sup>1</sup>*Glasgow Royal Infirmary, Glasgow, UK, <sup>2</sup>Western Infirmary, Glasgow, UK*

**INTRODUCTION:** Nephrogenic systemic fibrosis (NSF) is a rare, debilitating condition affecting individuals with severe renal impairment. Mortality is high in reported series but little information exists on mortality compared to a matched population. **METHODS:** Electronic patient records (EPR) used to identify all patients on renal replacement therapy (RRT) from 01/01/2000 to 01/07/2006. NSF and gadolinium based contrast agent (GBCA) exposure identified. Onset of RRT and outcome including date of death recorded. Survival to death or census (01/07/06) determined from either onset of RRT or scan date. **RESULTS:** 1826 patients were identified as having RRT within the 6.5 year study period. 1812 had outcome data. 704 (38.9%) patients died with median survival from RRT onset to death or census was 2.6 years. Median survival for the GBCA exposed cohort was also 2.6 years and median survival from scan to death or census was 2.0 years. Median survival for the gadodiamide exposed NSF population was not significantly different measured by RRT onset or post scan survival. No significant difference found when survival for total RRT cohort minus gadodiamide exposed cohort compared to the NSF population. In total 17 cases of NSF are known to our unit presenting between January 2001 and January 2007. 16 cases were associated with gadodiamide. No further cases have been reported despite increased awareness. **CONCLUSIONS:** Despite poor survival, no significant difference in mortality can be demonstrated between our NSF patients and the RRT population also selected for GBCA exposure.

**1130 A retrospective analysis of nephrogenic systemic fibrosis in a population undergoing renal magnetic resonance angiography stratified by eGFR**

Roditi, G.<sup>1</sup>, Collidge, T.<sup>1</sup>, Rao, A.<sup>1</sup>, Brown, M.<sup>1</sup>, Mark, P.<sup>2</sup>, Simpson, K.<sup>1</sup>, Thomson, P.<sup>1</sup>, and Morris, S.<sup>1</sup>  
<sup>1</sup>*Glasgow Royal Infirmary, Glasgow, UK, <sup>2</sup>Western Infirmary, Glasgow, UK*

**INTRODUCTION:** Nephrogenic systemic fibrosis (NSF) associates with administration of gadolinium-based contrast agents (GBCA) in individuals with renal impairment. The incidence in end stage renal failure patients exposed to highest risk GBCA (gadodiamide) is 3–7%. European guidelines contraindicate use of high risk GBCAs in acute kidney injury (AKI) and chronic kidney disease (CKD) <30 ml min<sup>-1</sup> with caution eGFR <60 ml min<sup>-1</sup>. We considered a population with varying eGFR to determine distribution of NSF related to renal function. **METHODS:** All patients who underwent renal MRA with electronic patient records and >90 days follow-up. Presence of NSF cross referenced to pathology database. Additionally all cases of NSF from our unit (n=16) reviewed with respect to eGFR at the time of MRI. **RESULTS:** 481 of 1551 episodes of renal MRA with 30 ml gadodiamide between 1998 and 2005 met inclusion criteria, spread of eGFR encompassed all CKD stages. 3 patients identified as having NSF, 2 with AKI at time of imaging, all alive at end of study. Third had deteriorating CKD with eGFR of 16.1 ml min<sup>-1</sup> at time of MRA, developed NSF 3 years later following second MRA and after peritoneal dialysis established for 16 months. Of all 16 patients 13 were on dialysis, 2 had AKI and one had an eGFR of 8.3 ml min<sup>-1</sup> when imaged. **CONCLUSIONS:** Individuals developing NSF have AKI or stage 5 CKD at time of gadodiamide exposure, no NSF cases linked to GBCA use with eGFR >15 ml min<sup>-1</sup>.

**1140 Magnetic resonance appearances of uterine malignant mixed Müllerian tumours (MMMT)**

Bharwani, N.<sup>1</sup>, Newland, A.<sup>1</sup>, Tunariu, N.<sup>2</sup>, Babar, S.<sup>2</sup>, Sahdev, A.<sup>1</sup>, Rockall, A.<sup>1</sup>, and Reznik, R. H.<sup>1</sup>  
<sup>1</sup>*Barts and The London NHS Trust, London, UK, <sup>2</sup>Imperial College NHS Trust, London, UK*

**PURPOSE:** Uterine malignant mixed Müllerian tumours (MMMT) are rare, aggressive tumours with a high incidence of lymphatic, peritoneal and pulmonary metastases. Pre-operative differentiation from endometrial carcinoma (EC) would be beneficial as prognosis differs. **MATERIALS/METHODS:** Retrospective MRI review in 51 patients (mean age 70) with histologically confirmed MMMT reviewed at 2 academic gynaecology units. Tumour size, imaging characteristics and invasion were recorded. Data compared with appearances of 73 EC (mean age 60). **RESULTS:** MMMT mean maximal tumour dimension was 6.3 cm (range 0.4–19.8). On T<sub>1</sub> weighting, MMMTs were predominantly isointense to myometrium (77%) and endometrium (71%) with a heterogeneous texture in 33% and hyperintense foci in 31%. On T<sub>2</sub> weighting, 92% were hyperintense to myometrium and either hypointense (55%) or isointense (41%) to endometrium. 82% had heterogeneous T<sub>2</sub> texture. In 12%, large MMMT obliterated uterine architecture while in 88% the appearances were indistinguishable from EC. Significantly more MMMT had cervical invasion (p=0.008) and lymph node enlargement (p=0.00008) than in EC. There was no significant difference in the incidence of deep myometrial invasion. Dynamic post-gadolinium images (19/51 patients) at <1 min showed MMMT enhancement to be hypointense (42%; 5/12) or isointense (33%; 4/12) to myometrium; between 1–4 min tumours were hypointense (58%; 7/12) to myometrium; and >4 min (n=19) showed tumours to be isointense to myometrium in 56%. This is significantly different to EC where 90% enhance less than myometrium (p=4 × 10<sup>-8</sup>). **CONCLUSION:** MMMT do not have a pathognomonic MRI appearance. However, suspicions should increase in the presence of large aggressive tumours or when tumoural enhancement equals or exceeds that of myometrium.

**1150 Clinical impact of F-18 FDG PET/CT in the management of cervical cancer**

Hepple, S. E.<sup>1</sup>, Shaikh, G.<sup>2</sup>, and Han, S.<sup>3</sup>

<sup>1</sup>West of Scotland Radiology Training Scheme, Glasgow, UK, <sup>2</sup>Beatson West of Scotland Cancer Centre, Glasgow, UK, <sup>3</sup>West of Scotland PET Centre, Glasgow, UK

**PURPOSE:** The UK PET/CT advisory board and the Scottish Intercollegiate Guidelines Network (SIGN) have recommended the use of F-18 FDG PET/CT in the management of cervical cancer. We aim to review the clinical impact of FDG PET/CT imaging in the management of cervical cancer in the West of Scotland. **MATERIALS/METHODS:** 55 women with cervical cancer had PET/CT scans in our centre during December 2007–September 2009 for tumour staging or for evaluation of suspected tumour recurrence. A retrospective review was performed on the PET/CT reports of these 55 patients (mean age 44 years, range 22–83). PET/CT reports were compared with pathology results in 15/55 (27%), and clinical and imaging follow-up in 40/55 (73%). **RESULTS:** 36 cases were for staging or restaging of regional nodal or distant metastases. Sensitivity, specificity and accuracy of PET/CT were 96%, 91% and 92% for regional nodes, and 100%, 93% and 94% for distant metastases. PET/CT identified true positive distant metastases in 6 patients (lung, liver, peritoneal, bone, and para-aortic nodes). Staging PET/CT altered clinical management in 11/36 (31%). 19 cases were for evaluation of suspected tumour recurrence. Sensitivity, specificity and accuracy in confirming tumour recurrence were 100%, 69% and 79%. The use of PET/CT in relapse assessment altered clinical management in 7/19 (37%). **CONCLUSION:** F-18 FDG PET/CT is a useful non-invasive imaging modality for staging as well as for evaluating suspected recurrence in patients with cervical cancer.

## 1000–1130

### Imaging the face: The essentials

#### 1000 The orbits

Miszkiel, K.

*Moorfields Eye Hospital, London, UK*

No abstract supplied.

#### 1030 The paranasal sinuses

Beale, T.

*Royal National Nose, Ear and Throat Hospital, London, UK*

No abstract supplied.

#### 1100 How to image the salivary glands

Richards, P.

*Barts and the London NHS Trust, London, UK*

No abstract supplied.

## 1000–1130

### CT in abdominal emergencies

#### 1000 Acute presentation of IBD

Zealley, I. A.

*Ninewells Hospital, Dundee, UK*

No abstract supplied.

#### 1030 Imaging in GI vascular emergencies: ischaemia and bleeding

Uberoi, R.

*John Radcliffe Hospital, Oxford, UK*

**PURPOSE:** To update on the current imaging for acute gastrointestinal haemorrhage and mesenteric ischaemia. Rapid and accurate diagnosis is vital in mesenteric ischaemia and gastrointestinal haemorrhage (GI haemorrhage). It requires a multi-disciplinary team approach. In a small percentage of patients with GI haemorrhage does the bleeding site remains elusive after endoscopy. With multi-detector CT, the majority of patients can be investigated with minimal invasive techniques. Several case reports and series advocate CTA in patients with GI haemorrhage, with accuracy in detection of GI haemorrhage

ranging from 79–100%. Unlike DSA it is non-invasive and more widely available. It is exquisitely sensitive for luminal contrast and detects lower rates of bleeding than DSA. Multi-planar reconstructions, can identify specific bleeding vessels leading to targeted embolisation. Even if an active bleeding is not determined, a lesion may be identified and the cause of intermittent bleeding established. In acute mesenteric ischaemia angiography remains the gold standard which also permits possible therapeutic intervention. Duplex may be used to identify high-grade stenoses/occlusions in mesenteric vessels. A peak systolic velocity of  $>275 \text{ cm s}^{-1}$  in the SMA identifies a  $>70\%$  SMA stenosis with a sensitivity of 92%, a positive predictive value of 80% and a negative predictive value of 99%. CTA has higher spatial resolution and faster acquisition times, with greater accuracy than duplex or MRA and in acute ischemia CTA it is more widely available. A sensitivity of 93%, specificity of 100%, and positive and negative predictive values of 100% and 94%, respectively, can be achieved with CT.

#### 1100 Does the patient have appendicitis?

Ryan, S.

*King's College Hospital, London, UK*

No abstract supplied.

## 1000–1200

### Radiography is dead – Long live radiography

#### 1000 Where have we come from? A brief history of radiography

Decker, S.

*University of Wales, Bangor, UK*

Radiography is a profession that has come a long way since 1920 when it was first recognised as an occupation. This paper draws on the findings of a doctoral thesis on the sociological analysis of the profession using documentary and oral historical accounts of diagnostic radiographers who have witnessed changes in the development, growth and practice of radiography post World War II to the end of the 20th century. The professionalization of radiography has been aided by several factors ranging from political, technological, sociological and economic factors. The focus of this paper is the influence of sociological and technological factors in radiographers' identity construction. The journey of the profession from the early X-ray workers pre World War II, to today's highly competent reflective healthcare practitioner is explored and discussed in relation to technological changes and changes in radiographers–radiologists' relationship. The paper concludes that radiography is a profession in transition as it continues to crave for professional "autonomy".

#### 1020 How has the core knowledge required, changed in diagnostic imaging?

Crotty, M. and Patel, A.

*Homerton Hospital NHS Trust, London, UK*

No abstract supplied.

#### 1040 How has QA changed in digital imaging?

Kotre, J.

*Freeman Hospital, Newcastle-upon-Tyne, UK*

No abstract supplied.

#### 1100 How have RIS & PACS changed diagnostic imaging?

Jones, T.

*Swansea NHS Trust, Swansea, UK*

How many of us still fondly remember the halcyon days of our early careers? The sweet smell of processing chemicals. The ability to "dip and look" in the nice and cosy dark rooms where you could hide from the stresses of the department? Practising our best handwriting on the name slips to identify our work and then the comfortable chats around the processor waiting for the film to emerge. Of course we also had the lost film packet, the processor cleaning and the jammed film to deal with. RIS and PACS are two major technological advances, but what have they brought to the table? The talk will explore the changes that

these two technologies have had on both the local level and a wider patient focused one. The outcome of the talk will be an understanding of the challenges and changes these systems have brought to the radiographic workplace.

**1120 How have roles changed in diagnostic imaging?**

Edwards, H.

Norfolk and Norwich University Hospital, Norwich, UK

No abstract supplied.

**1140 What does the future hold?**

Webster, P.

CCMU, Department of Health, UK

No abstract supplied.

**1000–1200**

**History session**

**1000 Museum X**

Busch, U.

Deutsches Röntgen Museum, Remscheid, Germany

No abstract supplied.

**1020 The life and work of the Birmingham radiologist James Brailsford**

Banerjee, A. K.

Birmingham Heartlands Hospital, Birmingham, UK

James Brailsford was born in Walsall and educated in Birmingham and his first career was that of a laboratory technician. He served in the RAMC as a radiographer during the First World War. On qualifying from Birmingham Medical School at 35, he was immediately appointed assistant radiologist to the Queen's Hospital, Birmingham. In 1928 he obtained the MD, and was elected FRCP in 1941. His book, *The Radiology of Bones and Joints*, first published in 1934, gave him an international reputation. He contributed numerous papers to the medical literature including his classic descriptions of chondroosteodystrophy (Morquio-Brailsford syndrome). Honours came from many sources, some non-radiological. His services to orthopaedic surgery were recognised in 1927 by the Robert Jones Medal and Prize of the British Orthopaedic Association; he was also a Hunterian Professor of the Royal College of Surgeons. In 1936, he received the Röntgen Award of the British Institute of Radiology. He was elected the first president of the British Association of Radiologists, now the Royal College of Radiologists. In 1945 he delivered the McKenzie Davidson lecture on "Reflection on the Teaching of Radiology". Brailsford's later years were marred by his forceful expression of views opposing orthodox opinion, robbing him of much of the reputation and status he had previously won. In this presentation his contributions to radiology and the controversial aspects of his career will be explored.

**1040 Radiology in Argentina**

Buzzi, A.

University of Buenos Aires, Buenos Aires, Argentina

No abstract supplied.

**1100 Ian Donald: the centenary of his birth**

Thomas, A.

Princess Royal University Hospital, Kent, UK

**PURPOSE:** To understand the contribution of Ian Donald to ultrasound. On the 27 December this year we celebrate the centenary of the birth of Ian Donald. His work on ultrasound transformed medical practice and it has been said that his memorial is the use of ultrasound in every maternity hospital. His important paper written with TG Brown appeared in the September 1961 issue of the *British Journal of Radiology*. The paper was based on a presentation at the Annual Congress of the BIR on the 26 April 1961 and was called

"Demonstration of tissue Interfaces within the Body by Ultrasound Echo Sounding" and is a classic. Ultrasound had been used for several years to look at flaws in metals and Donald (the doctor) and Brown (from Messrs. Kelvin Hughes Ltd.) applied the principle to tissue boundaries in the body. They saw the technique as ancillary to radiology and speculated on what might be achieved in time in the hands of radiologists were they to embrace the technique. The contribution of Ian Donald to ultrasound cannot be overestimated and his work will be reviewed in this presentation.

**1120 Using professional journals to examine gender in radiography 1935–1974**

Reeves, P. J.

Wrexham, UK

**PURPOSE:** In analysing the gendered history of radiography in the 1920s and 1930s Witz (1994) argued that male radiographers engaged in discursive tactics aimed at excluding females from the profession by means of the elevation of technical skills over patient care skills. This led the author of this paper to the following research hypothesis. An analysis of the gender of authors of technical papers in Radiography would reveal a preponderance of male authors, despite the fact that those in the UK gaining membership of the Society of Radiographers were overwhelmingly female. **MATERIALS/METHODS:** Documentary analysis of previous editions of *Radiography* was undertaken using a simple checklist to record the sex of the author (where this was apparent) and also their qualifications. A 40 year period was covered from the start of publication in 1935 to 1974. Membership lists were published in the journal during this period and these were analysed for gender breakdown; the Society of Radiographers was also contacted to provide data for years missing from the journal. In addition, results from the Teacher's and Fellowship examinations were also analysed for gender breakdown. **RESULTS AND CONCLUSION:** The results were entered in Excel spreadsheets for analysis. The hypothesis was proven. Discursive tactics, which included technical authorship in *Radiography* plus the results of the Society's Teachers' and Fellowship examinations for the same period, showed that those successful were predominantly males, despite the overall profile of the profession being female-dominated.

**1140 A Nobel history of nuclear medicine**

Lawson, R.

Central Manchester University Hospitals Foundation Trust, Manchester, UK

Nuclear medicine can trace its origins back to the discovery of radioactivity by Henri Becquerel in 1896 and his subsequent work with Marie and Pierre Curie. Ernest Rutherford gave us an understanding of the process of radioactive decay and his student George de Hevesy realised the importance of radioactive isotopes as ideal tracers. Frederic Joliot and Irene Curie developed new radioactive materials and the invention of the nuclear reactor by Enrico Fermi and the cyclotron by Ernest Lawrence soon made a variety of radionuclides readily available. Development of imaging techniques by pioneers such as Benedict Cassen, Hal Anger and Gordon Lee Brownell led to the commercial availability of rectilinear scanners, gamma cameras and PET scanners. Following the introduction of the technetium generator by Walter Tucker developments in radiopharmacy led to a rapid expansion of nuclear medicine during the 1970s. This talk will describe the contributions made by these pioneers, and others, to the development of nuclear medicine over more than 100 years. It will highlight the many Nobel prizes that have been awarded in the process – not forgetting the contribution of Joseph Rotblat.

**1230–1315**

**CoR William Stripp Memorial lecture**

**1230 Image interpretation: a whole team approach**

Keane, D.

South Tyneside District Hospital, Tyne and Wear, UK

All patients undergoing imaging procedures deserve focused attention from a professional with specialist training working within a comprehensive framework of governance. The creation of teams with robust processes of training, management and governance, incorporating feedback, discrepancy reporting and audit, enables members of the team to perform the role that is most appropriate for them. Doctors or radiographers is a false dichotomy; roles should be defined by how the team is trained, managed and governed not by historical precedent. This presentation addresses the central role of the multi-disciplinary team and gives examples of how patient care has been enhanced following a team approach.

### 1315–1445

#### Junior radiologists' forum

##### 1315 Getting started in radiology research

Waldman, A.

*Charing Cross Hospital, London, UK*

No abstract supplied.

##### 1345 Radiological expert witness

Ritchie, D.

*Western Infirmary Glasgow, Glasgow, UK*

**KEY LEARNING OBJECTIVES:** The role of the radiological expert witness. Process of litigation for medical negligence and personal injury. **DESCRIPTION:** The role of the radiological expert is to inform and educate the court in cases where specialist advice is needed. The responsibility of the expert is to the court and this overrides any obligation to the instructing parties. The Court expects a description and explanation of imaging findings in relation to the clinical findings, the implications for patient and assessment of performance of medical attendants in discharging their duty of care. For negligence cases, it is necessary to prove both breach of duty and causation. According to Bolam "A doctor is not guilty of negligence if he has acted in accordance with a practice accepted as proper by a responsible body of medical men skilled in that particular art". However, in a decision in Bolitho, it must also be shown to the judge's satisfaction that the decision taken was logical and reasonable in the circumstances. In considering causation, did the breach of duty cause or materially contribute to the damage, what difference did the breach make to the eventual outcome and is it more likely than not the patient would have suffered the same outcome in any event? **REFERENCE:** Providing Expert advice to the Court: Guidance for Members and Fellows. RCR 2006. **CONCLUSION:** The expert radiologist plays an important role in litigation for medical negligence and personal injury.

##### 1415 Identifying and managing workplace stress

Cooper, C.

*Lancaster University, Lancaster, UK*

**PURPOSE:** To explore the costs of occupational stress to organisations and society in terms of sickness absence, presenteeism, and lost productive value, to identify the common sources of stress in the workplace and to provide a possible framework for dealing with the organisational stressors identified. **MATERIALS/METHODS:** Brief review of the literature. **RESULTS:** The literature in the field will be reviewed, a conceptual model highlighted and the framework for organisational change to minimise workplace stress explored. **CONCLUSION:** The costs of stress in the health service are very high in terms of sickness absence, premature retirement due to stress and lost productive value. It is important for professional bodies like UKRC, hospital trusts and other parts of the NHS to do regular well-being/stress audits through anonymous but high quality psychometrics to identify the issues that may be causing health care professionals preventable stress and ill health.

### 1400–1615

#### GU session: Renal and adrenal lesions: not to be missed!

34

### 1400 Functional MRI of the renal tract

Thoeny, H.

*University Hospital of Bern, Bern, Switzerland*

CT and MRI provide excellent anatomical images enabling diagnostic work-up of various renal pathologies. However, these modalities are based on morphological alterations or perfusion changes and are therefore limited to detect diseases leading to changes in size, shape, and MR signal intensity or CT attenuation before or after contrast medium administration. Several new noninvasive MR techniques including diffusion-weighted MRI (DW-MRI), arterial spin labelling (ASL) and blood oxygen level dependent (BOLD) MRI have shown promising results providing functional information of the kidneys often preceding morphological changes. DW-MRI shows the Brownian motion in the extracellular extravascular space and is quantified by the apparent diffusion coefficient (ADC) that allows information on diffusion and perfusion provided that these entities can be separated. Thanks to the fact that microstructural changes can be determined by DW-MRI this technique is useful in the evaluation of early changes in diffuse renal pathologies including native and transplanted kidneys and for the work-up of indeterminate focal renal lesions. The assessment of changes in perfusion can be helpful for the evaluation of renal artery stenosis or ureteral obstruction. ASL has shown the potential to quantify the degree of renal artery stenosis noninvasively. BOLD-MRI provides noninvasive information on the renal oxygen content with clinical applications published in patients with acute unilateral ureteral obstruction and in patients with renal allografts for the differentiation between acute rejection and acute tubular necrosis. Future challenges in the functional assessment of the renal system are linked to the integration of multifunctional noninvasive approaches in daily clinical routine.

### 1425 Small renal masses – what do I do?

Patel, U.

*St George's Hospital, London, UK*

With the increasing sensitivity of the radiological modalities, especially CT, ever smaller renal masses are identifiable, but increased sensitivity has not been paralleled by improved specificity. Once, one could confidently state that an isolated incidental solid renal mass, if fatless, was likely to be a renal cell cancer. Definitive treatment could progress on these findings alone, as in >95% of cases the imaging diagnosis was likely to be accurate. Many confounding factors have come to erode this simple algorithm. When faced with small masses, how confidently can fat be excluded, or be sure that the mass is truly cystic. Modern 64 slice scanners may give us slice thicknesses down to 0.625 mm, but with this has come a reduced precision in density measurement. What density is a cyst? And how does this differ from intrinsically low density renal masses such as papillary renal cell cancers. Can growth rates help or should we biopsy more small masses, and how? A separate issue is that increasingly many small renal masses are of relatively indolent cell types, rather than aggressive or pure clear cell cancers. For example, some recent nephrectomy series have reported many nephrectomies were carried out for tumours later proved to be oncocytoma, or AMLs etc. It is possible that some small renal masses may be undergoing over treatment, either surgical or ablation. We need strategies to better characterise small renal masses, and sub-select high grade or rapidly growing renal cell cancers. This review will describe suitable such strategies.

### 1450 Unusual renal masses

Sahdev, A.

*Barts and the London NHS Trust, London, UK*

A wide variety of malignant neoplasms have been described in the kidney. 90% of primary renal cancers are classified as renal cell carcinomas (RCC). Transitional cell carcinomas (TCC) account for about 5–8% of the renal cancers and nephroblastomas, sarcomas, lymphoma and metastases commonly from breast, bronchus and malignant melanoma account for about 5% of renal cancers. With the increasing use of cross-sectional imaging, up to 60% of renal cancers are incidentally and of



these more than 80% are stage pT1 or pT11. Consequently, localized treatment options may be appropriate in small low stage tumours. However, histological subtypes with a poor prognosis such as collecting duct carcinomas, sarcomas and TCCs are not suitable for nephron sparing treatment options. Lymphoma and metastatic lesions require systemic chemotherapy. It is therefore necessary to know the histological subtype of the renal tumour prior to embarking on localised treatment options. The cross-sectional imaging appearances of most malignant tumours overlap such that pre-operative histological characterisation is seldom possible. However, some unusual renal tumours have sufficiently unique features to suggest the histology. The aim of this lecture is to describe unusual tumours that have characteristic imaging features. Pre-operative diagnosis of these histological subtypes could alter the management of the patient or allow conservative management.

#### 1515 Hypertension: adrenal causes

Reznek, R.

*Barts and The London NHS Trust, London, UK*

In most cases of hypertension due to adrenal causes, the clinical history and the biochemistry will point to the likely adrenal pathology. The purpose of imaging is to localise and characterise this pathology. In hyperaldosteronism, for example, the critical distinction is between an adrenocortical adenoma and bilateral adrenal hyperplasia. As these "aldosteronomas" are often small, care is required in identifying the pathology. Phaeochromocytomas can have a very varied appearance as these tumours frequently undergo necrosis or haemorrhage. Failure to recognise such a varied appearance can result in the missed diagnosis. Other adrenal causes of hypertension such as that which occurs in association with adrenal carcinoma, Cushing's syndrome or ACTH independent massive adrenal hyperplasia will also be discussed.

#### 1545 Hypertension: renovascular imaging

Meaney, J.

*St James's Hospital, Dublin, Ireland.*

No abstract supplied.

### 1400–1600

#### Imaging update in patients with white matter abnormalities

##### 1400 The clinicians viewpoint of imaging in multiple sclerosis

Miller, D.

*National Hospital for Neurology & Neurosurgery, London, UK*

No abstract supplied.

##### 1430 How to scan and report patients with probable multiple sclerosis

Quaghebeur, G.

*John Radcliffe Hospital, Oxford, UK*

MRI on its own cannot establish a diagnosis of multiple sclerosis. However, if used properly it can provide evidence of evolving multifocal pathology; identify lesions to support the clinical diagnosis; or identify alternative diagnoses. Many diagnostic criteria exist to aid the radiologist in this task and the talk will cover these, focusing on the latest revised McDonald criteria. Classical examples; atypical presentations and differential diagnoses will be demonstrated – highlighting the importance of clinical correlation; the utility of spinal imaging; and suggesting optimal use for contrast administration. Conventional structural MRI does not allow optimal diagnosis of associated grey matter lesions or diffuse changes, but it is the only practical tool available to most radiologists and this talk will aim to suggest best use of that. Advanced imaging/research techniques will be briefly mentioned.

##### 1515 How do I report this white matter lesion?

Connelly, D.

*Royal Hallamshire Hospital, Sheffield, UK*

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No abstract supplied.

### 1400–1640

#### Musculoskeletal keynotes & scientific session

##### 1400 MR arthrography of the hip

Seymour, R.

*Torbay Hospital, Torquay, UK*

MR arthrography of the hip is useful in demonstrating labral tears and, to a lesser degree articular cartilage damage. There has been a dramatic increase in demand in recent years because of the recognition of femoroacetabular impingement (FAI). In this presentation the speaker will describe MR arthrography technique and sequences and then give illustrations of findings in FAI, including labral tears and assessment of the femoral head/neck alignment. He will also describe the important plain film findings in FAI. In addition to the imaging features the challenges in FAI that will be discussed include how to cope with increased demand, how to report plain films for GPs, what the clinical features are and pitfalls such as dismissing more serious pathology as FAI.

##### 1420 MR arthrography of the wrist

King, L.

*Southampton General Hospital, Southampton, UK*

MR arthrography of the wrist can be performed with single, double or triple compartment contrast injections. The technique is particularly useful for evaluation of the intrinsic ligaments of the wrist and the triangular fibrocartilage complex. It combines the advantages of direct arthrographic depiction of abnormal communication between the wrist compartments signifying anatomical perforations with the direct visualisation of intrinsic ligament or TFCC tears as well as allowing assessment of bone marrow, articular cartilage and other soft tissues including the flexor and extensor tendons. MR arthrography also enables improved delineation of the extrinsic ligaments of the wrist and can help to distinguish between communicating and non communicating peri-articular fluid collections seen on standard MRI or ultrasound. The fluoroscopic and MRI techniques for wrist MR arthrography will be reviewed and the common pathologies encountered illustrated and discussed.

##### 1440 MR arthrography of the shoulder

Hutchinson, C.

*Hope Hospital, Manchester, UK*

No abstract supplied.

##### 1500 Sports Injuries in elite athletes: MRI and medals

Boyd, E.<sup>1</sup>, Remedios, D. A.<sup>1</sup>, and Budgett, R.<sup>2</sup>

<sup>1</sup>Northwick Park Hospital, Middlesex, UK, <sup>2</sup>Olympic Medical Institute, Northwick Park Hospital, Middlesex, UK

**PURPOSE:** The 2008 Olympic Games highlighted the need for an accurate assessment of sports injuries to facilitate the optimum rehabilitation programme. We evaluated the role of MRI in diagnosing sports injuries in elite athletes for the year leading up to the games. **MATERIALS/METHODS:** Imaging reports for consecutive national elite athletes referred through the Olympic Medical Institute for MRI examination following a sports injury between 01.08.2007 and 31.07.2008 were retrospectively reviewed. Concordance of clinical and MRI assessment was calculated. The severity and type of tissue injured (bone/muscle/tendon) were compared and correlated with outcome-performance and recovery time (estimated from the date of first imaging to subsequent competition). **RESULTS:** 37 athletes were identified with 39 MRI scans. 35 athletes competed within the same season, 18 participating at the Olympic Games and 12/37 winning international/national medals. 10 bone, 7 muscle and 22 tendon injuries were identified, with the mean recovery time of 138, 134 and 112 days, respectively. Clinical concordance for injured tissue was in 12/39 injuries (31%), and for severity in 19/39 (49%). **CONCLUSION:** Grading of severity



and identification of the injured tissue is difficult even for experienced sports physicians. Our study has demonstrated the important role of MRI in assessing the type of injured tissue, and therefore defining the rehabilitation programme. The severity correlated well with performance. Following appropriate rehabilitation 95% of athletes competed within the same season with 12/37 winning international/national medals.

#### **1510 Medial patellofemoral ligament injuries in acute patella dislocation: correlation between MRI appearances and surgical findings**

Thomson, L. K., Winter, A., Rooney, B., and Raby, N.  
*Western Infirmary, Glasgow, UK*

**PURPOSE:** Medial patellofemoral ligament (MPFL) injury occurs in acute patella dislocation (APD). Surgical repair of the MPFL is becoming increasingly common. Preoperative MRI is undertaken to determine the site of the MPFL injury to aid surgical planning. Correlative data of MRI with surgical findings is scarce. The current literature suggests that the MPFL more frequently ruptures at the femoral insertion. We assessed the site of MPFL injury following APD using MRI and correlated this with surgical findings. **MATERIALS/METHODS:** A retrospective analysis was undertaken of patients undergoing MRI of the knee for APD who proceeded to surgery. Surgical findings and radiological assessment of the MPFL were correlated. **RESULTS:** 17 patients were identified with sufficient operative and radiological information to allow comparison. 13/17 (76.5%) had concordant results, 4/17 (23.5%) were discordant. Patients with concordant results had ruptured the MPFL at the patellar insertion. 3/4 patients with discordant results had ruptured the MPFL at the patellar insertion, as opposed to femoral insertion rupture suggested on MRI. One patient had femoral insertion rupture at surgery with MRI appearances suggesting rupture at both sites. **CONCLUSION:** MRI is extremely accurate in identifying disruption of the MPFL at the patellar insertion in patients with APD. It is less accurate if the site of rupture is thought to be femoral insertion. Surgical correlation suggests that patellar insertion ruptures are more frequent in our cohort and are accurately identified at preoperative MRI. Our cohort demonstrated predominance for patella insertion rupture, at variance with the existing literature.

#### **1520 MRI follow-up of TruFit repair of osteochondral defects in the knee**

Collin, G., Dhillon, M., Spalding, T., and Crane, T.  
*University Hospital, Coventry, UK*

**PURPOSE:** TruFit plugs (a biodegradable synthetic scaffold) are a new treatment of osteochondral defects in the knee. The normal MRI findings following TruFit repair have only a limited description in the literature. We present a qualitative longitudinal study of the TruFit plugs MRI changes in our cohort over a 30 month follow-up period. **MATERIALS/METHODS:** 26 patients with osteochondral defects of the knee have undergone TruFit plug synthetic bilayer scaffold repair. These patients have been followed up with MRI at 6 monthly intervals where possible. MRI findings of: effusion; synovitis; bone oedema; TruFit plug resorption; subchondral lamina formation; cartilage integration and surface contour were assessed and scored. **RESULTS:** One of the patients had a sizeable effusion with evidence of synovitis which persisted. Small effusions occurred in some patients, but these resolved. The cartilage plugs show evidence of bony resorption in all patients by 1 year, which progresses on later scans. Similarly, cartilage integration and subchondral lamina formation improve over time. Bone oedema is variable on early scans but improves on later scans. A good surface contour is demonstrated in all patients on early scanning, although it does deteriorate in a minority of patients over time. **CONCLUSION:** MRI has already been shown to be an accurate and non-invasive way of assessing cartilage defects in the knee. We demonstrate MRI findings of TruFit plug repair follow a predictable graded differentiation into the respective layers over time – bone, subchondral lamina and articular like cartilage.

#### **1530 Femoroacetabular impingement in psoriatic arthritis: a poorly recognised relationship**

Shetty, S., Prentice, M., Robinson, G., and Glew, D.  
*Royal United Hospital, Bath, UK*

**PURPOSE:** In recent years there has been increased interest in femoroacetabular impingement (FAI), identifying it as a major cause for early onset hip osteoarthritis. In patients with psoriatic arthritis, hip arthritis is a recognised feature, thought to be due to the primary disease process. It can lead to significant morbidity. However, we believe there is an increased prevalence of FAI in patients with psoriatic arthritis as we have demonstrated in patients with ankylosing spondylitis. **MATERIALS AND METHODS:** We review the pelvic radiographs of 20 patients with established psoriatic arthritis. The following established plain film findings of FAI are evaluated: coxa profunda, protrusio acetabuli, focal acetabular retroversion (figure of 8 configuration), lateral centre edge angle, acetabular index, posterior wall sign, labral ossification and femoral head/neck configuration (CAM lesion). **RESULTS:** There is an increase in some features of FAI in psoriatic arthritis. **CONCLUSION:** It is likely that hip arthritis in these patients is partly due to impingement. This relationship is poorly recognised and its knowledge may impact on subsequent management.

#### **1540 Asymptomatic metal-on-metal (MOM) and polyethylene-on-metal (POM) total hip replacements (THR), spectrum and comparison of MRI findings**

Mistry, A., Toms, A. P., Cahir, J., Donnell, S. T., and Nolan, J.  
*Norfolk and Norwich University Hospital, Norwich, UK*

**PURPOSE:** MR, with metal artefact reduction sequences (MARS), is a useful tool for investigating symptomatic THRs, particularly MOM prostheses, where soft tissue reactions are common. These reactions such as bone marrow oedema, muscle oedema and muscle atrophy and avulsion could be part of the expected changes after uncomplicated hip replacement. The aim of this study was to define and compare the MR findings of asymptomatic patients with MOM and POM THRs. **MATERIALS/METHODS:** 21 THRs in 18 asymptomatic patients (5 men, 13 women, mean age 65, range 46–79 years) with normal hip radiographs were included in the study. These comprised 12 MOM, and 9 POM bearings. Each patient underwent an MR with MARS at a median time of 6 years (range 1–13) after surgery. Two musculoskeletal radiologists independently read each MR examination for fluid collections, soft tissue masses, muscle atrophy and bone marrow signal changes. **RESULTS:** A pre MR hip radiograph showed no significant differences in acetabular inclination, femoral stem angle and stem mantle grade between the two groups. A total of 21 abnormalities were demonstrated in 12 MOM THRs and 5 of the POM THRs (Fischer's Exact test  $p=0.004$ ). Subset analysis of the types of soft tissue change did not reveal a significant difference between MOM and POM for any one abnormality. **CONCLUSION:** A range of MR soft tissue abnormalities are present in normal THRs but the increased frequency of these associated with MOM THR suggest that some of these changes might represent subclinical disease.

#### **1550 Validation of an MR grading system for scoring soft tissue disease in metal-on-metal hip replacements**

Anderson, H. L., Toms, A. P., Cahir, J. G., Goodwin, R. G., Nolan, J. F., and Donnell, S. T.  
*Norfolk and Norwich University Hospital, Norwich, UK*

**PURPOSE:** Metal-on-metal (MOM) total hip replacements (THR) can cause periprosthetic soft tissue metal toxicity, which can be best demonstrated with MRI. The aim of this study was to validate an MR grading system for scoring the severity of MOM disease which can then be used to correlate with clinical outcomes. **MATERIALS/METHODS:** 59 MR examinations of 73 THRs (39 right, 34 left) in 59 patients were included. These included cemented MOM (n), Cemented plastic-on-metal (n) and uncemented MOM (n) prostheses. The DICOM data was anonymised, and labelled with a randomly assigned study number. A grading system was designed to categorise

MR findings into grades that treatment decisions. Grade A – normal or acceptable post-operative findings, B – Infection or inflammation, C1 – mild, C2 – moderate or C3 – severe MOM disease. Three musculoskeletal radiologists (2 with 5 years experience reporting MR of THR, 1 with little experience) independently scored each case according to this system. RESULTS: The distribution of scores was as follows: Grade A: 28%, B: 7%, C1: 12%, C2: 26%, C3: 27%. Weighted Kappa correlation demonstrated a very good reliability of  $r=0.86$  (95% confidence interval 0.78–0.95) between the two most experienced observers. When observers 1 and 2 were compared with the least experienced observer correlation measures were good;  $r=0.79$  (95% CI 0.69–0.89) and 0.78 (96% CI 0.67–0.89). CONCLUSION: The MR grading system, for soft tissue disease in MOM THR, described in this study is reliable for both experienced and less experienced MSK radiologists.

#### 1600 Serial multimodality imaging in diabetic foot osteomyelitis: clinical correlation

Pandya, S., Ejindu, V., Kong, W., Chambers, A., and Hine, A.  
*Central Middlesex/Northwick Park Hospital NHS Trust, Harrow, UK*

PURPOSE: Osteomyelitis is present in 20% of cases of foot infection in persons with diabetes. A retrospective study was undertaken for evidence of effectiveness of serial monitoring in follow up of patients with diabetic foot osteomyelitis (DFO). MATERIALS/METHODS: We reviewed all cases of confirmed DFO between September 2006 and November 2007. Scans were reviewed by specialist consultants, who were blinded to the outcome of clinical follow up, using proposed consensus criteria established by the International Working Group on Diabetic Foot (IWGDF). This data was then correlated with the clinical status of patients at follow up. RESULTS: 49 patients (mean age 66 years) with DFO were identified, Clinical correlation was achieved in 37 patients. With a median follow up 30 months (6–20 months), arrest (maintained healing at 1 year) was achieved in 86% and 3 patients needed amputations. Serial MRI scans (2 or more) were obtained in 31% patients and serial bone scans in 51%. In our series, the negative predictive value of serial imaging with bone scan in DFO was 95% and with MRI was 100%. The positive predictive value was 50% for MRI. CONCLUSION: High sensitivity and negative predictive value of serial MRI scan and relatively poor PPV may suggest MRI is very sensitive and may antedate the course of clinical outcome. Our study showed that combined serial imaging has high negative predictive value. Negative serial scan is highly predictive of clinical arrest. Hence, serial imaging can provide a valuable tool to aid decisions on antibiotic duration in DFO.

#### 1610 A pictorial review of the incidental findings on MRI of the spine

Sahu, A., Chaganti, S., Venkatanarasi, N., Gay, D., Gafoor, A., Hughes, P., and Suresh, S.  
*Derriford Hospital, Plymouth, UK*

LEARNING OBJECTIVES: 1. To discuss incidental findings noted on MRI of the spine. 2. To develop a systematic approach to detect them, and discuss the pitfall of use of set DDPs in PACS reporting. DESCRIPTION: We present a pictorial review of the incidental findings on MRI of the spine, using clinical cases from our centre. It is not infrequent to detect incidental findings during MRI examinations of the spine. The most common incidental findings include aortic aneurysms, retroperitoneal lymphnode abnormalities, adrenal masses, renal pathology including cysts, tumours, developmental anomalies and infarcts. Other incidental findings, on imaging of the thoracic spine include pulmonary nodule, soft-tissue sarcoma, pathologies of the liver, pancreas, biliary system, gallbladder, bowel or spleen, etc. Pelvic pathologies include adenomyosis or leiomyomas of uterus, abnormalities of the paraspinal musculature or the bony pelvis and retroperitoneal haematoma. We also review the various DDPs that are used for reviewing spinal images and suggest the optimal combination. CONCLUSION: It is very important to report incidental findings as these may be more relevant than the spinal

pathology and completely alter patient management. It is radiologist's responsibility to detect, characterise, and report any relevant incidental findings. Currently with PACS reporting, due to standard being DDPs used, one may not review the planning scout images, which may illustrate an incidental lesion. Hence it is absolutely vital to have a robust and systematic approach to the MRI of the spine during reporting in order to pick any incidental abnormality outside the region of clinical interest.

#### 1620 Is a lordotic spine associated with pars interarticularis fractures? A case controlled study

Bugg, W. G., Lewis, M., Juette, A., Cahir, J. G., and Toms, A. P.  
*Norwich Radiology Academy, Norwich, UK*

PURPOSE: It has been postulated that lower lumbar pars interarticularis fractures may be caused by compression from adjacent vertebrae in hyperlordosis. The aim of this study is to examine the relationship between lumbar lordosis and pars interarticularis fractures. MATERIALS/METHODS: Inclusion criterion for this retrospective case controlled study was bilateral pars interarticularis fractures at L5 demonstrated on MRI. Exclusion criteria included segmentation anomalies, spondylolisthesis, and other MRI changes associated with back pain. Age and sex matched control cases were identified from PACS. All cases were confirmed independently by 2 musculoskeletal radiologists; any disagreements were discarded. The angle of lordosis was measured as the angle between the inferior L4 and superior S1 endplates on a standing lateral lumbar spine radiograph. Angle measurements were performed by two independent observers. RESULTS: 29 cases of L5 pars fractures were identified (male=16, female=13, median age=36 years, range=9–63 years), and 29 age and sex matched controls were included in this study. The mean angle of lordosis in the pars interarticularis fracture group was 36.9° (SD=6.5°). The mean angle of lordosis for the control group was 30.1° (SD=6.4°). A student *t*-test for the difference in the means (6.8°) demonstrated a significant difference between the two groups ( $p<0.001$ ). The inter-rater reliability was very good: Intraclass correlation coefficient was 0.89 (95% CI 0.82–0.94). CONCLUSION: There is a strong association between the angle of lumbar lordosis and pars interarticularis fractures at L5.

#### 1630 The added value of single photon emission computer tomography (SPECT) examination of the spine in 99mTechnetium methylene diphosphonate (99mTc MDP) whole body planar scintigraphy in the assessment for spinal metastases

Chawla, S., Hanlon, R., White, D., Mullan, D., and Wiesmann, H.  
*University Hospital Aintree, Liverpool, UK*

PURPOSE: Establish the added value of 99mTc MDP SPECT scintigraphy of the spine to the whole body planar imaging in patients with clinical symptoms and suspicion of malignancy. INTRODUCTION: 99mTc MDP 2D whole body bone scintigraphy is a widely used test for the detection of bone metastases. Interpretation of the spine on the whole body planar images can be a diagnostic challenge due to the complexity of structures and the presence of degenerative changes. SPECT imaging is a technique, which uses multiple 2D images and reconstructs into 3D allowing the removal of overlying and underlying radioactivity hence improving contrast resolution and detection of metastases. METHOD: A review of all patients who had 99mTc MDP whole body bone scintigraphy followed by SPECT scintigraphy scans at our institution between January and November 2009. The clinical indication, the SPECT findings and the final MRI diagnosis were reviewed. RESULTS: Over the study period 422 patients underwent whole body bone scintigraphy, 80 (19%) patients had additional SPECT examination of the spine: male=49 (61%), female=31 (39%). In 44 patients (55%) the SPECT examination helped to solve diagnostic dilemmas in the spine, in 36 (45%) patients the SPECT examination was equivocal and MRI of the spine had to be performed for further clarification. CONCLUSION: Additional SPECT examination of the spine increases the diagnostic value of 99mTc MDP whole body bone scintigraphy and helps to

prevent diagnostic dilemma in patients with clinical symptoms suspicious of spinal metastases.

## 1400–1450

### Digital age challenges for radiology reporting

#### 1400 What is the ideal diagnostic imaging report?

Bury, B.

*Leeds General Infirmary, Leeds, UK*

The radiology report is the output of a complex referral, vetting and imaging process, and it is the only bit of that process that ultimately matters to the referring clinician and their patient. Despite that, nearly all of our education as radiologists, radiographers and imaging technicians deals with image production and interpretation, with little attention being given to the construction of a clinically useful report. This presentation will look at the issues surrounding report writing, with particular reference to the advent of electronic reporting and voice-recognition software. It will probably include a vain plea from an ageing presenter for the retention of style and individuality in reporting, in the face of pressure for a more standardised structure.

#### 1425 Can we do better? Maximising the clinical benefit from diagnostic imaging reports

Bosmans, J.<sup>1</sup>, Weyler, J.<sup>2</sup>, De Schepper, A.<sup>1</sup>, and Parizel, P.<sup>1</sup>

<sup>1</sup>University Hospital Antwerp, Edegem, Belgium, <sup>2</sup>University Hospital Antwerp, Wilrijk, Belgium

Although there is proof of the existence of radiology reports just 5 months after Roentgen's publication on a new kind of rays, radiographic images were considered self-explaining for a long time by Roentgen pioneers [1]. Today, many clinical specialists still interpret conventional radiographic examinations within their field of interest themselves, but most rely on the radiologists' competence to interpret the results of complex imaging modalities [2]. Consequently, efficient communication between the radiologist and the referring clinician is an essential feature of radiology practice. The radiology report, either in print or in digital form, is the most conspicuous and permanent product of the radiologist's work [3]. Since the beginning of the eighties, much effort has been spent studying and improving the communication between radiologists and referring physicians. Diverging views on the structure and content of a good report have been presented by several authors. In 2001, Naik *et al.* reported results of a survey on the preferences of radiologists and clinicians concerning style and content of the radiology report of complex examinations. Itemised reports with detailed content were preferred by a large majority of the clinicians and a somewhat smaller majority of the radiologists [4]. Similar results were found in two large-scale surveys in two neighbouring countries in Western Europe [2]. Despite these preferences, routine application of itemised reporting is still very limited, and seems to be confined mainly to mammography and cardiac MR reporting. Practice guidelines for the communication of diagnostic image findings have been proposed by the American College of Radiology in 1991 (last revision 2005). These guidelines suggest that a radiology report should contain four components: demographics (including data on the patient and on the examination performed), relevant clinical information and ICD-9 code as available, the body of the report (including procedures and materials, findings and limitations), and an impression (conclusion or diagnosis). Standardised computer-generated template reports that satisfy the above criteria are considered to conform to the guidelines [5]. Whether or not the itemised report can be as accurate and complete as the "narrative" or "prose" report, is still the object of debate, since the evidence is conflicting [6, 7]. At the current level of information technology, routine use of itemised reporting may compromise radiologist productivity and possibly accuracy [7]. In this presentation, a review of the literature will be presented and discussed, as well as the results of recent studies and expert meetings. REFERENCES: 1. Grigg ERN. The trail of the invisible light. Charles C Thomas Publ. 1965. 2. Bosmans JML, *et al.*

Submitted. 3. Gunderman R, *et al. Pediatr Radiol* 2000;30:307–14. 4. Naik SS, *et al. Am J Roentgenol* 2001;176:591–8. 5. URL: [http://www.acr.org/SecondaryMainMenuCategories/quality\\_safety/guidelines/dx/comm\\_diag\\_rad.aspx](http://www.acr.org/SecondaryMainMenuCategories/quality_safety/guidelines/dx/comm_diag_rad.aspx). 6. Sistrom CL, Honeyman-Buck J. *Am J Roentgenol* 2005;185:804–12. 7. Johnson AJ, *et al. Radiology* 2009;253:74–80. 8. Weiss DL, Langlotz CP. *Radiology* 2008;249:739–47.

## 1505–1700

### Digital Age Challenges-Integrating Workflow in and across clinical communities

#### 1505 Regional Data sharing and XDS-i. Can it accommodate all workflow scenarios?

Wessels, H. J.

*Forcare, The Netherlands*

No abstract supplied.

#### 1525 Wales – a regional PACS come true, one year on!

Ward, A.

*Welsh Health Estates, Cardiff, UK*

The many different PACS in use in Wales, whilst able to transfer data via the DICOM standard, this is a PUSH model and does not allow discovery of information in one system by another. The advent of XDS and Xydis from IHE was seen as the most appropriate, although not the only, mechanism by which images and reports could be made available across NHS Wales. The presentation will show the steps taken to achieve an XDS solution across NHS Wales and the current status of the solution role out.

#### 1545 Data sharing and workflow in Northern Ireland: towards XDS-i

Devlin, B.

*Altnagelvin Hospital, Derry, UK*

No abstract supplied.

#### 1605 Resolving data sharing in the NE-An example for the rest of us?

Trewhella, M.

*North Tees and Hartlepool NHS Trust, Stockton-on-Tees, UK*

No abstract supplied.

#### 1625 Application of the IHE framework to a National Data image and report sharing-Is this the only solution?

Harvey, D.

*North Tees and Hartlepool NHS Trust, Stockton-on-Tees, UK*

Since its publication in 1993, DICOM has been phenomenally successful, transforming the interoperability of radiological equipment, and permitting the development of PACS as we know it. DICOM was, however, designed primarily for internal use within a department, and whilst it can be used for other purposes such as tele-radiology, it has several shortcomings in this area, and it is not really suitable for wide-area image sharing. In addition cross-enterprise sharing generally requires more than just images, and users expect to be able to read reports, and other clinical documents alongside the images. Fortunately, a new mechanism for sharing all types of clinical documents called "Cross-Enterprise Document Sharing" (XDS) was published by IHE in 2005 and has started to gain widespread adoption. Whilst not primarily intended for images, a subsequent addition called "Cross-Enterprise Document Sharing for Imaging" (XDS-I) added that capability, allowing images to be shared, without needing to duplicate them outside their original source PACS. This method is now slowly acquiring critical mass around the world, and was recently specified for the Welsh PACS Integration project. Clearly, there are many possible ways to integrate multiple PACS, including: complete duplication as has been done in England; proprietary mechanisms which work only when all PACS are from

the same vendor; selective sending to other locations via direct DICOM C-STORE; XDS-I which only shares indexing information unless/until the images are needed. The different approaches are compared in this talk.

## 1515–1700

### ASRT keynote speaker and student radiographer scientific session

#### 1515 Advancing international assessment within radiologic sciences

Baker, S.

*Radiologic Science Programmes, Indianapolis, IN, USA*

National and international organizations along with funding entities have been expressing a renewed interest in outcomes assessment. Within the USA accrediting agencies for radiological sciences have placed a greater emphasis on outcomes assessment and the measurement of benchmarks related to assessment plans. Recently a greater emphasis is being placed on student learning outcomes within radiological sciences along with a renewed focus on outcomes assessment. For over 10 years various international higher education communities have been shifting their focus to an approach centred on the outcomes of learning. This shift on learning outcomes in itself implies the need for assessment criteria. More specifically the learning outcomes must be assessed to determine if they have been met. In conjunction with the international and national interest in outcomes assessment and student learning outcomes is a movement of defining what a student completing a degree in a specific field should know and be able to do. This agenda is being advanced via the “tuning” components of international and national projects. As the need and demand from employers worldwide to be assured of the knowledge and skills level of our graduates are similar, we in radiological sciences must prepare ourselves for the potential impact of this increased focus on the education and employment of radiological technologists in our global world.

#### 1545 Use of thyroid collar by radiographers during fluoroscopic assisted orthopaedic procedures

Raza, U.<sup>1,2</sup>

<sup>1</sup>Shukat Khanum Memorial Cancer Hospital and Research Centre, Lahore, Pakistan, <sup>2</sup>University of Bradford, Bradford, UK

**OBJECTIVE:** The aim was to determine the reason for not utilising the thyroid collar by radiographers during different orthopaedic procedures at two local hospitals of Lahore. **MATERIALS AND METHODS:** As a student radiographer, 100 orthopaedic procedures were observed prospectively from June to September 2009. In most of the procedures, it was observed that the radiographers were not wearing the thyroid collar, in spite of their availability. Therefore, a questionnaire was distributed among these radiographers ( $n=50$ ) to determine the reason for not using the thyroid collar. **RESULTS:** The response rate was 80% and out of these respondents, 28 were not aware of thyroid protection and the hazards of radiation on thyroid. 12 of them were aware of thyroid protection, but were showing negligence of using thyroid collar, during their practice. **CONCLUSION:** The use of thyroid collars should be encouraged among the radiographers. The continuous professional development (CPD) and other radiation protection awareness programme can also play an important role in professional development of radiographers, which will influence their practice.

#### 1555 Assessing patency of fallopian tubes: should hysterosalpingo-contrast-sonography replace hysterosalpingogram as initial examination?

Boyes, C.

*University of Bradford, Bradford, UK*

In the UK, approximately 1 in 7 couples find it difficult to conceive a child. Smoking, increased body mass index, occupation, stress and lifestyle are all acknowledged to contribute to sub-fertility. In addition, couples in Western society are increasingly delaying the age

at which they plan to start a family. In 2008, the mean age for women giving birth was 29.3 years with the majority of births occurring in the 30–34 years age range. Since fertility is acknowledged to decrease with age, conception difficulties are anticipated to increase in the future with associated increased referral for fertility testing. Damage to the fallopian tubes is reported in approximately 20% of women experiencing fertility problems. Currently, the imaging examination most commonly undertaken to evaluate this is the hysterosalpingogram (HSG), providing there are no contraindications. However, there are risks related to ionising radiation and contrast media associated with HSG. Hysterosalpingo-contrast-sonography (HyCoSy) provides an alternative approach to assessing the patency of the fallopian tubes and while the side effects and contraindications are similar to those associated with HSG, the risks associated with positive contrast media and ionising radiation are removed. This presentation will summarise the findings of a third year student project to determine whether HyCoSy should replace HSG as the imaging examination of choice in the assessment of tubal patency for infertility.

#### 1605 The diagnosis and staging of multiple myeloma

Mann, D.

*University of Bradford, Bradford, UK*

Multiple myeloma is a malignant disorder of the blood characterised by uncontrolled growth of plasma cells. The plasma cells produce and secrete a monoclonal protein (M protein) which distribute themselves focally or diffusely within the bone marrow leading to lytic lesions and osteoporosis visible on radiographs. Multiple myeloma is associated with high mortality and morbidity with patients suffering bone pain, infections and weight loss. Currently, conventional radiographic imaging is the modality of choice for detecting myelomatous bone lesions. However, there is some evidence to suggest that the increased sensitivity of MRI can identify myeloma cell infiltration within the bone marrow before destruction of mineralised bone is evidence on conventional radiographs. This presentation will summarise the findings of a third year student project which asks whether MRI should replace conventional radiography as the gold standard in the diagnosis and staging of multiple myeloma.

#### 1615 Does increasing SID result in improved image quality and lower radiation dose for DR pelvis examinations?

Heath, R. A.<sup>1</sup>, England, A.<sup>1</sup>, Ward, A. J.<sup>1</sup>, Ward, M.<sup>2</sup>, Charnock, P.<sup>2</sup>, Wilde, R.<sup>2</sup>, Harding, L.<sup>3</sup>, and Evans, P.<sup>3</sup>

<sup>1</sup>University of Liverpool, Liverpool, UK, <sup>2</sup>Integrated Radiological Services, Liverpool, UK, <sup>3</sup>Warrington and Halton Hospitals NHS Foundation Trust., Warrington, UK

**PURPOSE:** To investigate the effect of SID (source to image distance) on image quality and radiation dose using digital radiography (DR). **MATERIALS/METHODS:** An anthropomorphic pelvic phantom was positioned for standard AP pelvis X-ray examination using DR. The SID was initially set to 100 cm and the tube potential remained constant (80 kVp). Five exposures were undertaken at this SID, whilst recording the entrance surface (ESD) and effective doses (ED). Images were sent to a reporting grade PACS workstation for image quality analysis. The SID was then varied by 10 cm intervals (60–147 cm) again with 5 exposures taken at each SID. AEC and grid usage were also varied within the experiment in order to determine the effect of these variables. Image quality was then assessed blind by four observers (two images per parameter) using a rating system adapted from the European Commission guidelines. **RESULTS:** Increasing SID results in both lower ESD and ED when compared to 100 cm SID (147 cm; 2.57 mGy, 0.44 mSv versus 100 cm; 2.99 mGy, 0.51 mSv). Reduction of the SID results in an increased ESD and ED (80 cm; 3.79 mGy, 0.65 mSv). Analysis of the resultant images demonstrated a trend of increasing image quality with increasing SID. Image quality for 60, 80, 100, 120, 140 cm was given a mean score of 17.5, 30, 31, 33, 33. Removal of the grid resulted in lower image quality but lower overall ESD and ED. **CONCLUSION:** Increasing the SID to  $\geq 140$  cm, using a grid and an AEC may improve image quality and significantly lowers radiation dose.

**1625 Is the 10 kV rule applicable to computed radiography?**

Hinder, S. M., Chaloner, S. D., Parsons, A., Pringle, W., Bartlett, J., and Knapp, K. M.  
*University of Exeter, Exeter, UK*

**PURPOSE-MATERIALS:** The 10 kV rule is a rule of thumb, traditionally used with film–screen combination radiography, which states that “increasing or decreasing the tube kilo-voltage by 10 kV has approximately the same effect on image density as doubling or halving the mAs”, working most effectively between 50 kV and 75 kV. It is unclear whether this rule is applicable to computed radiography (CR), with its linear characteristic curve. The aim of this study was to investigate the applicability of the 10 kV rule to CR. **METHODS:** An anthropometric Pixy phantom was used to acquire an optimised pelvis radiograph using Siemens Multix-top X-ray and Konica computed radiography equipment. A Barracuda dosimeter measured entrance surface dose (ESD). The iontomat was used on the two outer cells to ensure the same density on the images and the kVp altered by 10 kVp between 50 kVp and 100 kVp. The results were plotted against the theoretical 10 kV rule results. Image quality was assessed using a 7-point scale. **RESULTS:** The theoretical mAs ranged from 200 to 6.25 for 50–100 kVp, while the actual mAs ranged from 171 to 5. The ESD ranged from 4.3 mGy to 0.5 mGy (50 kVp to 100 kVp). Median image quality did not significantly differ. **CONCLUSION:** The 10 kV rule over-estimates the mAs required when changing the kVp by 10, especially in the useful diagnostic range, thus leading to an increased dose. No significant differences in image quality were found due to the wide exposure latitude of CR. Lower ESD were recorded using higher kVp, with no detriment to image quality.

**1635 Diffusion tensor imaging and schizophrenia**

Lockwood, T.  
*University of Bradford, Bradford, UK*

Schizophrenia is a prevalent psychiatric disorder with approximately 24 million sufferers worldwide. Published data from the World Health Organisation (2009) suggests that almost 50% of schizophrenia sufferers are not receiving appropriate medical care. Previously published research has demonstrated a reduction in the grey matter of the brain of schizophrenia sufferers and supported better

understanding of the relationship between symptoms (hallucinations) and the disorder. However, confirmation of suspected associated disruption to brain white matter has not been possible until recently due to imaging technology limitations. The introduction of diffusion tensor imaging in the late 1990s permitted quantitative measurement of water diffusion and fibre tract organisation to be visualised. Although this is still considered a new and innovative imaging technique, it may provide opportunity to explore the relationship between schizophrenia and changes in white matter to further our understanding of the condition and inform treatment practices. This presentation will summarise the findings of a third year student project to determine whether diffusion tensor imaging can detect white matter tract integrity in patients with schizophrenia.

**1645 A systematic review assessing the effectiveness of fMRI in pre-surgical evaluation of intractable TLE patients**

Jesper, V. C. and Mackay, S. J.  
*University of Salford, Salford, UK*

**PURPOSE:** Surgical removal of epileptogenic lesions to treat intractable temporal lobe epilepsy (TLE) can be successful in up to 70% of patients. The pre-surgical intracarotid amobarbital test (IAT or “Wada test”), used to ascertain cognitive function laterality, is “gold standard” but has inherent flaws. It is argued functional magnetic resonance imaging (fMRI) is a non-invasive alternative to IAT. **AIM:** To assess the effectiveness of fMRI for localising and lateralising the cognitive functions of TLE patients evaluated for surgery. **MATERIALS/METHOD:** A systematic searching strategy identified primary articles relating to the aim. Inclusion and exclusion criteria were used to methodically select 4 most relevant articles published from 2006–2009. A data analysis tool enabled systematic critical analysis each study. **RESULTS:** fMRI had moderate convergence with IAT. However, it was inappropriate to combine the numerical data of the four articles; each had a varying approach to the topic area even though their methods were somewhat comparable. **CONCLUSION:** fMRI is shown to moderately correlate with IAT; however it is not significant enough to advocate replacing IAT with fMRI. Direct comparison of fMRI and IAT may be inappropriate; prospective studies which follow up on patient performance may be necessary to truly establish the effectiveness of using fMRI for pre-surgical evaluation.

# Scientific Poster Exhibition

## Breast poster

p101

### Breast on CT scans: a neglected territory

Khan, H.<sup>1</sup>, Khan, S.<sup>2</sup>, Alattar, M.<sup>1</sup>, Tennant, S.<sup>1</sup>, Grosvner, L.<sup>1</sup>, and Daintith, H.<sup>1</sup>

<sup>1</sup>Glenfield Hospital, Leicester, UK, <sup>2</sup>Queens Hospital Burton on Trent, UK

**KEY LEARNING OBJECTIVES:** To familiarise with different patterns of breast disorders encountered while interpreting CT scans. To provide guidelines for interpretation of these lesions. To determine which MDCT imaging features are predictive of malignancy. **DESCRIPTION:** Breast cancer is the most common female cancer and second leading cancer death in women, with a yearly mortality of around 12,000 in UK. Early detection is necessary to treat patients and improve their chance of survival. A wide variety of breast disorders are commonly identified on MDCT chest/abdomen in our daily practice. The radiologist should be aware of different breast pathologies and be able to characterise incidentally discovered breast lesions as benign, indeterminate, or sufficiently suspicious to warrant further workup. These can be missed if the reporting radiologist doesn't include breast in the review areas. **CONCLUSION:** A careful examination of breasts should be a routine part of all CT scans. There should be a low threshold for referral of women with CT-detected incidental breast masses to a breast clinic for Triple assessment.

p102

### Unusual benign breast presentations

Nicolaou, C., Wilbraham, A., and Donovan, R.

Sandwell and West Birmingham NHS Trust, Birmingham, UK

**KEY LEARNING OBJECTIVES:** The more common causes for patients to present to symptomatic breast clinics are: a palpable lump, pain and discharge. A lot of these patients have high anxiety levels because of the fear of malignancy. However, there are many benign breast abnormalities which can manifest in younger patients, both male and female. Male patients are less likely to present for 2 main reasons: 1. There is an underlying belief that breast pathology does not occur in men. 2. They are less likely to check their breasts for lumps. The aim of this poster is to highlight some of the more unusual benign conditions that may be seen in a routine symptomatic or screening clinic. **DESCRIPTION:** This poster demonstrates 5 cases of benign breast disease. These include: a male presenting with fibroadenomatous change, a young female with an axillary galactocoele, a female with juvenile fibroadenoma and papillary duct hyperplasia, a young female with granulomatous mastitis, and a post-menopausal lady with syringomatous adenoma of the nipple. Each case demonstrates the clinical presentation and findings along with diagnostic imaging. This is followed by a brief discussion, based on the available literature. **CONCLUSION:** Although the cases presented are not necessarily common, the conditions highlighted could be encountered in a routine symptomatic or screening clinic. Therefore, it is useful for radiologists to be aware of these uncommon pathologies, to ensure appropriate management and, where possible, alleviate unnecessary patient (and radiologist) anxiety.

p103

### Multimodality imaging in metastatic breast cancer: what modality to use and when to use it

Narang, G., Redman, S., and Graham, R.

Royal United Hospital, Bath, UK

Breast cancers most frequently metastasise to bone, followed by metastasis to lungs, liver and brain. Presence of metastases affects disease prognosis, patient's quality of life, and treatment options. Imaging bone metastases in particular is challenging as the lesions

can be osteolytic, osteoblastic, or sometimes mixed. Another problem is encountered in measuring response to treatment, because although bone metastases from breast can be treated, their response is not measurable according to existing response criteria. For these reasons, the best imaging modality for diagnosing the lesion and for assessing its response to treatment is still debatable. Imaging by plain radiography, CT, MRI, or skeletal scintigraphy, are used with varying success, and increasing use of positron emission tomography is now recommended. In our review, we discuss currently used algorithms, and the strengths and weaknesses of various techniques utilised to facilitate accurate and cost-effective choice of imaging studies for the detection of bone metastases.

p104

### How many previous films are reviewed by film readers when switching from film screen to digital reporting?

Russell, H. C., Godden, D. P., Hobson, L. J., Orr, B. M., Pashley, L. T., and Lyburn, I. D.

Gloucestershire Breast Screening Unit, Cheltenham, UK

**PURPOSE:** Full field digital (FFD) mammographic systems are now being installed in UK breast screening units. When switching from film screen to FFD each screening unit will have to adopt a strategy for comparing previous films with new in all prevalent screens. This will be necessary to maintain cancer detection rates without increasing the recall rate. There are a number of potential strategies. We present data on the proportion of previous films reviewed in the first 2 months of FFD reading in an NHS Breast Screening unit. This study will be useful for units planning for digital implementation. **MATERIALS/METHODS:** We use light-boxes to compare films, with all previous screening films available (but not loaded) and have collected data on the number of previous films reviewed in our clinical practise. Our 6 film readers audited the number of previous films they chose to review when reading. **RESULTS:** We present data on the first 9290 prevalent screen-reads in our new fully digital unit. The percentage of films reviewed ranged between readers from 13% to 26%. Numbers decreased slightly for most readers over the first few weeks. **CONCLUSION:** Our preliminary results show that our strategy of having previous films available is an efficient and manageable one. We are continuing to collect data for a much larger series.

p105

### Mammograms under 35 – why are we doing them?

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**PURPOSE:** Royal College of Radiologists (RCR) guidelines state that ultrasound is the first line investigation in patients <35 with a breast lump. Mammography should be used in addition if there are suspicious features on ultrasound or clinical examination. We reviewed mammography requesting in patients aged <35 presenting to our breast clinic. **METHODS:** Retrospective review of patients <35 presenting to the breast clinic within 1 year who underwent mammography. Demographic data, indication and results of mammography, ultrasound and pathology were reviewed. **RESULTS:** 28 patients (3 males) were investigated with mammography. The mean age was 32 (range 25–34). Mammography requesting was appropriate in 50% undergoing either follow up surveillance of malignancy or investigation for a breast or axillary lump. Of 8 patients presenting with a breast lump new cancer was diagnosed in 5. Invasive ductal carcinoma was most frequent but medullary, mucinous and phylloides tumours were also encountered in this age group. Mammography was appropriate in 1 patient with ascites and possible breast malignancy. Mammography requesting seemed inappropriate in the remaining 13 patients (46%).

Male patients with gynaecomastia, patients with breast tenderness or discharge should not be investigated with mammography as the first line investigation. **CONCLUSION:** Cancer in this age group while not frequent does occur and mammography is an appropriate investigation. However, unnecessary mammograms are still being performed for other indications. Clinicians and radiologists need to be aware of the appropriate indications for the requesting of mammography. We have reinforced the guidelines and will be re-auditing.

p106

**Breast MRI at 3T in high risk familial breast cancer screening: comparison with 1.5T**

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*University of Hull, Hull, UK*

**PURPOSE:** Due to artefacts associated with 3.0T scanners caution has been urged in the implementation of breast MRI at 3.0T. The aim of this work was to compare the sensitivity and specificity achieved by a 3.0T MR breast screening programme against the published results of screening studies performed at 1.5T. **MATERIALS/METHODS:** Over 18 months 290 patients were scanned on a 3.0T scanner. All patients were referred due to their high familial risk of breast cancer. Images were scored from 1 (normal) to 5 (highly suspicious of malignancy) according to the RCR Breast Group imaging classification. For this study RCR scores were dichotomised into benign (1–3) or malignant (4 or 5). All patients were offered followed up surveillance at either 12 or 24 months depending on their relative risk. **RESULTS:** Of the 290 patients scanned follow up data was available in 233 patients. In the initial screening round malignant RCR scores were assigned to 8 patients while 225 were scored as benign. Further investigations revealed 3/8 lesions with RCR MR scores 4–5 to be malignant while the remaining tumours were benign. One false negative result was determined at the second screening round. The resulting sensitivity and specificity for this study was 75% and 98% respectively while published 1.5T sensitivity and specificity range from 75–94% and 82–97%, respectively. **CONCLUSION:** The diagnostic accuracy of MR breast screening at 3.0T does not seem to be adversely effected by high field strength related artefacts and the results are comparable to those published at 1.5T.

**Breast e-poster**

e107

**MRI breast imaging: family history screening – the utility of further imaging and the second look ultrasound**

Riley, P. M., Mathen, V., Lim, Y., and Hurley, E.  
*University Hospital South Manchester, Manchester, UK*

**KEY LEARNING OBJECTIVES:** 1. To show how MRI Breast Screening is used in the context of family history screening. 2. To outline, the value of further imaging including the “second look” ultrasound in clinical practice. 3. To discuss cases of diagnostic difficulty following the initial MR Breast scan. **DESCRIPTION:** Review of an 18 month time period showed that 122 patients with a family history of breast cancer underwent MR scanning. This can be further subclassified as 48% patients with BRCA1, 25% with BRCA2, 2% with *p53* mutations and 25% of patients were the genetic predisposition is not specified. A total of 25 patients were recalled for ultrasound. A total of 5 breast pathologies were initially detected by breast MR; 3 invasive carcinomas and 2 papillomas were biopsied under ultrasound guidance. The remaining recall cases confirmed a benign pathology. There were 12 recalls for repeat MRI, within 6 months, none of which showed a significant change from the original MR. Case studies will outline some of the MR scans where there was diagnostic difficulty in predicting whether or not a significant pathology was initially seen and go on to show the benefit of additional imaging. **CONCLUSION:** MR Breast imaging in family history screening does detect significant pathology as described above. There is value to further imaging especially in cases of diagnostic difficulty.

e108

**Incidental breast lesion detection: an important review area on body CT**

Riley, P. M., Jeffree, J., and Brady, J.  
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**KEY LEARNING OBJECTIVES:** 1. To outline the importance of breast tissue as a review area on body CT. 2. To outline, with examples, whether a lesion can be accurately assessed by CT and show what factors imply benignity or malignancy. **DESCRIPTION:** CT is not a first line investigation in detecting breast lesions. In our centre the increasing number of scans performed leads to increasing incidental breast lesion detection. A retrospective analysis of CT thorax investigations over a 10 month period shows that an incidental breast lesion is detected in 0.7% of cases. Of these 32 lesions, 8 were found to be malignant. There were 18 benign pathologies, 10 of which required further imaging to confirm status. There were 6 indeterminate lesions, not followed up because of the clinical context (*e.g.* palliative patient with non breast primary) or unchanged appearances compared with a previous CT. Clinical, mammographic, and ultrasound correlation was therefore required in the majority of cases. **Case studies:** 1. Lesions likely to be malignant on CT. 2. Lesions of uncertain significance on CT found to be malignant on further imaging and biopsy. 3. A range of benign pathologies, mostly requiring further correlation including cysts, lipomas, sebaceous cysts, cellulitis, gynaecomastia and nipple abnormalities. **CONCLUSION:** Breast tissue is an important review area on CT. Further imaging as well as clinical review in the breast clinic is often required to accurately determine pathology. The examples outline the features suggestive of both benignity and malignancy.

e109

**Imaging of “lost” subcutaneous breast expander injection port**

Datta, S. and Chatterjee, S.  
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**OBJECTIVE:** The subcutaneous ports are known to migrate and inability to feel them at their site of fixation causes inconvenience to clinicians and prevents their use. Ultrasound has been used before to locate them however we have used ultrasound and mammography to locate them effectively. Two cases are presented. **DESCRIPTION:** Two cases of lost subcutaneous breast expander injection port were referred to us in last approximately 5 years. In case 1, the port migrated after the initial use. Ultrasound was used very effectively to locate and mark it for the clinician using the saline of the partially expanded breast expander as the window. In case 2, the port had never been used and that made ultrasound as a rather poor locator on the initial use. Mammography of the reconstructed breast localised the metallic disc of the expander effectively and the second look ultrasound correctly located it. **CONCLUSION:** Imaging can be used effectively to locate the migrated subcutaneous breast expander injection port; ultrasound remains the first method of choice.

e110

**The role of radio-isotopes in the localisation of breast cancer**

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**BACKGROUND:** The use of radioisotopes in the localisation of breast cancer is emerging as standard practice in the diagnosis and treatment of early breast cancers. Radioguided occult lesion localisation (ROLL) and sentinel lymph node localisation biopsy (SLNB) by an injected radiotracer is a possible alternative to practice such as wire guided localisation, ultrasound skin markers and full axillary lymph node dissection. The aim of this review is to ascertain from the studies carried out why radioisotopes are more advantageous than other surgical procedures, why these techniques have been developed and for most part embraced by breast cancer practitioners and surgeons. **METHOD:** A broad literature search was carried out using Pubmed, Science Direct, Ovid, NHS screening. The search engine Google was used to source up to date statistics from government websites. **DISCUSSION:** SLNB has a high specificity rate of 100% and a high



sensitivity rate of 91% with a false negative rate of just 9% (Veronesi *et al.* 2009). In a retrospective study the concern for overt axillary metastases was proven to be unfounded as the 5 year survival rate was 97.6%. Equally ROLL and SNOLL are easy to perform, have proven results in terms of localisation and tumour free margins, with an improved cosmetic result. CONCLUSION: The role of radio-isotopes in the localisation of breast cancer is an evolving one. Long term studies need to be carried out to ascertain if this improves survival and increases the patient's chances of remaining disease free.

## Chest poster

### p201

#### Standardisation of quantitative measures of airway remodelling in severe asthma using different software platforms

Gupta, S.<sup>1</sup>, Raj, V.<sup>2</sup>, Fetita, C. I.<sup>3</sup>, Mawby, D.<sup>2</sup>, Entwisle, J. J.<sup>2</sup>, and Brightling, C. E.<sup>1</sup>

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**PURPOSE:** Multi-detector CT has been used increasingly as a research tool to non-invasively measure intra-thoracic airway dimensions. Use of different software platforms for quantitative analysis can cause considerable variation in airway wall area (WA) and lumen area (LA) estimation. We sought to identify standardisation methods for the airway measurements. **MATERIALS/METHODS:** An in-house developed phantom model consisting of 9 plastic tubes (Phantom A) and a commercially available lung phantom (CTP674©, The Phantom Laboratory) consisting of six polycarbonate plastic tubes (Phantom B) of varying dimensions were used. CT scan was performed at 16×0.75 mm collimation, 120 kV and 40 mAs with reconstruction at 0.75 mm slices and FOV 350 mm. Dimensions of tubes 4–9 from Phantom A and all six tubes of Phantom B were assessed using two software platforms: (1) EmphylyxJ© and (2) MedView©. Regression equations were derived for correction of LA and WA dimensions. Right apical segmental (RB1) bronchus dimensions of 53 severe asthmatics were also assessed. **RESULTS:** The gold standard measurements for the phantom A tubes 4–9 ranged from: WA (7.5–47 mm<sup>2</sup>) and LA (5.1–20 mm<sup>2</sup>) and phantom B tubes 1–6 ranged from: WA (6.8–35 mm<sup>2</sup>) and LA (6.1–28.3 mm<sup>2</sup>). Mean (sem) RB1 LA and WA for severe asthmatics was significantly different when assessed using two software platforms [EmphylyxJ© Vs MedView©, paired *t*-test; LA, 14.6 (1.1) Vs 17.0 (1.1), *p* = 0.01; WA, 24.0 (1.0) Vs 33.7 (2.6), *p* = 0.0001]. Using the regression equations RB1 LA and WA absolute difference was reduced by 33% and 96%, respectively. **CONCLUSION:** Regression equations for WA and LA derived using phantom models can be used for standardisation of airway dimensions assessed with different software platforms.

### p202

#### Quantitative analysis of high resolution computed tomography scans in severe asthma sub-phenotypes

Gupta, S.<sup>1</sup>, Siddiqui, S.<sup>1</sup>, Haldar, P.<sup>1</sup>, Entwisle, J. J.<sup>2</sup>, Mawby, D.<sup>2</sup>, Wardlaw, A. J.<sup>1</sup>, Bradding, P.<sup>1</sup>, Pavord, I. D.<sup>1</sup>, Green, R. H.<sup>1</sup>, and Brightling, C. E.<sup>1</sup>

<sup>1</sup>University of Leicester, Leicester, UK, <sup>2</sup>Glenfield Hospital, Leicester, UK

**PURPOSE:** Severe asthma is a heterogeneous condition. Airway remodelling is a feature of severe asthma and can be determined by quantitative analysis of high resolution CT (HRCT) scans. Our aim was to assess whether airway remodelling is restricted to specific sub-phenotypes of severe asthma. **MATERIALS/METHODS:** We did a retrospective analysis of HRCT scans from subjects that had attended a single-centre severe asthma clinic from 2003 to 2008. The right upper lobe apical segmental bronchus (RB1) cross-sectional geometry was measured using the full width at half maximum method. The clinical and sputum inflammatory characteristics associated with RB1 geometry were assessed by univariate and multivariate regression analyses. Longitudinal sputum data were

available and were described as area under the time curve (AUC). Comparisons were made in RB1 geometry across subjects in 4 sub-groups determined by cluster analysis, between smokers versus non-smokers and subjects with and without persistent airflow obstruction. **RESULTS:** 99 subjects with severe asthma and 16 healthy controls were recruited. In subjects with severe asthma the RB1 % wall area (WA) was increased (*p*=0.009) and luminal area (LA)/body surface area (BSA) was decreased (*p*=0.008) compared to controls, but was not different across the sub-groups. Airway geometry was not different between smokers and non-smokers and RB1 %WA was increased in those with persistent airflow obstruction. %WA of RB1 in severe asthma was best associated with post-bronchodilator FEV1% predicted and sputum neutrophils AUC (Model R<sup>2</sup>=0.20, *p*=0.001). **CONCLUSION:** Airway remodelling of proximal airways occurs in severe asthma and is associated with impaired lung function and neutrophilic airway inflammation.

### p203

#### A pictorial review of high resolution computed tomography (HRCT) findings in rheumatic disease

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<sup>1</sup>Royal National Hospital for Rheumatic Diseases NHS Foundation Trust, Bath, UK, <sup>2</sup>University Hospitals Bristol NHS Foundation Trust, Bristol, UK, <sup>3</sup>Great Western Hospitals NHS Foundation Trust, Swindon, UK

**KEY LEARNING OBJECTIVES:** Illustrate the pulmonary manifestations of rheumatic disease seen on HRCT. Provide the radiologist with a structured approach to HRCT interpretation. **DESCRIPTION:** HRCT of the chest allows detailed evaluation of the lung parenchyma. The complex range of imaging appearances, disease classification and nomenclature often causes confusion. Systemic autoimmune diseases have a prevalence of >1%. Patients frequently undergo HRCT due to the high incidence of thoracic complications – systemic sclerosis (SS) is associated with pulmonary fibrosis in up to 50% of cases, and rheumatoid arthritis (RhA) in up to 10%. We illustrate the range of thoracic manifestations of these complex multisystem diseases and provide a systematic approach to HRCT evaluation. Interstitial disease will be demonstrated with examples of fibrosis associated with RhA, systemic lupus erythematosus (SLE), SS, polymyositis and dermatomyositis. Large airway disease will be demonstrated with examples of bronchiectasis in RhA and SS and thickening of tracheal and bronchial walls associated with Wegener's granulomatosis. Patients with Sjogren's syndrome may have bronchiolitis and small airways disease is also found in RhA and SLE. Pleural disease often accompanies SLE and Churg-Strauss syndrome. We illustrate complications of treatment including aspergilloma and military TB in a patient receiving infliximab, and extra-pulmonary manifestations of disease seen on HRCT. **CONCLUSIONS:** HRCT is used in the diagnosis and subsequent evaluation of thoracic complications of rheumatic diseases. We review the range of appearances and provide the radiologist with a structured approach to HRCT interpretation. Interstitial, small and large airway, and pleural manifestations will be illustrated.

### p204

#### HRCT patterns of interstitial lung disease in autoimmune connective tissue disorders

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**LEARNING OBJECTIVES:** By the end of reading this poster you should be able to describe the high resolution computed tomography (HRCT) features of various interstitial lung diseases (ILD) in patients with diverse connective tissue diseases (CTD); be aware of the incidence of ILD in autoimmune CTD; understand the importance of ILD as a cause of mortality and morbidity in autoimmune CTD. **DESCRIPTION:** Autoimmune connective tissue disease is not a rare entity. Sjogren's syndrome, for example, has a prevalence ranging between 0.5% and 3%. The incidence of ILD in CTD patients in an



outpatient setting has been estimated at 30% and mortality is high in those who go on to develop pulmonary hypertension. HRCT has proven to be of great value when assessing patients with diffuse lung disease. Based on the morphological findings visible on HRCT a specific diagnosis can sometimes be made, or the differential limited to a few possibilities. This poster reviews the typical HRCT findings patients with ILD associated with rheumatoid arthritis, progressive systemic sclerosis, polymyositis and dermatomyositis, Sjogren's syndrome, mixed connective tissue disease and antisynthetase syndrome. **CONCLUSION:** With this poster we aim to provide an overview of the radiographic patterns of autoimmune connective tissue diseases on HRCT. Because the prognosis, degree of reversibility, and optimal therapy differ for each disease presentation, knowledge of the imaging characteristics for each disease is important.

#### p205

##### **Anatomy and pathology of the mediastinum – a pictorial review**

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**KEY LEARNING OBJECTIVES:** To illustrate the radiological anatomy of the mediastinum on chest radiographs with CT correlation, demonstrating pathology in each of the mediastinal compartments. **DESCRIPTION:** The mediastinum is defined as the space between the two lungs extending from the thoracic inlet superiorly to the diaphragm inferiorly and bounded by the sternum anteriorly, the vertebral column and costo-vertebral junctions posteriorly and mediastinal pleura on both sides. Soft tissue landmarks important to the mediastinum include the right paratracheal, right and left para-vertebral, azygo-oesophageal, aorto-pulmonary, posterior tracheal and retro-sternal stripes and anterior and posterior junction lines. This space has been variably divided into superior, anterior or antero-superior, middle and posterior compartments for descriptive purposes. A mediastinal mass can be characterised on the basis of the radiological bony and soft tissue anatomy. This knowledge allows the radiologist to make an assessment of the likely underlying pathology even prior to CT. We give a pictorial description of various plain film signs that are used to indicate location of a mediastinal mass and its possible cause along with CT correlation. **CONCLUSION:** Knowledge of bony and soft tissue landmarks in the mediastinum is essential and allows the radiologist to appropriately classify mediastinal masses by location in order to arrive at a likely diagnosis.

#### p206

##### **The new seventh edition of the TNM classification of lung cancer: what are the changes and why have they come about**

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**KEY LEARNING OBJECTIVES:** 1. To identify and illustrate the differences between the previous TNM staging and the new IASLC staging classification for lung cancer. 2. To correlate changes in the new staging of lung cancer with prognosis and treatment. **DESCRIPTION:** Lung cancer is the second most common cancer in both men and women in the UK and has poor survival rates. It has been estimated that the lifetime risk of developing lung cancer is 1 in 14 for men and 1 in 21 for women in the UK. The importance of accurate, reproducible staging of lung cancer for patient management and clinical research cannot be overemphasised. The new TNM classification proposed by the International Staging Committee (ISC) of the International Association for the Study of Lung Cancer (IASLC) was recently published. Regional implementation in the UK is expected to occur throughout 2010. This refines current staging practices by better differentiating tumours of different prognoses. These changes apply for both non-small and small cell lung cancer. A sound appreciation of the new classification is important, not only in committing it to memory but also in improving clinical practice. In this poster we highlight the changes that have occurred in the new TNM classification with CT, plain film and PET examples and explain the rationale behind the changes. **CONCLUSION:** We will demonstrate, with the aid of

clinical examples, the seventh edition TNM staging for lung cancer, thus enabling Radiologists to understand and adapt seamlessly to the new directives.

#### p207

##### **Audit of diagnosis of lung cancer on chest radiography**

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**PURPOSE:** Early diagnosis of lung cancer optimises survival. NICE and RCR recommend CXR as the initial method of imaging in the investigation of patients with suspected lung cancer. Studies evaluating the detection of lung cancers on CXRs show a wide variation (20–50%) in the miss rate. By evaluating the miss rate of lung cancer on chest X-ray, we aim to optimise reporting in our trust. **MATERIALS/METHODS:** Primary lung cancer cases diagnosed in September 2009 were identified using the local Patient Pathway Monitor database. CXRs and reports from the year prior to diagnosis were reviewed. The presence of the lesion was evaluated. Errors in technique, reporting and communication and impact on date of diagnosis were recorded. **RESULTS:** 58% of lesions were identified on the initial CXR. 42% of cases had >1 CXR in the year prior to diagnosis. Of 17 misses (28%) identified, 2 were technical, 9 were perceptual and 6 were interpretive. Mean delay to diagnosis was 84 days in those with a missed lesion compared with 11 days in those with no miss. Appropriate communication was undertaken following 59% of the films on which an abnormality was identified and reported as suspicious. **CONCLUSION:** We aim to use a standard paragraph for reporting suspicious lesions to ensure efficient and clear communication of the result. We aim to develop a teaching file of missed lung cancers to improve local awareness of possible appearances. Following implementation of these recommendations re-audit will be performed.

#### p208

##### **Chest X-ray findings in patients referred for CTPA – a useful predictor?**

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**PURPOSE:** CXR is part of the routine work-up for patients suspected of having pulmonary embolism (PE). We investigated whether there was any difference in CXR findings between those positive or negative for PE, and therefore whether the CXR was a useful test in predicting investigation outcome. **MATERIALS/METHODS:** We searched our CRIS system to identify 500 adults undergoing CTPA. The most recent prior CXR for all these patients was reviewed along with the CTPA result. **RESULTS:** Of 500 patients, 13% were positive for PE. 97% of patients had a CXR prior to CT. In both positive and negative PE groups, 50% of CXRs were normal. Of the other 50%, abnormal findings included consolidation, lobar collapse, effusion and pulmonary oedema. The proportion of abnormal findings was the same in both the positive and negative PE groups. **CONCLUSION:** 1. The CXR prior to CTPA is just as likely to be abnormal in those patients with a positive PE scan as it is for those with a negative scan. No specific abnormal finding on CXR can help determine whether the patient will have a positive or negative CTPA result. 2. Reviewing the CXR prior to CTPA is useful to help determine the most suitable imaging modality for investigation of PE, but is not a good indicator of the likely result, and the presence of abnormalities, e.g. consolidation and pulmonary oedema does not make a positive CTPA result any more or less likely.

#### p209

##### **Putting the PE into perspective – investigating suspected pulmonary embolism in pregnancy**

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**PURPOSE:** PE (pulmonary embolism) remains the leading cause of maternal mortality with an incidence of 1 in 2000. We determine the positivity rate of computed tomography pulmonary angiography (CTPA) and perfusion scintigraphy (Q scan) for suspected PE in pregnant women. **METHODS:** Retrospective analysis over 2 consecutive years of all pregnant women with suspected PE who underwent imaging. Maternal demographic data was collected and the adequacy of CTPA scans determined. **RESULTS:** There were 8500 births in the 2 years. 66 pregnant women were investigated, mean age 30 years and mean gestation 27.6 weeks. 20 CTPAs were performed. None were positive for PE (2 demonstrated minor consolidation, 1 atelectasis). 46 Q scans were performed. 1 scan was high probability and 2 scans were indeterminate (1 patient subsequently had a normal CTPA, the other was treated for confirmed DVT). Positivity rate was 0% for CTPA and 2.1% for Q scan, with 4.3% indeterminate Q scans and 0% indeterminate CTPAs. The mean age of patients treated for PE was 33 years and the mean gestation 38 weeks. No missed PEs were recorded. **CONCLUSIONS:** In our population the incidence of PE is lower than suggested in the literature. Patients with PE are more likely to be older and in the third trimester. Both imaging modalities were adequate with few non-diagnostic scans. Physiological changes in pregnancy can mimic PE but clinicians and radiologists need to be aware of the true incidence of PE. Radiology departments need to formalise guidelines concerning appropriate imaging in pregnancy.

### p210

#### Automated tumour segmentation for assessment of treatment response in malignant pleural mesothelioma (MPM)

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**PURPOSE:** To develop an effective automated image segmentation method for improving the assessment of treatment response in MPM. **MATERIALS/METHODS:** Traditional segmentation methods based on thresholding or region growing are often unsuccessful in MPM due to the similar attenuation of adjacent structures. We therefore developed a novel computer-based algorithm for segmenting MPM. Our algorithm is based on probability density functions using non-parametric windows (NPW). The algorithm was applied to 12 CT examinations from 5 patients to calculate tumour area on multiple slices. (38 scans from 16 patients are available) For validation purposes, manual segmentation was performed independently by a thoracic radiologist using an electronic pen and tablet. **RESULTS:** The algorithm performed with a good degree of accuracy in cases where tumour was surrounded by effusion or aerated lung, with a mean difference (DICE) in aerated lung of 6% ( $\pm 2\%$  SD) compared to radiologist derived areas. However, the algorithm was less successful at segmenting tumour (25% mean difference, 15% SD) from atelectatic lung or diaphragm. In order to improve the performance of the algorithm, we are now working on a vector-based approach, applying the NPW estimator to other important image features such as tissue heterogeneity and texture. **CONCLUSION:** Our initial results show that segmentation with an NPW-based algorithm can segment MPM from surrounding tissues with a high degree of accuracy in simple cases. We believe that the addition of other vectors to the analysis will allow a more universally applicable automated method for calculating tumour volume and response to therapy.

### p211

#### Unexpected findings on CTPA – essential review areas

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**KEY LEARNING OBJECTIVES:** 1. For 1 in 20 patients, the CTPA scan for investigation of PE will reveal a significant unexpected finding. 2. A series of 5 simple review areas on CTPA can help identify the majority of incidental findings, and ensure important pathologies are not overlooked. **DESCRIPTION:** CTPA is increasingly becoming

the most popular modality used for the investigation of pulmonary artery embolic disease (PE). One advantage over V/Q scans is that other pathologies can be detected. We used our radiology CRIS system to search for patients over the age of 18 years who underwent CTPA for “?PE” in our institution within the last 6 months. 500 patients were included. The radiology reports of these examinations were then reviewed and any findings other than PE were identified. There were 25 significant new unexpected findings from 500 examinations (5%). In the thorax these included aortic dissection, 8 new lung cancers, acute thoracic spine fracture, a large pneumothorax and pulmonary abscesses. The selected venous images revealed further unexpected findings including renal cell carcinoma, an incarcerated inguinal hernia, abdominal aortic aneurysms and lymphoma. These findings can be grouped into 5 anatomical review areas which will ensure important pathologies are not missed. **CONCLUSION:** We present a pictorial review of unexpected CTPA findings and suggest 5 simple review areas which, if adhered to, will ensure these pathologies are not overlooked.

### p212

#### Influence of the multi-disciplinary meeting in interstitial lung disease (ILD)

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**PURPOSE:** The British Thoracic Society recommends that patients with suspected interstitial lung disease are discussed at a dedicated multi-disciplinary meeting (MDM). This study sought to quantify the effect that the MDM had on the management of patients with suspected ILD. **MATERIALS/METHODS:** Data was collected prospectively from ILD MDMs from October 2008 to October 2009 at a large Respiratory Medicine Unit. The data were used to determine whether the diagnosis of ILD was uncertain before MDM review, the proportion of patients having HRCT before review and whether management or diagnosis changed on the basis of the MDM discussion. **RESULTS:** 87 patients were discussed at 11 ILD MDMs. 79 patients had prior HRCT (91%). In 50 patients the diagnosis was unclear before discussion. A new working diagnosis was reached on the basis of radiological review ( $n=24$ ); clinical discussion ( $n=80$ ); or pathological review ( $n=3$ ). The diagnosis was changed as a result of radiological review in 7 of 37 with a definitive initial radiology report. In a further 23 of the 87 total cases (26%), an alternative diagnosis or further investigation was suggested on the basis of imaging review. **CONCLUSION:** Initiation of the ILD MDM in our institution positively influenced patient management in a large proportion of cases.

### p213

#### Chest X-ray referrals for asthmatic patients presenting to A&E departments. Do we do too many?

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**PURPOSE:** Acute exacerbation of Asthma is a common presentation at the emergency departments across the UK. Many patients presenting with exacerbations of asthma are referred for a chest X-ray. British Thoracic Society guidelines outline clear criteria to guide clinicians as to when to refer such patients for chest X-ray. The aim of this audit was to investigate the percentage of chest X-ray referrals for such patients that adhere to these guidelines. **MATERIALS/METHODS:** This retrospective case study looked at patients presenting to the emergency department at Aintree University Hospital with asthma between October 2008 and June 2009. This study identified 51 patients referred for CXR with acute exacerbation of asthma with no other pathology during the time period. We assessed whether those referred for CXR adhered to British Thoracic Society guidelines (BTS). **RESULTS:** The study found that 53% ( $n=27$ ) of patients referred for chest X-ray adhered to BTS guidelines. 47% ( $n=24$ ) of patients identified in the group did not meet the BTS criteria for chest X-ray. **CONCLUSION:** Although a small majority of asthmatic patients identified in this study referred for chest X-ray did adhere to BTS guidelines there were a significant number of patients who did not meet the guidelines. Greater

awareness of BTS guidelines among triage staff and junior doctors in the emergency department may increase the adherence rates to the guidelines. Stricter formal criteria for assessing chest X-ray requests could be enforced by radiographers and may also serve to improve adherence to the BTS guideline

**p214**

**TB and anti-TNF: radiologists beware!**

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**PURPOSE:** Anti-TNF (tumour necrosis factor) therapy has been used in the UK since 2001 to treat severe rheumatoid arthritis. The treatment is effective but it increases the risk of developing/re-activating mycobacterium tuberculosis (TB) infections. **MATERIALS/METHODS:** We reviewed the radiology of patients on anti-TNF therapy who had developed TB in our institution. **RESULTS:** 3 cases were found over the last 3 years. All were Caucasian with no other risk factors. Case 1 is a 63 year old lady with miliary TB. Changes on chest X-ray were picked up incidentally when she was admitted with abdominal pain. Despite the radiographic appearances rheumatoid lung disease was initially considered higher in the differential rather than miliary TB because of the clinical picture. Case 2 is a 73-year-old man, who was admitted with septic arthritis. His incidental chest X-ray showed miliary changes and joint aspirate confirmed bovine TB. He only had minor chest symptoms. Case 3 is a 49-year-old lady who developed chest pain and shortness of breath. She was suspected of having a pulmonary embolism. CTPA revealed a pleural effusion and some minor consolidation. This settled but she re-presented with an effusion in the other lung and further lung shadowing. A diagnosis of TB was made on sputum. **CONCLUSION:** In all of these patients on anti-TNF the diagnosis of TB not appreciated initially. This was because of the atypical presentation. The rheumatologists were instrumental in helping make the correct diagnosis because they were aware of the risks associated with this type of treatment.

**p215**

**Chest radiograph findings in H1N1 influenza infection: a perspective from the UK**

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**PURPOSE:** To identify the incidence, pattern and distribution of abnormalities seen on the initial chest radiograph of patients with novel swine-origin influenza A virus ("H1N1"). **METHOD:** All patients with laboratory confirmed H1N1 who presented to our Trust between July and November 2009 were enrolled in this study. The initial chest radiographs were retrospectively reviewed independently by two consultant cardiothoracic radiologists for pattern and distribution of abnormality. **RESULTS:** A total of 83 patients were identified as testing positive for H1N1, with ages ranging between 2 months and 71 years with a mean of 23.7 years. In 64 cases a chest radiograph was performed, of which 12 were normal (18.8%). A consensus opinion between the two reviewing consultants for radiographic findings on the abnormal films was achieved in 49/52 cases (94.2%). In 43/49 cases (87.8%) a single predominant disease pattern was identified, with consolidation in 19/43 (44.2%), bronchial wall thickening in 18/43 (41.9%), nodularity in 5/43 (11.6%) and reticulation in 1/43 (2.0%). In 6/49 cases (12.2%) a mixed pattern of abnormality was identified, including pleural effusions in 2 cases (4.1%). No significant difference was identified between unilateral, 26/49 (53.1%), and bilateral lung involvement 23/49 (46.9%). However, there was a significant preponderance to affect the lower lobes in 41/49 (83.7%) patients with abnormalities identified on initial chest radiographs. **CONCLUSION:** Although no single pattern was identified as being pathognomonic of H1N1 infection the most common abnormalities seen in our study were those of consolidation or bronchial wall thickening, with a strong preponderance to involve the lower lobes.

**p216**

**Tumour seeding following percutaneous biopsies in the thorax: a review**

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**PURPOSE:** Percutaneous lung biopsy is widely practised. Inevitably the needle transgresses the tumour field and tumour cells may migrate into adjacent tissues. This is a rare occurrence. We have undertaken a literature search of this complication. This paper describes our findings. **MATERIALS/METHODS:** We searched Medline, Embase and the Cochrane Library, combining keywords and subject headings for needle/percutaneous biopsy with those for neoplasm seeding, metastasis or local recurrence. Relevant articles were identified by inspection of titles and abstracts. **RESULTS:** Tumour seeding following lung biopsy appears to occur in less than 2% – most commonly with adenocarcinoma. Suggested, but unproven, risks include number of passes, needle size and technique. A study of 70,000 patients showed no difference in 5 year survival in resectable tumours with or without biopsy. The treatment for seeding is localised excision with radiotherapy. In pleural disease surgical biopsy of mesothelioma carries a risk of seeding of up to 40%. Image guided needle biopsy seeding occurs in about 5%. Recent studies have not confirmed any benefit from prophylactic radiotherapy of the biopsy site despite much earlier studies which advocated this approach. The biopsy to seeding interval is about 2–3 months in both tumours. **CONCLUSION:** Lung cancer seeding is rare and the literature would support the current practice of lung biopsy. In mesothelioma, seeding is a well known complication. A balance has to be struck between the seeding risk and diagnosis. The issue of prophylactic localised radiotherapy to the biopsy site remains debatable.

**Chest e-poster**

**e217**

**Computed tomography pulmonary angiography: accuracy of specialist registrar reports**

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**INTRODUCTION:** Computed tomography pulmonary angiography (CTPA) is now the accepted gold standard investigation of suspected pulmonary embolism (PE). In teaching hospitals, the initial reports for these examinations are done by specialist registrars. The purpose of this study was to assess the accuracy of these trainee reports. **MATERIALS AND METHODS:** We prospectively analysed the findings in 100 consecutive double reported CTPA examinations performed during a 28 day period in August–September 2008. The examinations were performed during routine working hours and out of hours. The initial report issued by the on call specialist registrar was compared to the verified consultant report, which was used as the reference standard. **RESULTS:** CTPA was positive for PE in 18 of 100 patients (18%). Trainee and consultant reports were concordant in 17 of these 18 patients (94%). There was a single missed PE. For the 83 patients with no evidence of PE, there was agreement in 82, with a single false positive. Alternative diagnoses in cases with no PE were made in 45 patients (45%). In these, there was agreement in 39 (87%). **CONCLUSION:** There is excellent agreement between trainee and consultant reports in the diagnosis or exclusion of PE. This reinforces the safety of registrar reports especially out of hours where it is the basis of initial management. There is a relatively high proportion of patients with alternative diagnoses and it is imperative for the trainee to be systematic and review all images if observational errors are to be reduced.

**e218**

**Unsuspected pulmonary embolism on chest CT – do we pick them up?**

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**PURPOSE:** The purpose of this study was to determine the incidence of unsuspected pulmonary embolism in contrast enhanced CT of the chest in different patient groups and the detection rate for these on the initial report. **MATERIALS/METHODS:** We reviewed retrospectively 937 contrast enhanced chest CTs on the monitor with 2 different window settings: standard soft tissue window and CT pulmonary angiogram. A pulmonary embolus was diagnosed when a filling defect was definitely present in at least two consecutive slices. When a PE was found the initial report of this study was reviewed to see if it was detected and reported. **RESULTS:** Of the 937 chest CTs reviewed, 32 were excluded for various reasons, therefore 905 CTs were entered into the study. Of these, 742 were done for diagnosis or follow up of malignancy, 16 for trauma and 147 for other indications, most commonly for lung disease. Altogether 26 PEs were found (26/905 = 2.9%). In the 742 cancer patients 23 PEs were found (23/742 = 3.1%), in the trauma patients no PEs and 3 PEs in the 147 non-cancer, non-trauma patients (3/147 = 2.0%). Of the 26 PEs found on our review 23 were mentioned in the initial report for this scan (23/26=85.5%). **CONCLUSION:** Pulmonary embolism, even without obvious clinical symptoms, is not an uncommon finding, especially in cancer patients. It is an important factor of morbidity and mortality, therefore every contrast enhanced chest CT should be scrutinised for the presence of pulmonary emboli because they can be easily missed.

### e219

#### Is CTPA in expiration a better technique for the diagnosis of pulmonary embolism?

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**PURPOSE:** Many CTPAs suffer from artefactual contrast enhancement patterns despite appropriate bolus timing, with generalised unsatisfactory pulmonary artery (PA) opacification and/or focal interruption in PA opacification. Consequently, there is potential for emboli to be hidden within an unopacified PA or for contrast column interruption to mimic embolus. Physiological studies attribute this to the effects of sharp inspiration on caval return (prompted by command to inspire at scan initiation), causing preferential return of unopacified blood from the IVC as opposed to contrasted blood from the SVC. We investigated the effects of performing CTPA in expiration, theoretically minimising the effects of sharp inspiration. **MATERIALS/METHODS:** 76 inspiratory scans performed during April 2008 were compared to 92 expiratory scans performed during April 2009 using a standard protocol. The incidence of transient contrast loss and the density of the PA at central, lobar and segmental levels were compared statistically. Scans were also compared for quality of lung parenchymal imaging, assessed on a five-point scale. **RESULTS:** Expiratory scans showed a significantly lower incidence of transient contrast loss (18.5% vs 42.1%,  $p=0.0007$ ) and lower number of scans with PA HU<200 ( $p=0.0002$ ), the minimum attenuation required to see all emboli. Expiratory scans showed significantly greater PA opacification at central ( $p=0.003$ ), lobar ( $p=0.0002$ ) and segmental ( $p=0.04$ ) levels but significantly lower quality scores ( $p=0.1 \times 10^{-7}$ ) for depiction of lung parenchyma. **CONCLUSION:** Expiratory scanning could be used as an optimal protocol for dedicated PA imaging. However, it suffers from inferior parenchymal imaging and should probably be reserved for failed inspiratory breath-hold CT.

### e220

#### Using preprocedural PET/CT to plan lung biopsy

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**KEY LEARNING OBJECTIVES:** Histological diagnosis of lung tumours is important for patient treatment; PET/CT identifies metabolically active tumour; functionally targeted biopsy provides a higher diagnostic yield; avoids repeat procedures and their potential complications. **DESCRIPTION:** British Thoracic Society guidelines for radiologically guided lung biopsy state that sample adequacy should exceed 90% with a sensitivity of 85–90% for tumours greater

than 2 cm. The guidelines report complication rates for pneumothorax, haemoptysis and death of 20.5%, 5.3% and 0.15%, respectively. Inadequate sampling is traumatic for the patient. Treatment may be delayed while further intervention is performed, with its potential complications, or sub-optimal treatment may be implemented in the absence of definitive histology. If PET/CT is available prior to biopsy, it should be reviewed and used to target metabolically active tissue. We present cases where inadequate or non-representative samples were acquired at first biopsy. Second biopsies were performed, with the benefit of preprocedural PET/CT guidance, with the result of diagnostic cores being obtained. **CONCLUSION:** Correlation with preprocedural PET/CT improves the diagnostic yield of lung biopsies. An adequate first biopsy reduces patient risk and prevents avoidable delay in the implementation of optimal treatment. We advocate that functional imaging is reviewed before lung biopsy and that it is used to target intervention.

### e221

#### The value of a chest X-ray prior to coronary angiograms

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**PURPOSE:** This study was undertaken to determine usefulness of a pre-coronary angiogram CXR on patient management. **METHOD:** Records of 500 consecutive patients who had coronary angiography at Lincoln County Hospital were reviewed on the radiology CRIS system. We reviewed reports of the CXRs. Positive findings were graded as either not significant (expected for patient age) or significant (unexpected findings which needed further imaging and could result in change in management). **RESULTS:** Out of 500 patients 197 had a routine CXR prior to angiography, 270 patients had a CXR in previous 6 months so no routine pre-angiogram CXR was done. 17 patients had both a pre-angiogram CXR and a CXR done in previous 6 months. 16 patients had no CXR. Of the 214 (197+17) patients who had a CXR immediately prior to coronary angiography 170 (79%) were normal. 39 (18%) had a CXR reported as abnormal with findings that were not considered significant or were expected for the clinical condition or the patient's age (*e.g.* cardiomegaly, small pleural effusion, unfolding of the aorta, old fibrotic change). In 5 (2.3%) cases further follow up was suggested, this was ignored in 4 cases but further imaging was performed in a patient with a lung cancer which was suspected clinically. In this study none of the patients had their coronary angiography postponed due to findings on the CXR. **CONCLUSION:** This study showed that a CXR prior to coronary angiogram did not provide useful information which lead to a change in the patient's cardiac management.

### e222

#### Poland's syndrome – size matters

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**KEY LEARNING OBJECTIVES:** To appreciate that MRI in Poland's Syndrome can be utilised not just for anatomical delineation but also to accurately undertake preoperative assessment and planning. **DESCRIPTION:** In 1841 Sir Alfred Poland documented in Guy's Hospital Gazette a syndrome characterised by the congenital deficiency of pectoralis major and minor muscles. Poland's Syndrome is now appreciated to be a spectrum with numerous associated abnormalities described in the literature. The majority of patients seek operative correction primarily for cosmetic reasons. Identification of the various musculoskeletal components ensures optimal thoracic reconstruction. We present 4 cases illustrating the use of MRI for assessment and reconstructive planning. Contiguous transverse and sagittal imaging of the thorax was performed and muscular variants identified. Utilising simple region of interest calculations individual muscle volumes of the pectoralis major, pectoralis minor and latissimus dorsi muscles are calculated bilaterally for comparative purposes and assessment of potential for flap transfer. The most successful reconstructions involve the use of the latissimus dorsi muscle and volumetry measurements

enable the accurate plastic surgical planning of reconstructive surgery for best cosmetic results. **CONCLUSION:** MRI is invaluable in both the qualitative and quantitative assessment of thoracic musculoskeletal abnormalities in patients with Poland's Syndrome wishing to undergo reconstructive surgery. Plastic surgeons at our institution have reported that the MRI based volumetric measurements are an invaluable asset in surgical planning.

e223

**PET/CT vs CT staging in primary lung tumours**

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**PURPOSE:** Our aim was to review our practice of PET/CT in primary lung tumours and assess any change to TNM stage when compared with contrast enhanced staging CT. **MATERIALS/METHODS:** The study was carried out at a medium sized district general hospital. Radiology reports were reviewed for all patients who underwent a PET/CT examination for primary lung tumours over a period of 15 months. Data was collected on changes to staging following PET/CT, additional findings on PET/CT and further investigations of these findings. **RESULTS:** 69 patients were included in the study, all which had half body PET/CT scans from skull base to mid-thigh. The malignancy was upstaged in 16 (23.2%) and down-staged in 9 (13%). There was no change to staging in 27 (39.1%) patients. 20 patients had additional imaging of the primary. 34 (49.3%) patients had 46 areas of additional abnormal uptake; 13 (28.2%) resulted in further imaging or clinical follow up, 7 were dismissed after review and 3 of the patients were too unfit for further investigations. 9 out of the 13 abnormalities which were followed up were normal. In the remaining 23 cases, 18 were not followed up despite recommendation and in 5 no follow up was recommended. **CONCLUSION:** PET/CT scan does aid with the staging of primary lung tumours, however there is also a high incidence of detection of additional findings which lead to further investigations often with normal results.

e224

**Pictorial review to illustrate the revised TNM staging for lung cancer**

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**AIM:** This educational poster aims to describe the differences between the old and new TNM classification system for lung cancer. We review key imaging features which highlight these differences and enable the radiologist to apply this new system into current practice. **LEARNING OBJECTIVES:** The newly instigated changes to the TNM classification of lung cancer, now emphasise the prognostic relevance of tumour size. For example, the recommendations are to subclassify T1 and T2 according to tumour and also to upstage large T2 tumours. They also reassign T4 and M1 tumours. The nodal component of TNM shows no change from the previous system. This poster discusses and illustrates specific examples where the new TNM staging has led to reclassification of lung cancer and subsequent change in its management. **CONCLUSION:** This review demonstrates with examples, the key changes to the TNM classification for lung cancer. We consider this poster to be useful as an educational tool to assist day to day practice.

e225

**The apparently normal chest radiograph: a pictorial view of potential pathologies**

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**KEY LEARNING OBJECTIVES:** We present a pictorial review of subtle abnormal findings on the chest radiograph (CXR). **DESCRIPTION:** CXRs are the most commonly ordered radiological investigation and also regularly feature in the final part of the exam for fellowship of the Royal College of Radiologists (FRCR 2b). There are a number of relatively subtle findings on the "apparently

normal chest radiograph" that may be missed unless specifically searched for, including inferior rib notching, Pancoast's tumour and apical pneumothorax. We demonstrate a strategy for tackling these films, providing examples of a number of such abnormalities. **CONCLUSION:** With prior forethought, radiologists can maximise their chance of identifying pathology on the CXR, which is important for success in exams, and more importantly, in day to day practice.

e226

**Pulmonary arterial hypertension: an overview of the radiology from a satellite service**

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The current clinical aspects of pulmonary arterial hypertension (PAHT) have resulted in a rapidly expanding sub-speciality. 10 years ago no licensed therapies were available for patients with PAHT. Now there are a number of treatment options that can significantly improve both mortality and morbidity. We have expanded our PAHT clinic and now offer the biggest satellite service in the UK and one of only two PH services in the South West. Patients may be investigated with CT pulmonary angiography (CTPA), HRCT of the lungs, echocardiography and right heart catheterisation. Due to our close proximity to the Royal National Hospital for Rheumatic Disease, many patients have co-existent interstitial lung disease. However, CTPAs are performed in large numbers in every NHS trust and provide an opportunity to detect PAHT. This is currently being under-diagnosed. In this poster we explore the various CT findings seen in patients with proven pulmonary hypertension and discuss the crucial, and varied, impacts it has on patient management. We emphasise the importance of picking up chronic thromboembolic disease, with several of our patients having been referred for pulmonary thromboendarterectomy. We also visit the more subtle area of parenchymal lung change in PAHT associated with interstitial lung disease. In combination, CTPA and HRCT are invaluable in determining which patients with PAHT will respond to PAHT-specific medical therapy and/or surgery.

**Cardiac poster**

p301

**Minimising use of higher strength contrast media in CT coronary angiography using bolus shaping software**

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**PURPOSE:** With today's advanced CT technology allowing rapid acquisition of CT coronary angiography examinations, it has been necessary to use higher strength contrast media to optimise contrast opacification. By using a bolus shaping software called "Optibolus" to exponentially decrease the injection flow rate, it is possible to both optimise vascular opacification and reduce the total iodine dose administered to patients, by using lower strength contrast media. **MATERIALS/METHODS:** Patients for CT coronary angiography were assigned to two groups in a prospective randomized study. Group A received 100 ml of Iohexol 350 with an Optibolus injection protocol; start flow rate of 5.7 ml s<sup>-1</sup>, end flow rate of 4.4 ml s<sup>-1</sup>. Group B received Iomeprol 400 using a uniphasic (5 ml s<sup>-1</sup>) protocol. The same iodine flux was delivered in both arms of the study. Contrast enhancement was scored by 2 radiologists, who independently interpreted the images and were blinded to both protocols. Assessment of the absolute contrast density was measured in Hounsfield units utilising a standard 200 pixel circular region of interest placed in the aortic root. **RESULTS:** With a mean and median of 399 and 396, respectively, for Group A, and mean of 443 and median of 419 for Group B, a confidence level of 80.4% and *p*-value of 0.198 was obtained. **CONCLUSION:** This study demonstrates that using "Optibolus" with a lower strength contrast media produces high quality CT coronary angiography examinations with a contrast enhancement and iodine flux of no statistical difference than those produced using higher strength contrast media.

p302

**Non-invasive cardiac imaging in patients presenting for primary percutaneous coronary intervention (PPCI) and non-obstructive angiogram**

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**PURPOSE:** Primary percutaneous coronary intervention (PPCI) is now the treatment of choice for patients presenting with ST elevation infarction (STEMI). However, a proportion of patients coming for PPCI are found to have no obstructive coronary artery disease on the angiogram and may have alternative cause for their chest pain. We set out to evaluate the usefulness of non-invasive cardiac imaging in these patients. **MATERIALS/METHODS:** The hospital databases were retrospectively searched for all the non-invasive investigations like X-ray, CT, MRI, echocardiography and radionuclide-imaging in patients presenting for PPCI over a 2 year period. The patient demographic data, clinical symptoms and signs, ECG, biomarker levels, angiographic findings and non-invasive imaging were reviewed for analysis. **RESULTS:** Out of 1022, 910 (89.04%) patients had an angiogram. of the 910 patients, 704 (68.88%) had PPCI, 21 had CABG, and 185 (18.10%) did not have any coronary intervention. The latter subgroup had chest X-rays in 96, echocardiography in 88, CT scans in 25, MRI in 12 and radionuclide scans in 18 patients. Abnormalities such as pulmonary embolism (4), emphysema (5), pulmonary consolidation (7), coronary artery disease (2), pleural effusion (9), hypertrophic cardiomyopathy (18) and ischaemic cardiomyopathy (17) were identified on non-invasive assessment. **CONCLUSION:** Non invasive imaging investigations are valuable adjunct in the above patient group when considered along with clinical symptoms, ECG findings and biomarker levels. With this retrospective review we were able to draw a diagnostic pathway for the future practice. However, a randomised control trial is warranted.

p303

**Cardiac stress MRI – the radiographers perspective**

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We present the Radiographers and patients' role in these examinations prior, during and after the examination and the necessity for dedicated specially trained MRI staff and an educated patient for the safety and delivery of a successful examination. This will take the form of: 1. Workup prior to the examination, *i.e.* clinical referral, information available to the patient, dietary requirements, cessation of particular medications, verbal + written questioning, importance of ECG workup/recognition of patterns and contraindications 2. Setup on the MRI scanner, IV access, essential monitoring/infusion equipment, patient compliance. 3. During the scan, the Radiographer and patient role. Monitoring and communication during the stress drug infusion. Acquiring diagnostic images (trade-offs/pitfalls), interpretation of pre-stress images, *e.g.* aortic stenosis, signs to look for, *e.g.* ECG (AF/heart block)/patient tolerance, when to recognise a successful test/adverse patient reaction. 4. Observation after the test; the Radiographers role in possible adverse reactions. Post procedure instructions. We will also present the information from a patient survey of "stress" patients gathered prior and after their examination to give a unique insight into the procedure and how/where patient's experience can be utilised in future studies. **CONCLUSION:** MRI cardiac stress exams are an essential tool in the workup in specific cardiac groups. However, only if strict guidelines, appropriately trained Radiographic staff and educated patients can the examination effectively and safely contribute to the patient well-being and clinical outcome.

**Cardiac e-poster**

e304

**The assessment of pericardial disease on cardiovascular MRI**

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**KEY LEARNING OBJECTIVES:** To review normal pericardial anatomy and physiology. To empower the reader to confidently identify pericardial pathology on cardiac magnetic resonance imaging (CMR). **DESCRIPTION:** Pericardial disorders are uncommon and are notoriously difficult to assess with echocardiography. Increasingly, therefore, cross-sectional imaging techniques are being used to evaluate the pericardium as these can provide a comprehensive assessment. The advantages of CMR are its ability to make a functional assessment, particularly in cases of suspected pericardial constriction where it can be reliably distinguished from restrictive cardiomyopathy, and tissue characterisation sequences which allow further analysis of inflammatory conditions and pericardial tumours. In this poster, we review the anatomy of the pericardium as demonstrated on CMR. We also demonstrate the variety of pericardial pathologies that can be identified, including pericardial effusions and thickening, constrictive physiology, developmental abnormalities and tumours. The specific sequences that are required for a thorough assessment are also reviewed. **CONCLUSION:** CMR is an increasingly useful non-invasive investigation for cardiac disease. This imaging review highlights pericardial anatomy, physiology and pathology, specifically illustrating the CMR findings of acquired and developmental pericardial disease, and thus empowering the reader to confidently identify pericardial abnormalities on CMR.

e305

**Interventricular septal fibroma in a 40 year old female patient**Ali, I.<sup>1</sup>, Ubaid, S.<sup>2</sup>, and Cusack, M.<sup>1</sup><sup>1</sup>*The Royal Wolverhampton Hospital, Wolverhampton, UK,*<sup>2</sup>*Stafford Hospital, Stafford, UK*

**KEY LEARNING OBJECTIVES:** "Always think outside the box". The case below illustrates how a young female was found to have cardiac fibroma when she presented with atypical chest pain. Such a rare pathology presented itself with a very common symptom. It is important to think differently and consider other differentials when making a diagnosis. **DESCRIPTION:** A 40-year-old female presented with atypical chest pain. Her past medical history was not significant. She was a non-smoker and had no significant family history of cardiac diseases. Physical examination was unremarkable. ECG demonstrated T-wave inversion anteriorly with poor progression of the R-waves. Exercise tolerance test was unremarkable. An echocardiogram showed a mass within the interventricular septum. MRI scan showed significant Gadolinium uptake and late enhancement of the mass. A bone marrow examination was normal and a CT scan of her thorax and abdomen showed no significant lymphadenopathy with the only abnormality seen being that within the heart. Cardiac catheterisation showed the distal left anterior descending coronary artery to be occluded, possibly as consequence of the distortion of this artery due to this mass. This lady underwent an open cardiac biopsy. Multiple biopsies confirmed the presence of a benign dense fibroma within the interventricular septum. **Conclusion:** Primary heart tumours are very rare specially fibromas. It was interesting to find in a busy tertiary cardiac centre over 5 years one case of interventricular septal fibroma in a young female presenting with atypical chest pain.

e306

**Coronary artery fistulae: depiction at multidetector row CTA and their relationship to normal coronary arteries**

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**KEY LEARNING OBJECTIVES:** Outline the definition, incidence, morphology, clinical presentation and potential treatment of coronary artery fistulae. To appreciate the increasing role and availability of cardiac MDCT as a non-invasive imaging modality. Review the current literature on coronary artery fistulae. **DESCRIPTION:** Coronary artery fistulae (CAF) are rare, usually congenital,

connections between one or more coronary arteries and a cardiac chamber or the systemic or pulmonary vasculature. Identification of CAF are often incidental as most patients are asymptomatic but the likelihood of symptoms and complications increases with CAF size and age, therefore it is important to recognise CAF on imaging. The artery involved may be a main or usual branch vessel or a variant vessel. Traditionally invasive coronary angiography with echocardiography provided the main diagnostic pathway. However, these may be inadequate and we present 3 cases illustrating the added value of ECG gated helical cardiac CT in diagnosis of coronary arterial fistulae. Current literature on these rare coronary arterial anomalies is reviewed. **CONCLUSION:** Although coronary arterial fistulae are infrequent they are important to identify due to the long-term potential for severe morbidity/mortality. Cardiac CT is accurate in delineating the origin, course and drainage of CAF to allow planning of intervention.

## Vascular poster

### p401

#### **Tools of the trade. What trainees need to know about equipments in interventional radiology?**

Vardhanabhuti, V.<sup>1</sup>, Ninan, T.<sup>1</sup>, Nizami, H.<sup>2</sup>, Olubaniyi, B. O.<sup>1</sup>, Nensey, R.<sup>1</sup>, and Kakani, N.<sup>3</sup>

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**KEY LEARNING OBJECTIVES:** To review different types of specialised equipment such as puncture kits, catheters, sheaths, guidewires, balloons, stents and specialised prepared kits for various diagnostic and therapeutic procedures in interventional radiology. **DESCRIPTION:** Junior trainees interested in interventional radiology often find it difficult to get started in this subspecialty because they are unfamiliar with the various equipments that are used. Recent advances in technology of guidewires, catheters, balloons, stents and specialised kits mean that the use of various equipments are becoming increasingly complex and are constantly changing. The aim of this exhibit is to be a comprehensive review of basic interventional equipments as well as including updates of various recent advances in equipment technology. Not only will this be useful for trainees but also serve as an update to general radiologists who may have become unfamiliar with the recent developments. **CONCLUSION:** This comprehensive review will serve as a basic requisite for junior trainees. Armed with this knowledge, they should be competent at handling various equipments that are in routine interventional use.

### p402

#### **Embolisation agents. What, when and how?**

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**KEY LEARNING OBJECTIVES:** To provide an overview of embolisation agents. To be aware of the different types of embolisation agents, their different properties, safety profile and specific clinical use. To demonstrate in a step-wise algorithm how to choose between different agents depending on clinical situation, size of vessel and degree of reversibility of occlusion required. **DESCRIPTION:** Since the development of first embolisation agent in 1972, the number has increased markedly and there are now various different types of agents available. The techniques have also become increasingly complex. Historical aspects of embolisation material will be discussed as well as brief descriptions of each embolisation agent available in routine use today. The various types of agents will also be listed in tabulated form. This will be followed by a discussion and decision algorithm for their various uses depending on size of vessel, clinical situation, and whether their use is intended to be permanent or temporary. Choice of embolisation material is also determined by other factors such as position of microcatheter in relation to the bleeding point, collateral circulation,

underlying disease aetiology and costs. All of these factors will be discussed. **CONCLUSION:** With the various embolisation agents available today, choosing a correct embolisation material may be a daunting task. Armed with knowledge from this exhibit and the use of stepwise systematic approach as illustrated by an algorithm, this task should be considerably simpler.

### p403

#### **The evolving management of blunt splenic injuries. What a radiologist needs to know**

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**KEY LEARNING OBJECTIVES:** The purpose of this exhibit is to review the classification of traumatic splenic injuries and to review the latest spleen saving management strategies and propose a traumatic splenic injury treatment algorithm. **DESCRIPTION:** The spleen is the most commonly injured abdominal organ in blunt abdominal trauma in both adults and children. Laparotomy and splenectomy has been the mainstay of treatment for many years. However, the risk of post splenectomy complications including severe post splenectomy sepsis has seen a shift in the management of these injuries from laparotomy and splenectomy towards spleen saving procedures. We discuss the classification of splenic injuries and discuss the newer management options paying particular attention to angiography and trans-catheter splenic artery embolisation. **CONCLUSION:** The radiologist now plays a central role not only in the diagnosis and triage but also in the management of traumatic splenic injuries. Following reading this exhibit the reader will: 1. Be able to classify splenic organ injury. 2. Be aware of the management options available to treat splenic organ injury. 3. Be aware of the indications for angiography and trans catheter embolisation.

### p404

#### **Endovascular management of vascular complications after elective orthopaedic surgery: a case series**

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**KEY LEARNING OBJECTIVES:** This case series highlights the emerging role of interventional radiology in managing vascular complications after elective orthopaedic surgery. **BACKGROUND:** Arterial injury after elective orthopaedic surgery is rare (incidence of 0.005–0.3%) but well documented. Vascular complications after arthroplasty causes significant morbidity in a subgroup of patients who are elderly and have multiple co-existing medical conditions. Traditionally, open vascular surgery was the only option available but over the last decade endovascular repair offers a less invasive and increasingly attractive alternative. In this pictorial review, we discuss the endovascular management of five cases of vascular injury that occurred as a result of elective orthopaedic surgery. **DESCRIPTION:** Case 1: A profunda femoris artery arteriovenous malformation that occurred secondary to the insertion of a dynamic hip screw. Case 2: A geniculate artery aneurysm post total knee replacement (TKR). Case 3: A subclavian artery pseudoaneurysm that occurred after open reduction and internal fixation (ORIF) of a clavicular fracture. Case 4: A popliteal artery pseudoaneurysm following TKR. Case 5: A profunda femoris pseudoaneurysm post ORIF of a femoral shaft fracture. **CONCLUSION:** Endovascular management of vascular complications after elective orthopaedic surgery is successful in selected cases.

### p405

#### **Clinical outcome of primary subintimal angioplasty in critical lower limb ischaemia**

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**PURPOSE:** To compare the 6 weeks to 6 months patency rates in patients with critically ischaemic limbs treated with subintimal



angioplasty (SA) versus standard bypass surgery and to evaluate the graft patency of subintimal angioplasty in diabetic patients with critical limb ischaemia (CLI) compared to non diabetics. **MATERIALS/METHODS:** Between April 2001 and August 2004, 87 patients (mean age 70 years, range 45–91) with critical limb ischaemia underwent subintimal angioplasty ( $n=43$ ) or bypass surgery ( $n=44$ ) for superficial femoral artery (SFA) or aorto-iliac stenosis. Data was retrieved from hospital inpatient inquiry and case notes **RESULTS:** Primary technical success was 100% for both Subintimal angioplasty and bypass grafting. The 6 weeks patency in the subintimal angioplasty group was 90.4% vs aorto-iliac bypass group was 88.9%. 6 months survival was 81.4% vs 61.9%, respectively. The 6-month survival rate was in subintimal angioplasty was 66% in non diabetics and 56% in diabetics. Primary patency was not different in the SA versus bypass groups; however, long term patency was higher in the SFA bypass group. **CONCLUSION:** Subintimal angioplasty is increasingly replacing bypass surgery in the management of critical limb ischaemia without compromising primary patency, limb salvage, patient survival, or subsequent vascular intervention. Frequent clinical follow-up and a duplex surveillance program are necessary to maintain patency in this cohort. Subintimal angioplasty is almost equally effective in diabetics as in non diabetics suffering from critical limb ischaemia.

#### p406

##### **Retrospective review of lower limb thrombolysis at the University Hospital Coventry and Warwickshire (UHCW)**

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**PURPOSE:** Optimal first line therapy for acute lower limb ischaemia is debatable. Studies have suggested certain indications for thrombolysis with a favourable outcome in these scenarios. Bearing this in mind we proposed to review the indications and outcome of thrombolysis at the University Hospital Coventry and Warwickshire (UHCW). **METHODS:** Data from records of all patients attending the interventional suite for thrombolysis over a 4 year period was collected retrospectively. Data collected pertained to indication for thrombolysis (embolic versus thrombotic, chronic versus acute, graft versus native), outcome – both angiographic and clinical and complications. All had rtPA at a rate of 1 mg h<sup>-1</sup> for a maximum of 48 h. **RESULTS:** 18 procedures were performed on 17 patients. 5 patients were thought to have embolism as the cause and the other cases were secondary to thrombosis, 6 of these cases were secondary to graft thrombosis. Of the 6 cases of graft thrombosis, lysis was successful in 5. There were 2 patients who developed large haematomas and bleeding from the puncture site, and in both cases this necessitated termination of thrombolysis. Overall there was a good angiographic outcome in 12 procedures with partial improvement in 2 allowing a bypass option. There was absolutely no improvement in 6 patients. **CONCLUSION:** Thrombolysis is a useful tool in thrombotic disease, allowing prosthetic graft salvage (occasionally revealing focal abnormalities amenable to endovascular intervention), and revealing run off in native vessels to allow by pass. We were surprised by its relative success in dealing with embolic disease.

#### p407

##### **Endovenous laser therapy in children – an option for treatment of venous anomalies**

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**PURPOSE:** Endovenous laser therapy (EVLT) is a well established method of treating superficial venous incompetence in adults. Results of EVLT use in children have not been published. We describe the use of EVLT in our paediatric population and our initial results. **METHODS:** Each patient referred for treatment of a lower limb venous anomaly,

underwent ultrasound and MRI. Selection criteria for EVLT included (i) anomalous veins thought to be the primary contributor to the condition, (ii) anatomically amenable sites for EVLT and (iii) patency of the deep veins (confirmed by venography). In those children who fulfilled the criteria, EVLT was performed, according to established methods in the adult population. The children were then followed-up with clinical review and ultrasound. **RESULTS:** Over 2.5 years, EVLT was performed in 8 children (M:F 1:4, aged 3.5–16.2 years), on 15 venous segments. Each patient underwent EVLT of 1–4 venous segments over 1–2 sessions. Complete closure in 13/15 segments and partial closure in 1/15 segments was seen on follow-up ultrasound. Repeat EVLT of the partially closed segment achieved further closure at 3 months. In 2/8 patients, new large calibre veins were seen post EVLT, in these patients, symptoms did not improve. All other patients reported significant ( $n = 4$ ) or complete ( $n = 2$ ) symptomatic relief. There were no reported complications. **CONCLUSION:** EVLT appears to be a safe procedure in children and should be considered as a minimally invasive, effective procedure for the treatment of certain vascular anomalies in selected children.

#### p408

##### **Liver appearances post RFA, a trainee's guide**

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**KEY LEARNING OBJECTIVES:** A guide to varied appearances on follow-up CT in a successful radiofrequency ablation. To differentiate between normal expected findings and recurrence. To highlight different patterns of recurrence. **DESCRIPTION:** Imaging protocol post RFA. Common post treatment findings unrelated to the liver. Features differentiating a successful and unsuccessful ablation. Different patterns of recurrence on CT. An outline of normal expected findings unrelated to the liver. **CONCLUSION:** This poster would give a radiologist, who is not routinely involved with RFA, a guide of what to expect in the follow up imaging of the patients treated with RFA for liver tumours.

#### p409

##### **Pictorial review of anatomical variants of renal vasculature in transplant donors using CT**

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**KEY LEARNING OBJECTIVE:** To be familiar with the normal and variant renal anatomy in pre-operative evaluation of renal transplant donors using multi-detector computed tomography (MDCT). **DESCRIPTION:** Pre-operative radiological evaluation of kidney donor anatomy (renal vessels, collecting system and parenchyma) is essential in renal transplant surgery. Previously catheter angiography was used to evaluate the donor renal artery anatomy. Computed tomography angiography (CTA) performed as an out patient is a cheaper, safer, and more accurate method for pre-operative evaluation of renal vessels. MDCT offers the advantage of short acquisition time along with complete anatomical coverage including visualisation of venous drainage. Three dimensional visualisation of structures on post processing provides important information in pre-operative planning of the procedure. CT may also detect previously unsuspected co-existent pathologies. We demonstrate a pictorial review of the normal renal vasculature. We also illustrate arterial and venous variants including multiple renal arteries, retro-aortic left renal vein, circum-aortic left renal vein and duplication of inferior vena cava. Significant coexistent pathology such as renal tumour is also illustrated. **CONCLUSION:** The use of CTA demonstrates anatomical variations in renal vasculature and accurately conveys the information to the transplant surgeon. CTA provides this information non-invasively and may also detect other significant pathology.

#### p410

##### **"Common complications of Port-a-caths" – a pictorial review**

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**KEY LEARNING OBJECTIVES:** To recognise and diagnose common complications associated with venous access port-a-caths. **DESCRIPTION:** Port-a-caths are tunnelled and totally implanted venous access devices. In the UK, whilst common in young cystic fibrosis patients, they are now increasingly used in oncology to deliver chemotherapy. The life span of port-a-caths is longer than tunnelled external catheters (Hickman lines). There are many studies reporting lower complications rates with port-a-caths. However, they are not without complications. This review reports and illustrates the most frequent complications to include: infection (local and systemic), catheter migration, pinched off syndrome and direct port failure. Many of these are avoidable with good technique and after care. They are a common cause for port replacement and interrupt drug treatment and add to patient morbidity. **CONCLUSION:** Use of port-a-caths is increasing in the UK especially in oncology. It is therefore important to recognise and minimise common complications encountered with these devices. This illustrated summary will help with this process.

**p411**

**Portal vein Doppler ultrasound**

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**LEARNING OBJECTIVES:** To promote awareness, competence and good standardised practice in the assessment and interpretation of portal venous (PV) Doppler ultrasound. **BACKGROUND:** Whilst reviewing the use of PV Doppler ultrasound in the clinical setting, it was noted that there was a lack of standardisation of how the PV was imaged and assessed. It is essential to understand the importance of PV flow direction, hepatopetal (antegrade) and hepatofugal (retrograde), and to interrogate the velocities within the PV accurately. Clinical indications for PV Doppler ultrasound include: portal hypertension; cirrhosis; presence of free peritoneal fluid; splenomegaly; steatosis hepatitis; abnormal LFTs. **PROCEDURE DETAILS:** The main technique approaches for PV imaging are subcostal and intercostal. It is important that the PV is insonated (the angle between transducer and vessel being imaged) at an angle between 45° and 60°. This ensures true colour Doppler filling of the vessel. For spectral Doppler assessment of the PV, the operator must also utilise a Doppler angle of between 45° and 60°, which allows for accurate velocity measurements to be taken. **CONCLUSION:** It is essential that the portal vein is imaged when there is clinical indication to do so. Following the method outlined above will allow for the technique can be standardised throughout an imaging department and will provide true and accurate comparable results for present and subsequent scans.

**p412**

**Use of a blood pool contrast agent for MR vascular mapping in patients with cystic fibrosis**

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**PURPOSE:** To evaluate the use of blood pool contrast agent (Vasovist) when mapping the central vascular anatomy of a patient with cystic fibrosis. **MATERIALS/METHODS:** Vasovist (MS-325), an MRI contrast agent, reverse binds to serum albumin allowing it to remain intravascular as opposed to the traditional extracellular MRI contrast agents. Extracellular agents are mainly limited to “first pass” data being acquired with spatial and temporal limitations. Being intravascular, Vasovist, allows an extended imaging window (steady state) which thus allows these limitations to be overcome. An adapted T1 3D GRE sequence was used to image at a 0.5×0.5×0.5 mm matrix whilst maintaining high SNR thus allowing for a fully detailed vascular map. A case study is described on a patient where this adapted technique has been implemented. **RESULTS:** The procedure was well tolerated and due to the intravascular nature of the blood pool contrast agent,

high quality diagnostic images were produced that clearly showed the patients venous anatomy enabling a vascular map to be formed. **CONCLUSION:** Patients with cystic fibrosis often need repeat imaging prior to totally implantable vascular device insertion/resiting. Imaging techniques usually employed include X-ray angiography and CT thus causing repeated doses of ionising radiation in these young patients. Blood pool MRI contrast agents allow vascular maps with very high spatial resolutions in patients who may need repeat imaging in this area. This allows smaller vessels than usual to be imaged using “first pass” MRI without the need of ionising radiation.

**p413**

**Varicoceles – to ligate or coil**

Alex, J., Manjappa, P., Forster, J., Scott, P., Lakshminarayan, R., Robinson, G., Cooksey, G., and Ettles, D.

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**PURPOSE:** To compare outcome between patients who underwent surgery and patients who had endovascular treatment of varicoceles. **MATERIALS/METHODS:** Retrospective analysis of data from January 2003. Case-notes, images, lab results and follow up clinics. **RESULTS:** 20 patients underwent surgical treatment, while 150 patients underwent endovascular treatment. Indication for treatment, primary success rate, recurrence rate, symptomatic relief, complications and duration of hospitalisation were compared. Where applicable laboratory data were also analysed. **CONCLUSION:** Endovascular treatment of varicoceles is a reliable and cost effective alternative to surgery.

**Vascular e-poster**

**e414**

**Unilateral absence of the pulmonary artery: a review of its causes and MRI appearances**

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**KEY LEARNING OBJECTIVES:** Incidence, presentations and aetiology of this rare condition. The role of MRI in the assessment of this condition. Imaging findings of cases with absent pulmonary arteries with particular reference to MRI. **DESCRIPTION:** Unilateral absence of the pulmonary artery is a rare pulmonary vascular anomaly. Both congenital and acquired anomalies may result in absence of the pulmonary arteries in both children and adults. We present several cases illustrating the various congenital and acquired causes of the absent pulmonary artery and discuss their imaging with particular reference to the MRI appearances. **CONCLUSION:** Although rare, MRI has an important role in the identification and establishment of the underlying aetiology in patients with absent pulmonary arteries.

**e415**

**CT imaging in the acute aortic syndrome: should ECG gated CT be the routine first line investigation?**

Litton, K. J., Goyal, N., Gordon, A., and Wood, A.

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**KEY LEARNING OBJECTIVES:** Advantages and limitations of the ECG gated multi-detector computed tomography (MDCT) technique in emergency imaging of the thoracic aorta. Demonstration of the imaging findings using MDCT and ECG gated CT in the acute aortic syndrome. **DESCRIPTION:** The “Acute Aortic syndrome” is a non-traumatic range of life-threatening emergencies with a similar clinical presentation. With increasing availability of ECG-gated MDCT in the emergency setting, Radiologists should be aware of the advantages of this technique and common radiological findings in this disease. CT is the primary imaging technique in the diagnosis of Acute Aortic syndrome. ECG-gated scans are potentially advantageous in proximal aortic disease, where motion and pulsation artefact from the heart reduces diagnostic accuracy. ECG gated CT also allows evaluation of the coronary arteries, which could potentially be the cause of chest pain and would need to be evaluated prior to cardiac or aortic surgery.

Limitations of the technique include the need for a regular cardiac rhythm and the requirement to safely manipulate the pulse rate in a potentially unstable patient. Also, in order to provide this service, radiographers and radiologists may require additional training and additional equipment to perform the scan. **CONCLUSION:** MDCT is the primary imaging modality used in the diagnosis of acute thoracic aortic emergencies. In our opinion ECG gating improves the sensitivity and specificity of this technique. This facilitates accurate diagnosis, delineating the anatomical extent of the disease and allows the initiation of prompt and appropriate management.

#### e416

##### **Congenital anomalies of the inferior vena cava**

Khan, T. J.

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**LEARNING OBJECTIVES:** To review developmental anomalies of the inferior vena cava (IVC). To review complications associated with anomalies of IVC. **DESCRIPTION:** The embryogenesis of the IVC is a complicated process involving development, regression, anastomoses and replacement of three pairs of venous channels, posterior cardinal, subcardinal and supracardinal veins. This process begins at the sixth week of gestation and is completed by tenth week. The anomalies of IVC arise from the failure of normal embryogenesis. The most commonly described anomalies of IVC include circumaortic left renal vein (1.5–8.7%), azygous or hemiazygous continuation of IVC (0.6%), retroaortic left renal vein (2.1%), double IVC (0.2–3%) and isolated left sided IVC (0.2–0.5%). The majority of cases are clinically silent and diagnosed incidentally on imaging for other reasons. However, these venous anomalies may have significant clinical implications, especially during retroperitoneal surgery and in the treatment of thromboembolic diseases. Knowledge of caval anomalies can prevent misinterpretation of mediastinal masses, iliac occlusion with venous collaterals, or paravertebral lymph node enlargement. Detailed knowledge of these anomalies is crucial for IVC filter placement, spermatic vein embolisation and adrenal or renal venous sampling. **CONCLUSION:** A comprehensive understanding of anatomical variations/anomalies of the IVC is paramount for cross-sectional and interventional radiologists. Identifying these anomalies helps to avoid erroneous diagnosis and also alert the surgeon and interventionalist for a potential source of complication preoperatively.

#### e417

##### **Imaging of filling defects of the inferior vena cava: multi-detector row CT and MR**

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**LEARNING OBJECTIVES:** Describe the MDCT and MR techniques for preoperative evaluation of IVC filling defects caused by tumour. Describe the characteristic imaging features of primary and secondary tumours of the IVC using MDCT and MR. Discuss the advantages and limitations of MDCT and MR in assessing tumour thrombus in the IVC. **BACKGROUND:** IVC tumour involvement can be caused by primary leiomyosarcoma or by tumour invasion from an adjacent organ. Accurate characterisation and anatomic evaluation is critical for surgical planning. **IMAGING FINDINGS OR PROCEDURE DETAILS:** We reviewed patients with pathologically-proven tumour invading the IVC including primary leiomyosarcoma and tumour thrombus from renal cell carcinoma, adrenal cell carcinoma, and hepatocellular carcinoma. Multi-detector row CT and MR findings were correlated with surgical results. Filling defects in the IVC observed at MDCT and MRI as a result of flow artefacts, anatomic variations, or bland thrombus are also discussed. **CONCLUSION:** Both MDCT and MR provide excellent assessment of IVC tumour and tumour thrombus because of their high in-plane resolution (thin slices), multi-planar imaging/reformatting, and multiphase contrast studies. The multi-planar viewing capabilities facilitate surgical decisions. Familiarity with anatomy and flow effects is critical for distinguishing true from false filling defects in the IVC.

#### e418

##### **The role of interventional radiology in arterial vascular emergencies: a pictorial review**

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**KEY LEARNING OBJECTIVES:** To illustrate the angiographic imaging findings in arterial vascular emergencies. To describe the growing role of interventional radiology in such emergencies. **DESCRIPTION:** Arterial vascular emergencies can be life or limb threatening and interventional radiology is playing an ever-increasing role in their diagnosis and management. Non-interventional diagnostic modalities such as CT play a vital part in diagnosis and endovascular solutions are being found for an increasing number of these emergencies, whether they are traumatic or non-traumatic. The Royal College of Radiologists in the UK has described certain situations where emergency interventional radiology is the preferred treatment. These include stopping haemorrhage either following trauma, gastrointestinal bleeding or post-partum haemorrhage. Conversely the radiologist can relieve acute ischaemia, either peripheral or visceral. Treatment of thoracic or abdominal aortic aneurysm rupture, aortic dissection, ruptured peripheral aneurysms and the complications of type B dissection are situations where the interventional radiologist has an emerging role. We will describe the angiographic findings in these cases and illustrate how the interventional radiologist uses techniques such as angioplasty, endovascular stenting and embolisation in their management. **CONCLUSION:** The role of interventional radiology in arterial emergencies is now well established. Technical development of new equipment and devices, increasing skill and experience of interventional radiologists and better understanding of events following interventions continuously improve results of the treatment.

#### e419

##### **Using multi-detector CT to identify trauma patients for: surgery, interventional radiology and conservative management**

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**KEY LEARNING OBJECTIVES:** Recognise the patterns of injury, and the key features on trauma CT, that help stratify further clinical management. Appreciate the range of interventional radiology techniques that can be used in trauma management. Understand the indications, limitations and complications of radiological intervention. **DESCRIPTION:** Multi-detector CT plays a crucial role in the emergency management of trauma patients. This pictorial review illustrates the range and patterns of traumatic body and limb injuries that are observed on CT at The Royal London Hospital, a busy UK Trauma Centre. Key CT features that help decide further management by surgery, interventional radiology or more conservative methods are demonstrated. The indications for, and advantages of radiological intervention in trauma patients are discussed. Interventional radiology techniques utilised in trauma management are illustrated, and their limitations and complications outlined. **CONCLUSION:** Understanding various injury patterns and their corresponding CT features, improves the detection of serious injuries, and can help identify trauma patients for surgery, interventional radiology, or conservative management. Rapid recognition of the CT-indicators for radiological intervention, is a crucial part of the radiological assessment of trauma patients, and can help improve their clinical outcome.

#### e420

##### **Liver appearances post radiofrequency ablation: a trainee's guide**

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**KEY LEARNING OBJECTIVES:** A guide to varied appearances on follow-up CT in a successful radiofrequency ablation. To differentiate between normal expected findings and recurrence. To highlight different patterns of recurrence. **DESCRIPTION:** Imaging protocol post RFA. Common post treatment findings unrelated to the liver. Features

differentiating a successful and unsuccessful ablation. Different patterns of recurrence on CT. An outline of normal expected findings unrelated to the liver. **CONCLUSION:** This poster would give a radiologist who is not routinely involved with RFA, a guide of what to expect in the follow up imaging of the patients treated with RFA for liver tumours.

e421

### Contrast-enhanced MRA in the NSF era: potential for contrast dose reduction with a high relaxivity contrast agent

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**PURPOSE:** Higher doses of gadolinium-based contrast agents (GBCA) are often used for contrast-enhanced MRA (CE-MRA). Patients with kidney disease undergoing CE-MRA are known to be at increased risk for developing nephrogenic systemic fibrosis (NSF), a risk that increases with higher GBCA doses. Herein we present information on the application of a higher relaxivity GBCA for low dose CE-MRA. **METHODS AND MATERIALS:** 87 subjects were studied in 6 intraindividual crossover studies comparing gadobenate dimeglumine (Gd-BOPTA) to conventional GBCA for CE-MRA. In each study contrast enhancement was evaluated in a blinded manner using qualitative and quantitative metrics. **RESULTS:** In MRA renal arteries greater ( $p < 0.05$ ) vascular enhancement (signal peak duration, maximum signal intensity (SI), and AUC) was observed for Gd-BOPTA vs Gd-DTPA. In peripheral MRA post-contrast SI was higher after Gd-BOPTA than Gd-DTPA from the aorta to the tibial arteries, with better performance at lower levels. In pelvic vessels Gd-BOPTA yielded higher ( $p < 0.02$ ) SNR and CNR than Gd-DTPA and better delineation of small vessels. In supra-aortic MRA, vessel delineation was higher ( $p = 0.005$ ) and relative CNR greater ( $p = 0.021$ ) after Gd-BOPTA. Comparing  $0.1 \text{ mmol kg}^{-1}$  Gd-BOPTA to  $0.2 \text{ mmol kg}^{-1}$  Gd-DTPA in the carotid arteries, higher SI and CNR was seen with Gd-BOPTA despite the lower dose. In renal arteries, equivalent SNR and CNR were seen for Gd-BOPTA and 2X Gd-DTPA with a greater increase seen at lower aortic levels with Gd-BOPTA. **CONCLUSION:** Intraindividual CE-MRA studies suggest that MR angiography may be performed with a single dose of Gd-BOPTA, potentially limiting patient exposure to GBCA.

### Gastrointestinal poster

p501

#### Barium swallow – not quite extinct

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**KEY LEARNING OBJECTIVES:** The purpose of this poster is to review the indications for performing a barium swallow as opposed to endoscopy with a pictorial review of the pathologies where barium swallow is considered the investigation of choice. **DESCRIPTION:** Endoscopy is now widely used as the primary investigation in a number of pathologies of the upper GI tract due to its better sensitivity of small mucosal abnormalities and the ability to take biopsies of suspicious lesions. The barium swallow, however, remains a superior investigation particularly in motility disorders such as achalasia and where functional information is required. It also has a place in the assessment of anatomy prior to the surgical repair of conditions such as hiatus hernias and pharyngeal pouches. Water soluble contrast swallows are the primary investigation to assess for leaks post upper GI surgery. We provide a pictorial review of these pathologies as diagnosed on contrast swallow examinations. **CONCLUSION:** With a number of barium investigations being superseded by endoscopic and CT based investigations the barium swallow may well be the last that is performed on a routine basis in the future. This poster provides an overview of the indications where barium swallow remains the investigation of choice.

p502

#### Patterns of gastric emptying and their relationship with presenting symptoms

54

Sonoda, L. I., Godfrey, E. M., Solanki, C., Bird, N. J., Halim, M. Y., Middleton, S. J., and Balan, K.

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**PURPOSE:** In patients with upper gastrointestinal (GI) symptoms, clinical impression of rapid or delayed gastric emptying (GE) may be misleading. This study was performed to determine the frequency of rapid/delayed GE in 642 patients sequentially referred for GE scintigraphy. **MATERIALS/METHODS:** A retrospective review of 642 consecutive GE studies was performed. Each patient received a standard solid meal containing two large eggs labelled with  $12 \text{ MBq } ^{99\text{m}}\text{Tc-tin}$  colloid and a glass of water. Static imaging in upright position (anterior and posterior 60 s) every 15 min was performed for 150 min. using a large field of view gamma camera fitted with a low energy collimator and a computer system. GE was classified as normal, rapid and delayed based on half-emptying time and percentage retained at 150 min. **RESULTS:** Seventy (11%) patients with suspected rapid and 572 (89%) with suspected delayed GE were studied. Normal, rapid and delayed GE, respectively, were observed in 11 (16%), 54 (77%) and 5 (7%) patients with the clinical suspicion of rapid GE and 178 (31%), 215 (37%) and 178 (31%) patients with suspected delay in GE. One patient with suspected delay had a biphasic GE pattern. Positive Predictive Value (PPV) of clinical suspicion and rapid GE was 77% while PPV of clinical suspicion and delayed GE was 31%. **CONCLUSION:** Our experience shows that GE scintigraphy using a solid egg meal is very useful in the evaluation of patients presenting with various GI symptoms, especially those with symptoms suggestive of a delay in GE, where clinical impression is often misleading.

p503

#### Intrathoracic gastric herniation post fundoplication: radiological diagnosis of a surgical emergency

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**KEY LEARNING OBJECTIVES:** Fundoplication is a treatment option in symptomatic cases of gastro-oesophageal reflux when medical treatment fails. This procedure is associated with complications, some of which occur in the early post-operative period. In our centre where laparoscopic fundoplication is frequently performed, we have diagnosed cases of post-operative intrathoracic gastric herniation that required urgent surgical intervention. This complication is characterised by specific symptomatology and findings on chest X-ray, water-soluble contrast-swallow and CT. We present a case series describing the clinical presentation and radiological findings that prompted early surgical intervention. **DESCRIPTION:** Typically, patients who suffer from intrathoracic gastric herniation following fundoplication present during the early post-operative period. They are generally unwell, suffer from dysphagia and persistent vomiting. Aspiration may result in symptoms of chest infection. The mass effect of the herniated stomach may cause respiratory distress. An urgent chest radiograph and water-soluble contrast swallow are indicated followed by a limited CT. An erect chest radiograph typically shows a relatively long air-fluid level in the lower thorax/mediastinum that is due to the herniated obstructed stomach. A water-soluble contrast study confirms the severe obstruction of the distal oesophagus and as a result very little contrast enters the herniated stomach. A limited CT scan through the lower thorax/upper abdomen with coronal and sagittal reconstruction helps to define the precise anatomy of gastric herniation and obstruction. This information facilitates surgical correction. **CONCLUSION:** Awareness of this complication and appropriate investigation facilitates a prompt diagnosis. Immediate communication of the findings to surgical colleagues aids an optimal outcome.

p504

#### A pictorial review of small bowel MRI in Crohn's disease

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**KEY LEARNING OBJECTIVES:** To review the diagnostic images and benefits of MRI in small bowel Crohn's disease. **DESCRIPTION:** Patients with Crohn's disease are frequently young who require multiple imaging investigations. Small bowel MRI is an emerging and evolving technique that carries the considerable advantage of avoiding the radiation burden that has traditionally been associated with radiological investigations of the small bowel. This poster provides a pictorial review of the spectrum of diagnostic images that are associated with this condition. The MRI studies provide valuable information on disease activity, by assessing areas of active inflammation following the administration of contrast. Inflammatory strictures, bowel dilatation and fistulas can be detected as well as the anatomical depiction in chronic disease that is required for planning surgery. **CONCLUSION:** Small bowel MRI provides a valuable diagnostic tool in Crohn's disease. The high spatial resolution contributes to quality anatomical images and information on biological activity that is central to the effective management of these patients.

**p505**

**Negative oral contrast agents in abdominal CT**

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**PURPOSE/MATERIALS:** To compare water and whole milk as negative oral contrast agents. **METHOD:** 89 consecutive outpatients attending for CT studies were given 1–1.2 l of whole milk or water 45–60 min prior to scanning. Gut distension was compared by measuring the maximum lumen diameters at six fixed anatomical points from stomach to terminal ileum. Maximum gallbladder (GB) volume was also measured. A subjective assessment of overall small bowel distension was also made (categories: <20% of small bowel, 20–80% and >80% distension). **RESULTS:** Milk produced significantly ( $p>0.002$ ) greater distension of the stomach and D2, than water; and significantly ( $p>0.002$ ) smaller GB volumes. There was no significant difference in small bowel distension measurements using the fixed reference points. However, on the subjective scale milk produced poor (<20%) distension in 30% of cases, compared with 18% of the water studies. **CONCLUSION:** 1. Whole milk provides greater distension of the stomach and duodenum than water. 2. No evidence that milk is superior to water in distension of the small bowel. 3. GB volume is smaller following milk ingestion.

**p506**

**Whole gut transit scintigraphy with a liquid-phase meal in patients with chronic gastrointestinal symptoms**

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**AIM:** Functional gastrointestinal symptoms are common in the general population. Whole gut transit scintigraphy (WGTS) has been available to investigate patients with functional gastrointestinal symptoms for several years but the technique has not been widely utilised. The aim of this study was to review our experience of doing a liquid-phase WGTS in patients with functional gastrointestinal problems and determine its clinical usefulness. **MATERIALS AND METHODS:** 56 patients with functional upper and lower GI symptoms had undergone WGTS using <sup>111</sup>In-DTPA in water and a dual-headed gamma camera over a 5-year period. Gastric-emptying (GE) analysis was done using time-activity curves. Small-bowel-transit (SBT) was determined by the time taken for 10% of total abdominal counts to reach the caecum. Geometric-centre (GC) of activity was used to determine colonic-transit (CT) time. **RESULTS:** Presenting symptoms were constipation ( $n=27$ ), diarrhoea ( $n=14$ ) and dyspepsia ( $n=15$ ). WGTS confirmed the diagnosis in 63% patients with constipation. 26% patients with constipation also had a delayed GE and SBT. 30% patients with constipation and 29% with diarrhoea had normal colonic transit. Only 29% of diarrhoea patients seemed to have a rapid CT. More than 50% patients with dyspepsia had normal GE, SBT and CT whereas 40% of them had a delayed CT and SBT. **Conclusion:** WGTS appears to have

a useful role in patients with symptoms of chronic constipation. In patients with diarrhoea, WGTS helps to elucidate its true cause. The procedure helps the clinician explain the symptoms and focus on a particular region of the GI tract for further investigation.

**p507**

**Extracolonic findings in 1244 CT colonography (CTC) studies on patients with colorectal symptoms**

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**PURPOSE:** CTC is an established method of imaging the colon for screening and in investigation of symptomatic patients. Its additional benefit is the ability to report on both luminal and extracolonic findings (ECF). We aim to determine the prevalence of extracolonic findings on CTC in patients investigated for colorectal symptoms. **METHODS:** This is a retrospective audit of 1244 CTC studies performed between March 2002 and December 2007. Demographics, clinical presentation and findings were recorded. Extracolonic findings were classified according to the CTC Reporting and Data System Consensus Proposal. Inclusion criteria were E3 pathology (extracolonic findings where further investigation may be needed according to local hospital protocol) and E4 pathology (potentially important findings needing prompt specialist referral). Patients were considered to be true negatives if they did not present with an extracolonic cancer at the end of 18 months. **RESULTS:** Indications for CTC were change in bowel habit (32.7%), abdominal pain (13.5%), anaemia (12.4%), rectal bleeding (12.1%) and others (29.3%). 1244 CTC were performed without morbidity or mortality. 102 (8.2%) patients with E3 and 102 (8.2%) patients with E4 findings were reported. The sensitivity, specificity, positive and negative predictive values were 93.5%, 98.3%, 84.2% and 99.3%, respectively. **CONCLUSION:** Clinically significant extracolonic findings (E3 and E4) were revealed in 16.4% of the patients, leading to additional diagnostic or therapeutic considerations. CTC has a high negative predictive value for E4 pathology. CTC provides additional benefit at no extra radiation or cost.

**p508**

**The clinical impact of fluoro-deoxyglucose PET/CT in patients with a rising carcino-embryonic antigen**

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**PURPOSE:** To assess the local impact of the introduction of fluoro-deoxyglucose positron emission tomography/computer tomography (FDG PET/CT) into the diagnostic algorithm for patients with a history of colorectal malignancy who have a rising carcino-embryonic antigen (CEA) and normal conventional imaging. **MATERIALS/METHODS:** 25 consecutive patients who were referred between June 2006 and September 2008 for FDG PET/CT imaging for the evaluation of a rising CEA were included in the study. Case notes were reviewed to assess how PET/CT had impacted on the long term management. **RESULTS:** Of the 25 patients, 19 had an identifiable cause for the rising CEA on the PET/CT imaging. 18 of these have been confirmed as true positives by surgery or follow up imaging. 5 cases had no identifiable cause on PET/CT imaging. All of these cases have had negative conventional follow up imaging to date (6 months to 1 year follow up data). 1 patient had equivocal lung nodules which later increased in size on subsequent imaging. **CONCLUSION:** PET/CT has had a significant impact on the management of patients with a rising CEA and should be included in the diagnostic algorithm of all patients with normal or equivocal conventional imaging.

**p509**

**The role of multi-detector computed tomography in the diagnostic algorithm of acute GI bleeding**

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**KEY LEARNING OBJECTIVES:** A pictorial review of the current diagnostic modalities used in the investigation of acute GI bleeding with emphasis on the emerging role of MDCT, its imaging findings and pitfalls. **DESCRIPTION:** Acute GI bleeding is a common presentation in the Emergency Department with increased morbidity and mortality worldwide. It requires a multidisciplinary approach between emergency physicians, gastroenterologists, surgeons and radiologists. Accurate rapid localisation and identification of the bleeding cause is crucial to plan treatment and improve patients' outcome. Illustrated cases comparing conventional catheter angiography vs MDCT angiography are used to highlight the advantages of this technique why it should be used as a first line imaging modality in the acute setting of GI bleeding. A suggested diagnostic algorithm used in our institution will also be presented. **CONCLUSION:** MDCT angiography is an emerging modality which has proved its importance in the acute setting of GI bleeding as a non-invasive, widely available and fast procedure in unstable patients with increased sensitivity and specificity; it can also provide a good arterial road map which may enable a focused subsequent intervention.

p510

**Multi-modality diagnosing of peritoneal pathology – a pictorial review**

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**LEARNING OBJECTIVES:** To discuss various benign and malignant pathologies involving the peritoneum. To illustrate the findings as seen on various imaging modalities: ultrasound, CT, MR and PET-CT. **DESCRIPTION:** The peritoneum, a serous membrane composed of single layer of mesothelial cells forms the lining of the abdominal cavity. Peritoneal ligaments support intra-abdominal viscera and serve as a pathway for the passage of blood vessels and lymphatics. The peritoneum serves a more important immune function and on account of this, is involved by numerous pathologic processes either primarily or secondary to visceral involvement. Knowledge of the peritoneal anatomy is especially relevant to radiology when defining pathology. There are a wide spectrum of benign and malignant processes causing involvement of the peritoneum. Traditionally, peritoneal pathology is difficult to diagnose on imaging studies and this accounts for the high false negative rates seen with imaging. Multi-modality imaging may improve diagnostic rates of these pathologies as peritoneal findings can give clue to the primary cause/site of pathology. **CONCLUSION:** Knowledge of various benign and malignant pathologies affecting the peritoneum is essential to the radiologist. The appearance of a spectrum of peritoneal pathologies (common and uncommon) diagnosed with various imaging modalities is presented in a pictorial format.

p511

**A pictorial review of the anatomy of the peritoneal cavity as demonstrated by mucin producing peritoneal tumours**

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**KEY LEARNING OBJECTIVES:** To revise/understand the anatomy of the peritoneum and its interconnecting spaces. To provide a description of the typical appearances of the uncommon mucinous tumours of the appendix, which spread via the peritoneal pathways. **DESCRIPTION:** The peritoneal spaces, their borders and connections are complex but important to understand as a radiologist. Many disease processes involve and are contained by the peritoneum. Understanding this anatomy allows the radiologist to describe the sites of intraperitoneal pathology, predict where pathology is likely to spread thus aiding accurate clinical management and narrow down a differential diagnosis by clearly understanding the site of origin of disease. Pseudomyxoma Peritonei is a mucinous tumour, predominantly arising from the appendix. It produces thick mucin which spills and spreads throughout the peritoneal cavity. It is well demonstrated on CT and can clearly define the regions and boundaries of the peritoneal cavity it infiltrates. We will provide illustrated multi-

planar reconstructed images of the main peritoneal spaces filled with mucin/fluid and thereby describe their anatomy. **CONCLUSION:** By using examples of mucinous tumour spread throughout the peritoneum, this pictorial review will offer a good visual review of the anatomy of the peritoneum.

p512

**A review of abdominal liposarcoma**

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**KEY LEARNING OBJECTIVES:** We present a pictorial review and share our own cases of abdominal liposarcoma. **DESCRIPTION:** Abdominal liposarcoma is the most common primary malignant retroperitoneal neoplasm and the second most common soft tissue sarcoma. It is much rarer to occur intraperitoneally. There are 5 histological sub-types – well-differentiated myxoid, pleomorphic, round-cell and dedifferentiated liposarcomas. There is only limited evidence to suggest these sub-types can be differentiated radiologically. Furthermore, there is no current review of the imaging characteristics of abdominal liposarcomas. So we propose to present a review of the current literature on this interesting entity and share our own imaging experiences. **CONCLUSION:** Understanding of the imaging features of this rare and interesting entity aids in differentiation between other fat-containing tumours of the abdomen.

p513

**Pictorial review of lipomas of the gastrointestinal tract**

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**KEY LEARNING OBJECTIVES:** To illustrate the key imaging features of GI lipomas. **DESCRIPTION:** Gastrointestinal (GI) lipomas are benign, usually single slow growing tumours. They can be found anywhere along the entire length of the gastrointestinal tract, but are most common in the caecum and ascending colon. The vast majority (90–95%) are submucosal, with only a small number subserosal. Lipomas can be sessile or pedunculated. GI lipomas are usually detected incidentally, but they can cause symptoms such as obstruction, intussusception and haemorrhage. On both CT and MRI lipomas can be diagnosed on account of their density (–80 to –120 HU) / intensity following that of fat on all sequences. Lipomas are usually entirely of fat density without solid components. Presence of a solid component should raise the rare but distinct possibility of a liposarcoma. 1. Lipomas usually require no treatment. If they are symptomatic then local excision is sufficient. 2. We present a selection of lipomas in different parts of the gastrointestinal tract from our institute in order to demonstrate their typical CT appearances. **CONCLUSION:** GI lipomas can present diagnostic challenges. A knowledge of their typical presentation and imaging appearances will greatly aid to avoid diagnostic confusion.

p514

**Abdominal radiography at Chelsea and Westminster Hospital**

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The aim of this poster is to provide a reference for Accident and Emergency (A&E) radiographers and clinicians on the best use of plain film abdominal radiography in the A&E department. **KEY LEARNING OBJECTIVES:** To highlight the main indications for plain abdominal radiography, small and large bowel obstruction, kidney obstruction, foreign body location and gastrointestinal perforation. To be a point of reference for radiographers and clinicians when deciding if and abdominal radiograph is required. To briefly cover alternative imaging modalities including CT, MRI and ultrasound and their accessibility within Chelsea and Westminster. **Description:** This poster includes the guidelines for requesting an abdominal X-ray and then explains why these guidelines are in place: potential danger of unnecessary X-ray and diagnosis that can be made. The main sections are small

and large bowel obstruction, kidney obstruction, foreign body location and gastrointestinal perforation. Each section includes radiographs showing the relevant topics, and also explains why each examination was appropriate, in regards to the clinical indications. References were included to show previous studies related to abdominal imaging. The final section showed examples of other modalities, including CT, MRI and ultrasound. Examples were given on availability of each service and priorities given to each individual examination. **CONCLUSION:** It was concluded that clinical indications must be justified for each examination. Also each modality has benefits for different clinical indications. The poster acts as a point of reference for radiographers and clinicians within Chelsea and Westminster Hospital.

**p515**

**Use of gadoxetate disodium (Primovist) in characterising liver lesions in a tertiary referral centre: our experience**

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**AIM:** To enhance the resident's knowledge about the use of Gadoxetate disodium (Primovist) in characterising liver lesions. **BACKGROUND:** Gadoxetate disodium (Primovist) is the first organ-specific MRI contrast to be used in characterising liver lesions. As a liver cell specific contrast agent, its mode of action has several distinctive features compared to existing contrast agents. Gadoxetate disodium improves the detection of liver lesions during the liver-cell specific imaging phase and thus enables an early diagnosis of liver diseases such as hepatocellular carcinoma (HCC). Furthermore, the precise image contrast achieved with this allows a clear delineation of structures, such as tumours and intrahepatic vessels. By combining early dynamic and hepatocyte-phase imaging, Gadoxetate disodium enhanced MRI helps to characterise and clearly localise liver tumours and can act as a guide for surgical planning. **Imaging features:** The primary role of Gadoxetate disodium is in differentiating malignant from benign lesions. We provide examples of imaging characteristics of various liver lesions such as poorly differentiated and well differentiated HCC, hypervascular and hypovascular metastases, adenoma, FNH, vanishing liver tumours, cirrhosis and various different types of nodules such as regenerative, and sideroblastic nodules, and HCC in a dysplastic nodule using Primovist. **CONCLUSION:** Primovist plays a very useful complementary role in the characterisation of various liver lesions including benign and malignant lesions. However, it is comparatively more costly than the regular contrast agent and hence it should be used as a problem solving tool rather than using it for all focal liver lesions.

**p516**

**CT guided pancreatic drainage: our experience**

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**KEY LEARNING OBJECTIVES:** 1. To describe a modified technique of insertion of large bore percutaneous CT guided catheter drainage of acute necrotising pancreatitis. 2. Are large drains better than small drains? **DESCRIPTION:** Acute necrotizing pancreatitis is associated with high morbidity and mortality. Percutaneous CT-guided catheter drainage is an important treatment option. We describe a modified technique of inserting a CT guided percutaneous large bore drains, its indications, outcomes, and complications. In retrospective review (Jan'08 to Oct'09) at UHB NHS Trust, 154 patients were admitted with acute pancreatitis. 18 patients (11.6%) had acute necrotizing pancreatitis and 16 (88.8%) of these patients (Male: 13, Female: 5) needed CT guided percutaneous drainage. We divided the size of drains into small (<16F) and large (>18F). Out of 16 drain insertions, 11 patients (68.7%) had small drains and 5 patients (31.25%) had large drains. Of the 11 small drains, 8 patients (72%) were upsized to large drains. **RESULT:** Average drain output ranged between 10–490 ml day<sup>-1</sup>. The time between drain placement and removal ranged between 50–180 days. All drains were removed when the drain

output was less than 10 ml day<sup>-1</sup>. The length of stay being 25–120 days. Associated complications included blockage, sepsis, renal failure, shock, biliary obstruction, and deaths. **CONCLUSION:** Image guided drainage of pancreatic fluid collections in acute necrotising pancreatitis is an important therapeutic option. We need to insert large bore drains in all patients presenting with acute necrotising pancreatitis at the outset.

**p517**

**Intra papillary mucinous neoplasm (IPMN) – a review**

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**KEY LEARNING OBJECTIVES:** We present a pictorial review of intra papillary mucinous neoplasm (IPMN) of the pancreas in terms of imaging characteristics and the contribution of imaging to management and follow-up for these patients. **DESCRIPTION:** Intra papillary mucinous neoplasm of the pancreas is an entity that poses difficulty in terms of management because of the lack of clinical presentation and the wide range of sub-types ranging from non-invasive to invasive and malignant. Management is further affected depending on whether it is a main duct, branch duct or mixed type of IPMN. Imaging plays a key role in determining management for these patients as to the type of surgery required or whether surgery is required at all. The main modalities currently advocated are MD-CT and MR. When diagnostic dilemma persists than EUS or ERCP are used. So we by reviewing the current literature and drawing on our own experience as a national centre for hepato-biliary work attempt to add clarity to imaging strategies that can be used when tackling IPMN. **CONCLUSION:** By thoroughly understanding the imaging of this entity we are in a position to provide clearer management decisions for these patients.

**p518**

**ERCP – the basics**

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**PURPOSE:** To provide basic knowledge of endoscopic retrograde cholangio-pancreatography (ERCP) examinations. To act as a visual reference for those involved in carrying out ERCP examinations, and to help improve radiographic skills. **DESCRIPTION:** The poster outlines basic information about ERCP examinations. It was specifically designed for students and newly qualified radiographers. It was arranged in poster format so that it could be used in the fluoroscopy examination room as a learning tool and point of reference. The presentation provides information on basic anatomy involved in procedures and how they carried out. It includes why ERCP is chosen for both diagnostic and therapeutic procedures, and what the indications and complications can be. It also briefly covers alternative imaging. Images are included as a visual aid demonstrating a few of the steps involved. **CONCLUSION:** This poster has assisted both student and newly qualified radiographers who are new to this type of imaging modality.

**p519**

**Detection of duodeno-gastric reflux during routine 99mTc-HIDA scintigraphy**

Sonoda, L. I., Godfrey, E. M., Solanki, C., Bird, N. J., Halim, M. Y., Middleton, S. J., and Balan, K.  
*Addenbrooke's Hospital, Cambridge, UK*

**PURPOSE:** Duodeno-gastric reflux (DGR) is an incidental finding on 99mTc-HIDA studies but its detection often yields useful clinical information. Present study was carried out to determine the rate of detection as well as incidence of DGR in patients undergoing HIDA scanning over a 5-year-period. **MATERIALS/METHODS:** 183 sequential patients who underwent 99mTc-HIDA cholescintigraphy over a 5-year-period between 2004 and 2008 have been retrospectively reviewed. Age, sex, previous surgery, clinical indications for the study, presence or not of DGR and clinical reports were subjected to analysis. **RESULTS:** Biliary dyskinesia ( $n=135$ ; 74%), post-surgical

symptoms ( $n=33$ ; 18%) and sphincter of Oddi dysfunction ( $n=15$ ; 8%) were the main indications for the study. 33/183 (18%) patients had DGR of which 21 (64%) were present in 117 patients with otherwise normal studies while 12 (36%) were seen in 66 patients with abnormal results ( $p=0.87$ ). All except one case of DGR was detected and mentioned in the original clinical report. 25/132 (19%) and 8/51 (18%) patients, respectively, with normal and abnormal biliary tract anatomy were found to have DGR ( $p=0.77$ ). Occurrence of DGR had no significant relationship with age, sex or gall bladder ejection fraction. CONCLUSION: DGR is an easily detected common finding on routine cholescintigraphy and may be the cause of presenting symptoms in patients who may have an otherwise normal HIDA study. The occurrence of DGR does not appear to have any significant relationship with age and sex of patients, biliary tract anatomy, or gall bladder function.

p520

**A pictorial review of bilomas**

Regi, J., Morgan, S., and Paravasthu, M.  
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Bilomas represent pathological collections of bile anywhere within the body. They can be spontaneous, secondary to stone disease, trauma or iatrogenic. This poster explores the different causes, locations, investigations and radiological treatment options. Most bilomas occur within or around the liver and are iatrogenic, secondary to surgical intervention or ERCP. We present multimodality cases of bilomas within the thorax, abdomen, pelvis, retroperitoneum and intrahepatic compartments. We assess the best modality for follow up and discuss the treatment options.

p521

**Hepatic portal venous gas: not always representative of bowel infarction**

Stevenson, J. E., Glancy, S., Shabbir, J., and MacLean, P.  
*Western General Hospital, Edinburgh, UK*

KEY LEARNING OBJECTIVES: To review some of the alternative aetiologies in adults, which, in addition to bowel infarction, are causes of hepatic portal venous gas (HPVG) on CT. DESCRIPTION: Case 1, Inflammatory bowel disease: 59F. Active sigmoid Crohn's disease. CT performed due to worsening sepsis, and clostridium positive blood cultures. Laparotomy, following CT detection of HPVG, revealed a paracolic abscess. Uneventful recovery following sigmoid colectomy. Case 2, Bowel Obstruction: 58M. Elective panproctocolectomy for ulcerative colitis. Post-operative CT following clinical deterioration revealed intramural gas, HPVG, and a bowel loop adherent to the incision. Laparotomy confirmed obstructed, but healthy small bowel, due to wound dehiscence. The patient recovered well. Case 3, Septic Thrombophlebitis: 62M: Severe sepsis following proven campylobacter gastroenteritis. CT detected portal and IMV thrombosis, small bowel venous infarction and extensive HPVG. The patient recovered well with conservative management. Follow-up CT was normal. Case 4, Incidental: 74M. Emergency admission with severe abdominal pain. CT demonstrated small bowel obstruction, peripancreatic inflammation and HPVG. Laparotomy revealed chronically obstructed, otherwise healthy bowel. The patient died of multi-organ failure due to fulminant pancreatitis. Case 5, Iatrogenic: 84M. Routine CT colonography detected an obstructing sigmoid carcinoma, and HPVG, traceable directly into the peritumoural IMV tributaries. The patient remained well following observation. CONCLUSION: As illustrated, increasing use of CT has led to increased detection of HPVG, in a vast array of clinical scenarios, with a more favourable prognosis than the classically described context of fatal bowel ischaemia.

**Gastrointestinal e-poster**

e522

**A pilot study on effect of experimental fasting protocols for hepatobiliary ultrasound examination on healthy volunteers with regards to ultrasound image quality**

58

Ivy, H.

*Singapore General Hospital, Singapore, Singapore*

PURPOSE: To study the effects of various fasting protocols on the image quality of hepatobiliary system ultrasound examination. MATERIALS/METHODS: 20 healthy volunteers were divided into four groups of A (7 h fast with light snack), B (4 h fast without light snack), C (4 h fast with light snack) and D (7 h fast without food, control group). Light snack refers to 2 slices of plain bread, plain water, coffee or tea without milk. Images of gallbladder (GB) in longitudinal (LS) and transverse (TS) with and without measurement, common bile duct (CBD) with and without measurement and lastly image of pancreas were documented. These images were reviewed and rated by a radiologist who was blinded to volunteers' fasting instructions. The images were rated into A and B where A is unacceptable and B is acceptable and scored on scale of 1–5. RESULTS: Using Kruskal Wallis test, comparing of all 4 groups (A, B, C & D),  $p$ -value of GB (LS), GB (TS), CBD, pancreatic head and body was calculated to be at 0.931, 0.995, 0.052, 0.249 and 0.881, respectively. All  $p>0.05$  so there is no significant difference between the various fasting groups compared with the control. CONCLUSION: It is possible to reduce the fasting time of the patients prior examination, and still produce good diagnostic ultrasound image quality.

e523

**Gallbladder carcinoma – the missing primary**

O'Donovan, E. J.<sup>1</sup>, Khatri, P.<sup>1</sup>, Shahabuddin, K.<sup>1</sup>, Sharma, B.<sup>2</sup>, and Khan, N.<sup>1</sup>

<sup>1</sup>Chelsea and Westminster Hospital, London, UK, <sup>2</sup>Royal Marsden Hospital, London, UK

DESCRIPTION: Gallbladder carcinoma is the most common biliary cancer. It is, however, frequently misdiagnosed and its imaging misinterpreted. Early diagnosis is essential to improve clinical outcome and potential cure. KEY LEARNING OBJECTIVES: Classification and pathology. Imaging features of gallbladder tumour on CT/MR/ultrasound/PET/nuclear imaging and angiography. Differential diagnoses that may result in mis-diagnosis such as the different forms of cholecystitis, adjacent visceral tumours, metastases and polyps. Pattern of spread and metastases. Different staging systems. Management options according to radiological tumour stage and location. CONCLUSION: If the diagnosis of gallbladder carcinoma is made incidentally at cholecystectomy resection can be curative. However, often by the time of presentation the tumour is unresectable. We intend to radiologically highlight this condition to ensure it is no longer the missing primary.

e524

**Cholangiocarcinoma: a radiological overview**

O'Donovan, E. J.<sup>1</sup>, Shahabuddin, K.<sup>1</sup>, Khatri, P.<sup>1</sup>, Prasad, P.<sup>1</sup>, Sharma, B.<sup>2</sup>, and Khan, N.<sup>1</sup>

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DESCRIPTION: Mortality rates from cholangiocarcinoma have been rising. Despite the modest increase in median survival with the advent of photodynamic therapy and new gemcytobine based chemotherapy, prognosis remains poor. As surgery is the only means of cure, the onus of diagnosis and selection of appropriate patients for differing therapy is placed on the radiologist. It is therefore imperative that state of the art imaging is used to assess this patient group to ensure that their staging is accurate. LEARNING OBJECTIVES: Diagnostic criteria; Anatomical classification; Pathological classification; Cholangiocarcinoma identification on established imaging techniques including ultrasound, CT, MRI and cholangiography. Strengths and weakness of differing imaging; We demonstrate the use of specialist imaging including endoscopic ultrasound and PET CT; The benefits of PET in response assessment; Staging systems and site of disease in relation to choice of further management. CONCLUSION: It is vital in a disease with such a poor prognosis that the patient is imaged in



the best possible manner to optimise their care, quality of life and in some cases cure. In order to do this the radiologist must appreciate the differing imaging techniques available and interpret them accurately, with a good understanding of the disease and its management.

### e525

#### **Gastric linitis plastica – not just one cause**

Rodriguez, C. L., Clayton, A., and Owen, R. E.  
*University Hospital of Wales, Cardiff, UK*

**KEY LEARNING OBJECTIVES:** To review the different causes of linitis plastica and highlight its radiological appearances as seen on different imaging modalities, with endoscopic and pathological correlation. **DESCRIPTION:** The most common cause of a characteristic linitis plastica appearance on imaging is a primary gastric scirrhus carcinoma, which spreads primarily in the submucosa and provokes a marked desmoplastic reaction in the gastric wall. There are a number of other causes of linitis plastica which are often overlooked. Gastric metastases or lymphoma can produce similar appearances. Carcinoma of the breast is well known to metastasise in a linitis plastica pattern. Rarer benign causes include granulomatous disease, eosinophilic gastritis, corrosive agents, gastric irradiation and amyloidosis. Differentiating between these different causes can be difficult due to a high negative biopsy rate. A linitis plastica appearance is classically manifested at the fluoroscopic barium study by gastric narrowing, rigidity of the wall with loss of normal peristalsis and pliability in the involved portion of the stomach. The appearance of linitis plastica of different aetiologies will be demonstrated on barium studies, CT, PET-CT, endoscopic ultrasound and endoscopy. **CONCLUSION:** The appearances of gastric linitis plastica of any cause are indistinguishable on imaging. It is clinically important to determine whether gastric linitis plastica is primary, metastatic or benign; this is usually achieved by endoscopic biopsy but many are inconclusive. The possibility of metastatic infiltration, lymphoma or other rarer benign causes of linitis plastica should always be considered when this diagnosis is made.

### e526

#### **Imaging appearances of various AIDS defining illnesses in the gastrointestinal tract**

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*Chelsea and Westminster Hospital, London, UK*

**KEY LEARNING OBJECTIVES:** We aim to provide a multi-modality review of imaging findings of various AIDS defining illnesses affecting the gastrointestinal tract. **DESCRIPTION:** The GI tract is a common location for many AIDS defining illnesses in the form of opportunistic infections or specific neoplasms. We will be presenting the imaging findings divided into two main categories: infections and neoplasia associated with AIDS, including Non Hodgkin's lymphoma and Kaposi's sarcoma. **CONCLUSIONS:** We hope this poster will aid the readers in interpreting various disease processes effecting the GI tract in HIV patients, with a focus on AIDS defining illnesses and illustrate the significance of correlating the level of immunocompromise when interpreting these findings.

### e527

#### **The acute abdomen in the immunocompromised patient: a pictorial review**

Williams, A. L.<sup>1</sup>, Stockley, H.<sup>2</sup>, and Filobos, R.<sup>3</sup>  
<sup>1</sup>Mersey School of Radiology, Mersey, UK, <sup>2</sup>Manchester Radiology Training Scheme, Manchester, UK, <sup>3</sup>North Manchester General Hospital, Manchester, UK

**KEY LEARNING OBJECTIVES:** 1. Review the differential diagnosis of the acute abdomen in the immunocompromised patient. 2. Illustrate the multi-modality imaging features of the most common aetiologies using cases encountered at our institution. **DESCRIPTION:** The immunocompromised population is increasing. The clinical evaluation of the acute abdomen in the immunocompromised patient is challenging and is complicated by unusual aetiologies and atypical

presentations of common conditions. The radiologist can therefore be instrumental in making an accurate diagnosis in these cases. **CONCLUSION:** This educational exhibit reviews the differential diagnosis of the acute abdomen in this complex patient group and presents the imaging features of the most common aetiologies, using cases encountered at our institution.

### e528

#### **Imaging the small bowel in non-dedicated, routine oncology CT scanning of the abdomen and pelvis: comparison of protocols**

Mortimer, A. M., Mathew, P., and Planner, A.  
*Great Western Hospital, Swindon, UK*

**PURPOSE:** Administration of oral contrast to improve small bowel conspicuity on MDCT is commonplace. However, its diagnostic value for routine non-dedicated examinations is uncertain. We retrospectively compared scans performed using three protocols in the same 10 patients. Regimens using a barium-based agent, a volume of water or no oral contrast, were compared for small bowel distension, wall/lumen differentiation, and cost. Clinical follow up of 100 similar patients scanned without positive contrast was made over a 1–3 year period to ensure no significant small bowel pathology was missed. **MATERIALS/METHODS:** Two radiologists retrospectively analysed each CT study assessing distension and wall/lumen differentiation using a formal scale. The electronic case notes and where possible follow-up scans of 100 patients were then assessed over the following 1–3 year period. **RESULTS:** No significant difference in small bowel distension was demonstrated between the three groups. The bowel lumen/wall differentiation was superior for positive oral contrast media. No significant improvement for water over non-contrasted scans was seen. The additional cost of contrast was £2.50/patient. On follow-up of 100 patients, no diagnostic error or missed pathology relating to small bowel interpretation was identified. **CONCLUSION:** Although there is a slight improvement in small bowel conspicuity with the use of positive oral contrast agents this does not appear to have an impact on diagnostic yield. Rather this study supports the practice of using no oral contrast, which appears safe, cost effective and logistically simpler, during non-dedicated MDCT imaging of the abdomen and pelvis in this population group.

### e529

#### **A pictorial review of the typical and more unusual metastatic behaviour patterns of primary abdominal neuroendocrine tumours of the pancreas and gastrointestinal tract**

Jaffer, O., Patel, P., Lung, P., and Ryan, S.  
*King's College, London, UK*

**KEY LEARNING OBJECTIVES:** To illustrate, with examples, the typical and more unusual metastatic behaviour patterns of primary abdominal neuroendocrine tumours of the pancreas and gastrointestinal tract. **DESCRIPTION:** The method of presentation of abdominal neuroendocrine tumours is found to be quite variable. Though often lead by clinical and secondary biochemical suspicion, imaging can be the first investigation to suggest the diagnosis. Often, the primary tumours can be relatively inconspicuous and in these cases, it is the nature and imaging characteristics of the secondary metastatic disease which raise the possibility. The review will concentrate on these specific characteristics and how to differentiate between different pathologies of similar appearances. Though the liver is the most widely recognised organ of secondary involvement, examples of nodal, peritoneal, mesenteric, bone, lung, brain, heart and ovarian disease will be included. The exhibit will address the specific features on CT, MRI and nuclear medicine (somatostatin analogues and MIBG studies). Typical clinical symptoms and associated biochemical findings will also be discussed. **CONCLUSION:** Due to the variable patterns of presentation and inconspicuous or indeed occult nature of the primary tumour, it is important to be aware of the key imaging findings of metastatic abdominal neuroendocrine tumours. This will allow appropriate ancillary radiological investigation, as well as influence the surgical and non-surgical management of the patient.



e530

**Multimodality imaging of the abdominal wall**Colledge, J. D., Power, N., Cross, S., Odedra, B., and Flanagan, S.  
*Barts and the London NHS Trust, London, UK*

**KEY LEARNING OBJECTIVES:** 1. Anatomical layers of the abdominal wall; 2. Modalities used to image the abdominal wall and their corresponding merits; 3. Imaging features of specific pathologies affecting the abdominal wall. **DESCRIPTION:** The abdominal wall is ideally suited to imaging with all cross sectional modalities. This review will focus on the normal anatomical layers of the abdominal wall on CT and MRI as well as the appearances of a range of pathological processes including the sequelae of blunt and penetrating trauma, non-traumatic rectus sheath haematoma, vascular and infectious diseases, abscess formation, benign and malignant primary tumours such as lipoma and liposarcoma, metastases from a range of malignancies and miscellaneous conditions such as endometriosis and herniae. **CONCLUSION:** The pathology of the abdominal wall is varied and is well shown using current techniques. The imaging features are as described.

e531

**Rectal bleeding on MDCT mesenteric angiography: starting from the bottom**Lim, G., Tan, C., Thian, Y., Tan, G., and Uei, P.  
*Tan Tock Seng Hospital, Singapore*

**KEY LEARNING OBJECTIVES:** 1. Familiarise with the complex vascular anatomy of the rectum. 2. Know the imaging findings of rectal bleeding on MDCT mesenteric angiography. 3. Understand the potential pitfalls in diagnosis unique to rectal haemorrhage. **DESCRIPTION:** Per rectal bleeding is common and occasionally life-threatening. MDCT angiography of the mesenteric vessels is useful in identifying and localising haemorrhage arising from the rectum that may sometimes be challenging clinically. The complex vascular anatomy of the rectum and their attendant treatment implications are detailed with illustrative cases. We further present the MDCT findings in a series of cases, highlighting the importance of adequate scanning technique as well as the potential pitfalls in diagnosis that are unique to rectal haemorrhage. **CONCLUSION:** MDCT angiography of the mesenteric vessels can be useful in demonstrating the site of rectal haemorrhage. Familiarity with pertinent vascular anatomy and imaging findings, coupled with proper scanning technique and knowledge of potential pitfalls unique to this region, allows for prompt and accurate diagnosis.

e532

**Fat containing lesions of the liver: the trainee's perspective**Chawla, S., Edwin, P. J., and Adapala, R.  
*Wirral University Hospital, Wirral, UK*

**KEY LEARNING OBJECTIVES:** Fatty liver, also known as fatty liver disease (FLD), steatorrheic hepatitis, or steatosis hepatitis, is a reversible condition where large vacuoles of triglyceride fat accumulate in liver cells via the process of steatosis. It is a common finding encountered during everyday cross sectional imaging. There is a 10–24% prevalence of fatty liver disease in the general population. **DESCRIPTION:** Focal and diffuse fatty infiltration and sparing often complicates the final radiological diagnosis. There has been a reported decrease in the sensitivity and specificity of lesion detection and characterisation on a background of fatty liver. The majority of these lesions are detected incidentally in asymptomatic patients. We as radiologists need to be familiar with the imaging features of the various fatty liver lesions irrespective of the imaging modality used. We present as a pictorial review a cohort of cases of fat containing liver lesions which provide a diagnostic challenge for the interpreting trainee. Our spectrum of cases includes lesions misinterpreted in the first instance as either benign or malignant. Furthermore, normal structures simulate as pathology on a background of fatty infiltration. **CONCLUSION:** From a trainee's perspective, identification of the lesion on MRI and MDCT needs

to be supplemented with characterising the lesion. We particularly highlight MRI's capability as problem solving tool. This review provides a framework for characterisation of the common fatty liver lesions and a practical approach on MRI identification of fat containing primary and secondary malignancies.

e533

**A pictorial review of post-operative complications of pancreatoduodenectomy (Whipple procedure), with an emphasis on those requiring radiological intervention**Jaffer, O., Lewis, D., Peddu, P., Ryan, S., Kane, P., and Karani, J.  
*King's College, London, UK*

**KEY LEARNING OBJECTIVES:** To review the post operative complications of pancreatoduodenectomy (Whipple procedure) detected with cross-sectional imaging. The pictorial review will aid the viewer in recognising differing presentations of the various complications and the subsequent management. **DESCRIPTION:** Examples of the following complications and subsequent management will be presented: 1. Gastroduodenal artery pseudoaneurysm haemorrhage; 2. Abdominal and pelvic abscess formation; 3. Pancreatitis; 4. Anastomotic leak; 5. Biliary obstruction; 6. Tumour recurrence; 7. Biliary stricture/intrahepatic biloma/hepatic abscess; 8. Segmental liver ischaemia; 9. Portal vein thrombosis and portal hypertension; 10. Roux loop ischaemia; 11. Roux loop stasis. **CONCLUSION:** The exhibit will demonstrate the key imaging characteristics of the differing post operative complications of pancreatoduodenectomy and the appropriate subsequent management. Emphasis will be placed on those complications which would benefit from radiological intervention and thus allow the viewer to make informed decisions in aiding management of post-operative complications.

e534

**Acute pancreatitis: the role of imaging in diagnosis and treatment**Bharwani, N., Prabhudesai, S., Patel, S., Fotheringham, T., and Power, N.  
*The Royal London Hospital, Whitechapel, London, UK*

**KEY LEARNING OBJECTIVES:** 1. Role of imaging in the diagnosis of severe acute pancreatitis. 2. Complications – imaging findings and what the clinician needs to know for management decisions. 3. Role of image-guided intervention in management – indications, techniques and case studies. **DESCRIPTION:** Pathophysiology of acute mild, moderate and severe pancreatitis; Traumatic pancreatitis; Complications including: Acute inflammation; Pancreatic necrosis; Abscess formation; Splenic vein thrombosis; Splenic infarction; Pseudocyst formation; Haemorrhage; Image-guided interventions including the use of stents for enteric drainage of abscesses and pseudocysts and closed drainage of necrotic pancreas. **CONCLUSION:** Majority of cases of acute pancreatitis are self-limiting and respond rapidly to conservative management. However, some cases present with a more pronounced clinical picture, requiring immediate medical care to avoid fatal complications. These cases account for most of the morbidity and mortality associated with the disease. Imaging plays a significant role in identification of the development of local/systemic complications and in planning and providing further management. The timing and extent of surgery in complicated cases warrants careful decision making as this may further worsen morbidity. Image guided interventional procedures may prove to be less invasive and reduce the need for surgical intervention thus improving outcome

e535

**A pictorial review of splenic pathology**Stubbs, E. G. C. and Bhat, R.  
*Queen Margaret Hospital, Dunfermline, UK*

**KEY LEARNING OBJECTIVES:** Splenic pathology is relatively common and can be investigated by imaging modalities from ultrasound to angiography. Imaging findings can be unexpected

with overlap in appearances that can cause diagnostic difficulty. **DESCRIPTION:** The spleen may be involved in many disease processes that include inflammatory, vascular, infective, neoplastic, traumatic and granulomatous. We present a pictorial review of the wide spectrum of splenic pathology using CT, MRI and ultrasound. Where appropriate we have included selected images of their endovascular treatment. **CONCLUSION:** The imaging of splenic pathology may require multiple modalities with a wide range of findings that can cause diagnostic difficulty. The authors share this pictorial review of their personal experience.

**e536**

**Multimodality imaging features of acquired sub-diaphragmatic bowel fistulae**

Gayed, J., Gayed, W., Prabhudesai, S., Gademsetty, C., and Power, N.

*Barts and The London NHS Trust, London, UK*

**KEY LEARNING OBJECTIVES:** To understand: 1. The definition, classification and aetiology of bowel fistulae. 2. The key imaging features of bowel fistulae and their associated complications using various imaging modalities. **DESCRIPTION:** 1. Define and categorise bowel fistulae (internal, extra-intestinal and external fistulae). 2. Describe the complex nature of bowel fistulae with their surrounding viscera. 3. Review the underlying aetiologies into various groups (neoplastic, inflammatory bowel disease, iatrogenic, e.g. post radiotherapy). 4. Illustrate the radiological features on (Barium/water soluble studies, CT, MRI). 5. Describe other complications associated with fistulae, e.g. abscesses. **CONCLUSION:** The major teaching points of this exhibit are: 1. To learn the categories of bowel fistulae and their imaging features. 2. To be alert to the associated complications of bowel fistulae.

**e537**

**Imaging characteristics of abdominal hernia**

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**KEY LEARNING OBJECTIVES:** The aim of this exhibit is to provide a pictorial review with anatomical correlation and line diagrams of the different types of abdominal hernias. **DESCRIPTION:** Abdominal hernias are broadly subdivided into external and internal types. The external abdominal hernias can be further sub categorised into groin, lumbar, pelvic floor, diaphragmatic and ventral varieties and internal into paraduodenal, lesser sac, etc. Hernias should be identified by the reporting radiologist not only when the patient is obviously symptomatic but also when the diagnosis is obscure. They are sometimes diagnosed co-incidentally on imaging studies preventing possible further life threatening complications. **CONCLUSION:** We anticipate that this pictorial review will provide a visual guide to the various abdominal hernias on commonly used modalities – plain radiography, ultrasound, CT and MRI as well as a methodical approach in identifying the salient findings to arrive at a precise diagnosis.

**e538**

**PET/CT vs CT staging in primary oesophageal tumours**

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**PURPOSE:** To review our practice of PET/CT in primary oesophageal tumour staging and assess any change to TNM stage when compared with contrast enhanced staging CT. To review the incidence and outcome of any additional findings on PET/CT. **MATERIALS/METHODS:** The study was carried out at a 750 bed district general hospital. Radiology reports were reviewed for all patients who underwent PET/CT examination for primary oesophageal tumours over a period of 15 months. Data was collected on changes to radiological staging following PET/CT, additional findings on PET/CT and further

investigations of these findings. **RESULTS:** 28 patients were included, all of which had half body PET/CT from skull base to mid-thigh. The malignancy was upstaged in 5, down-staged in 3 and unchanged in 20 patients. 3 patients had additional imaging of the primary. 18 areas of additional abnormal uptake were found in 12 patients, 16 FDG avid and 2 FDG inavid. 4 resulted in further imaging. 2 of these were normal on additional imaging, and 2 were found to be benign lesions. Of the remaining 14 cases, 2 were disregarded after review, 3 were not followed up despite recommendation, in 1 case the patient was too unfit for further investigation, and in 8 no follow up was recommended. **CONCLUSION:** PET/CT scan can aid with primary oesophageal tumour staging, however there is also a high incidence of additional findings. The majority of these are not pursued, and abnormalities which do lead to further radiological investigation are often normal or benign in nature.

**Uroradiology poster**

**p601**

**Reducing the radiation dose in the investigation of suspected renal colic**

Iqbal, A.

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**PURPOSE:** CT KUB and KUB have a similar effective dose. However, CT is far superior to plain film in sensitivity and specificity for renal stones. However patients admitted for suspected acute renal colic are undergoing both investigations. The aim of the study was to devise a method to reduce the effective radiation dose. **MATERIALS/METHODS:** The imaging and clinical symptoms of 50 consecutive patients who had been admitted from the casualty department and had undergone CT KUB for suspected renal colic were retrospectively reviewed. Patients with a previous history of known renal stones were excluded from the study. The effective radiation dose was calculated for each patient. **RESULTS:** 62% of patients who underwent CT KUB had a positive diagnosis of renal stones and 84% of this group had also had a KUB. Of the 38% of patients who had a negative CT KUB for renal stones, only 18% had a good history of renal colic and only 14% had an alternate pathology. If patients with a good history of renal colic only underwent CT KUB, the average effective dose is reduced by 25%. **CONCLUSION:** Patients presenting with a good history of renal colic should undergo CT KUB and not KUB as a first line of investigation which will reduce the effective radiation dose.

**p602**

**Comparison of ultrasound with CT urogram (CTU) as a pathway to investigate haematuria**

Modi, P., Modi, S., Sagoo, R., Patel, R., and Roy-Choudhury, S.  
*Heartlands Hospital, Birmingham, UK*

**PURPOSE:** To assess the impact of replacing ultrasound with CT urography (CTU) for haematuria investigation. **MATERIALS/METHODS:** Between June 2007 and July 2008, 139 patients (M:F ratio: 2.3:1, mean age of 64 years) had ultrasound of urinary tract as well as CTU to investigate macroscopic (121/139) and persistent microscopic (18/139) haematuria in addition to cystoscopy. 14 patients were under 40 years. Two phase split dose (50+50 ml) CTU using a 16 slice CT (Toshiba) was performed and assessed by four uroradiologists. Multidisciplinary discussion, CTU and clinical follow up (median 12m) were combined to create a gold standard. **RESULTS:** 100/139 patients with haematuria had normal ultrasound of which 25/100 (25%) were false negative. 12 (43%) had renal calculi, 3 had bladder TCC picked up, 1 had upper tract TCC, 1 Bosniak 3 renal cyst, 1 had an atrophic kidney, 3 had thickened bladder wall presumed to be chronic cystitis, 1 had renal papillary necrosis and 3 had enlarged prostate. 39/139 patients with haematuria had an abnormal ultrasound scan, of which 26/39 (67%) were consistent with the gold standard of which 3/39 were not seen on CTU. False positive findings 13/39 on ultrasound included stone (2), renal mass (4), hydronephrosis (4), duplex (2), cortical scarring (1). This gives a sensitivity, specificity, positive and negative predictive values with ultrasound of 50%, 85%, 67% and 75%, respectively. All patients under 40 years had

normal ultrasound but 2/14 had renal stones that were picked up on CTU. **CONCLUSION:** In addition to cystoscopy, CTU is a superior investigation in the investigation of haematuria over ultrasound in patients over 40 years.

### p603

#### Incidence of non-urolological findings in CT urography (CTU)

Modi, P., Modi, S., Sagoo, R., and Roy-Choudhury, S.  
*Heartlands Hospital, Birmingham, UK*

**PURPOSE:** To assess the distribution of non-urolological pathologies on CT urography (CTU). **MATERIALS/METHODS:** Reports of 266 consecutive CTU performed between June 2007 to July 2008 (M:F ratio: 2.6:1, mean age of 65.4 years) were retrospectively reviewed. Two phase split dose (50+50 ml) CTU using a 16 slice CT (Toshiba, Netherlands) was assessed by four urologists. All reported non-urolological findings were classified according to the reporting standard for extra colonic findings on CT colonography; E0=limited examination, E1=normal finding/variant, E2=abnormal finding requiring no change in management, E3=abnormal finding - potential change in management, E4=urgent action required. **RESULTS:** 107/266 (40.2%) of all CTU detected non-urolological pathology. By number of abnormalities, these were: E0=0, E1=3 (this may not have been reported as many radiologists feel it is not necessary to comment upon normal variants), E2=71 (liver cysts 15, gall stones 20 and degenerative spinal disease 12 and others), E3=64 (diverticulosis 34, adrenal adenomas 7, infra-renal aneurysms <5 cm 5, mesenteric panniculitis 4 and others) E4=22 (infra-renal aneurysms >5 cm 3, pseudomembranous colitis 2, colon cancer 1, small bowel tumour 1, liver metastasis 1, foreign body distal ileum 1 and others). **CONCLUSION:** A significant number of non urological pathologies are detected on CTU, of which 21% are significant requiring urgent action. This offers an added advantage in incorporating CTU in the pathway to investigate haematuria. This may even lead to overall fewer investigations for the patient.

### p604

#### Bowel preparation in intravenous urography. Does it make a difference?

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**PURPOSE:** Haematuria and renal colic are commonly investigated by intravenous urography (IVU). Patient preparation with dietary restriction and laxatives is often used prior to elective IVU to aid visualisation of the renal collecting systems. In our NHS Trust there was variation in policy with two sites using bowel preparation and the other site using none. Our aim was to compare the quality of the IVUs across the three sites with a view to implementing a single patient advice sheet and appointments system for the entire Trust. **MATERIALS/METHODS:** All elective IVUs performed in Northumbria Healthcare NHS Trust over a 1 month period ( $n=114$ ) were reviewed for the presence of overlying gas or faeces which would make interpretation difficult. The collecting system was subdivided into upper/middle/lower calyces and renal pelvis. Data was analysed according to hospital site and patient preparation policy. **RESULTS:** There was no significant difference ( $p>0.05$ ) between the three sites in terms of the proportion of clear IVUs, nor in the proportion of collecting system segments obscured by faeces or gas. There was no difference ( $p>0.05$ ) between the three sites in terms of the presence of gas or faeces. **CONCLUSION:** This study indicates that the routine use of patient preparation prior to intravenous urography does not improve the visibility of the renal collecting systems and has no effect on the relative proportions of gaseous or faecal patterns. Financial savings can be made by not using bowel preparation agents. Furthermore, patients' lives are less disrupted through having restricted diets and laxatives.

### p605

#### Infection rates following transrectal ultrasound guided prostate biopsy – is it dependent on the number of cores taken?

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**PURPOSE:** Transrectal ultrasound guided (TRUS) prostate biopsy is considered a safe and accurate diagnostic tool. There has been a general trend towards increasing the number of cores taken to improve diagnostic yield. Studies show that the administration of prophylactic antibiotics is associated with a reduced incidence and severity of infective complications. Few studies have addressed whether the number of needle passes through the rectal wall increases the risk of infection. Our study aimed to determine whether the risk of infection following TRUS prostate biopsy is associated with the number of cores taken. **METHOD:** Patients were prospectively followed-up 10 days after TRUS prostate biopsy. Infective complications were defined as any fever requiring antibiotic therapy. Severe infections were defined as those requiring admission to hospital or multiple courses of antibiotics. All patients received 2 doses of oral ciprofloxacin prophylaxis. **RESULTS:** A total of 585 patients underwent TRUS prostate biopsy with an overall post biopsy infection rate of 6.0% (35/585). 296 patients underwent <8 passes with an infection rate of 6.1% (18/296) and a serious infection rate of 0% (0/296). 289 patients underwent  $\geq 8$  passes with an infection rate of 5.9% (17/289) and a serious infection rate of 1% (3/289). **CONCLUSION:** Our results suggest that while the frequency of infective complications is not significantly altered by the number of passes at TRUS prostate biopsy, the risk of severe infection is greater. Prolonged prophylactic antibiotic regimens may be required to improve protection against severe infection in patients undergoing  $\geq 8$  passes at TRUS prostate biopsy.

### Uroradiology e-poster

#### e606

#### "Renal colic" – is it just stones?

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**KEY LEARNING OBJECTIVES:** To highlight the importance of being aware of several non-urinary or acalculous urinary conditions which may mimic renal colic. To emphasise the importance of recognising such conditions simulating urolithiasis on unenhanced computed tomography (CT). **DESCRIPTION:** "Loin to groin" pain or flank pain accounts for a substantial proportion of patient presentations both at primary and secondary care levels. The high sensitivity and specificity, the ability to quickly answer the clinical question and the advancements in CT dose reduction has resulted in unenhanced CT abdomen being a primary tool for investigating renal colic in a large number of institutions. However, several intra abdominal entities may present with symptoms akin to renal colic. Gastrointestinal, urological (non-stone disease), vascular, gynaecological or muscular conditions may mimic renal colic. If any such condition is suspected and the patient is still at the scanner, intravenous contrast administration and a tailored CT protocol may be able to further characterise the abnormality promptly. **CONCLUSION:** It is important that the CT scan is not read with a view to exclude urolithiasis only. Intra-abdominal conditions on an unenhanced CT may be difficult to identify and interpret, particularly on low dose settings, unless the radiologist is aware of them. Our poster will be an educational exhibit with a pictorial review of conditions mimicking renal colic.

#### e607

#### Radiofrequency ablation for small renal masses: indications, tips and tricks for a successful procedure

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*Bart's and the London NHS Trust, London, UK*

**KEY LEARNING OBJECTIVES:** A narrative review of the current indications, important technical considerations and complications of radiofrequency ablation for small renal tumours. **DESCRIPTION:**

Radiofrequency, thermal ablation (RFA) is a recent and expanding modality used in the management of often asymptomatic, incidentally detected renal masses. It avoids much of the morbidity associated with open surgical procedures and has been used with success in patients considered poor surgical candidates due to comorbidity. Though still in the early stages data so far suggests comparable oncological and functional outcome to standard management. Here we present the experience of the Royal London Hospital of RFA for small cortical renal tumours. The indications and features of lesions that make the technique a suitable management choice are discussed, with representative cases from our Hospital. Emphasis is placed on the technical aspects of the procedure and how to avoid the common problems and pitfalls encountered in practice. The hydrodissection technique to protect adjacent bowel, the pyeloperfusion technique to protect injury of the pelvicalyceal system and the combined ablation with ethanol and RFA ablation for large tumours, are presented through characteristic case examples. **CONCLUSION:** Radiofrequency ablation is an increasingly important therapy for small, localised renal masses. As the intervention matures, much can be learnt from review of early experience with the technique. We demonstrate valuable lessons to avoid complications for those interventional departments seeking to expand in this area.

**e608**

**Ultrasound measurements of the renal size and renal pelvis in paediatric patients with urinary symptoms – is there a significant difference between supine and prone positions?**

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*Fairfield General Hospital, Bury, UK*

**PURPOSE:** Measurement of the renal pelvis and kidneys is very important for the treatment of children with urinary pathology. Our aim was to assess if there is a significant difference in measurement at supine or prone position. **MATERIALS/METHODS:** This is a retrospective study of paediatric urinary ultrasounds performed trust wide in the year 2007. The age limit was set at 5 years old and below. This was undertaken using the PACS system and taking information from the clinical reports available. We recorded; size of kidneys and size of the renal pelvis, whether it was supine, prone of both, and referring criteria/clinical symptoms **RESULTS:** 146 ultrasounds were performed during 2007. Of these 89 were male patents and 57 female. The average size of the right Kidney Supine (cm) was 5.99, left Kidney Supine (cm) was 6.21, right Kidney prone (cm) was 5.70, and left Kidney prone (cm) was 6.20. The average size of the right renal pelvis Supine (mm) was 11.07, left renal pelvis Supine (mm) was 12.76, right renal pelvis prone (mm) was 12.30, and left renal pelvis (mm) was 11.54. The average percentage difference between the right kidney supine/prone positions was 5%, left kidney supine/prone was 0.2%, right renal pelvis supine/prone was 10.0% and left renal pelvis supine/prone was 9.7%. **CONCLUSION:** There is a significant difference in calculating sizes while scanning the renal pelvis thus both views should be attained. For the kidney size one should use the approach which is the best at the moment of scanning.

**e609**

**Non-malignant testicular lesions: a review of the differential and imaging features**

Bull, M. D., Dubbins, P. A., and Freeman, S.  
*Peninsula Radiology Academy, Plymouth, UK*

**KEY LEARNING OBJECTIVES:** To review the non-malignant diagnoses that may be encountered during ultrasound examination of the testes. **DESCRIPTION:** Ultrasound of the testes is a common examination in most centres. The usual indication will be scrotal/testicular mass or pain. While extra-testicular masses are almost always benign, intra-testicular masses are generally a cause of greater anxiety, with exclusion of malignancy being the main concern. There are a wide variety of pathologies that may present as intra-testicular masses. We present images of over 20 separate benign pathologies which have been found at our centre. These include epidermoids, intra-testicular varicoceles, leydig cell tumours, adenomatoid tumours,

sarcoid, gumma and abscesses. Some of these diagnoses have been confirmed with histopathology, others have been diagnosed with a combination of imaging characteristics, long term follow-up and clinical history. **CONCLUSION:** While performing ultrasound of the testis, it is important to be aware of the patients' presentation and past medical history. Careful examination in combination with a thorough history may negate the need for orchidectomy.

**Gynaecology & Obstetrics poster**

**p701**

**A pictorial review of ovarian dermoid tumours**

Rao, S. K., Jacoby, J. M., and Blaquiere, R. M.  
*Southampton General Hospital, Southampton, UK*

**KEY LEARNING OBJECTIVES:** To provide the viewer with an understanding of the pathogenesis and prevalence of dermoid tumours; the differing appearances of dermoid tumours on plain radiography, ultrasound, CT and MRI. The potential complications of dermoid tumours. The most appropriate imaging modalities to investigate dermoid tumours and how imaging informs management. **DESCRIPTION/CONTENTS:** These potentially bizarre tumours of pluripotent germ cell origin are relatively common. We aim to present a concise and informative poster in order to achieve our key learning objectives within the following framework: Introduction – including a brief outline of prevalence, pathogenesis and histology; imaging appearances of dermoid tumours: on plain film, ultrasound, CT and MRI; complications of ovarian dermoid tumours – including rupture, torsion, inflammation, fistula formation and malignant degeneration with imaging examples; how best to image dermoid tumours – including potential differential diagnoses and how imaging informs management. **CONCLUSION:** Although the majority of gynaecological imaging is carried out by specialist gynaecologists, radiologists and radiographers, it is still important for the general radiologist performing ultrasound on a day today basis to be familiar with the imaging appearances of this relatively common neoplasm.

**p702**

**What are the radiological features that distinguish benign from malignant adnexal masses in peri/post-menopausal women?**

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*St Mary's Hospital, London, UK*

**KEY LEARNING OBJECTIVES:** 1. To demonstrate the radiological features of complex, benign adnexal masses in peri/post-menopausal women. 2. To raise awareness of the differential diagnoses for a complex, adnexal mass in peri/post-menopausal women to expedite accurate diagnosis and treatment. **DESCRIPTION:** Complex adnexal masses in peri/post-menopausal women usually raise concerns about the presence of ovarian cancer. Pelvic inflammatory disease is less common in this age group but has an increased risk of severe sepsis and shock and may present with a tuboovarian abscess. Their clinical presentation is often with non-specific symptoms and this delays non-invasive diagnosis. The differential diagnosis for a benign, complex adnexal mass also includes diverticular abscess, appendicular abscess, actinomycosis, endometriosis, fibroids, various benign ovarian tumours and peritoneal pseudocysts. We have completed a retrospective review of the imaging of peri/post-menopausal women who presented with complex, adnexal masses, subsequently shown to be benign, at St Mary's Hospital over a 10 year period. Clinical and radiological correlation with subsequent outcome, including microbiological findings, has been performed. The purpose of this imaging review is to emphasise the radiological features of these benign masses in order to assist the clinician in making a prompt diagnosis. Distinguishing imaging features will be presented and discussed. **CONCLUSION:** The radiological features of complex, benign adnexal masses in peri/post-menopausal women have been demonstrated using clinical cases. Understanding of these radiological features and knowledge of the differential diagnosis for a complex adnexal mass will expedite accurate diagnosis and treatment.

p703

**The utility of FDG PET/CT in the assessment of post radiotherapy carcinoma of the cervix – our initial experience**

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*Southampton University Hospitals NHS Trust, Southampton, UK*

**KEY LEARNING OBJECTIVES:** To highlight the role of FDG PET in the evaluation of the post radiotherapy carcinoma of the cervix. To understand the clinical implications of persistent uptake in the treatment field and new uptake in non irradiated areas in this clinical setting. **DESCRIPTION:** Cervical cancer spreads in a predictable pattern early in the disease, mainly via local invasion and lymphatics. Local disease staging is usually with CT and MRI, while “surgical staging” considered the gold standard for para-aortic lymph nodes is not without associated morbidity. Some guidelines recommend the use of PET/CT in the staging of locally extensive carcinoma which is potentially curable by exenterative surgery. There is some preliminary data in current literature to suggest its role in the assessment of the post treatment cervix. Post therapy FDG uptake is an indicator of tumour response and maybe a predictor of disease outcome. New sites of disease detected on whole body PET/CT may preclude potentially curative exenteration. PET/CT is also of value in the assessment of para-aortic lymph nodes, which may be borderline by size criteria. We share our initial experience in a tertiary referral centre and present data from post treatment PET/CT scans over a period of 1 year and discuss their influence on subsequent management. **CONCLUSION:** This exhibit illustrates the value of PET/CT in the post radiotherapy cervix, where residual/recurrent tumour can be difficult to detect on conventional modalities like MRI. The presence of residual tumour/new sites of disease can alter treatment strategies and outcome.

**Gynaecology & Obstetrics e-poster**

e704

**Pre-UAE MRI – beyond fibroids: a pictorial review**Williams, P. L.<sup>1</sup>, Coote, J. M.<sup>2</sup>, and Watkinson, A. F.<sup>2</sup>*<sup>1</sup>Derriford Hospital, Plymouth, UK, <sup>2</sup>Royal Devon and Exeter Foundation Trust, Exeter, UK*

**KEY LEARNING OBJECTIVES:** Understand diagnostic challenges in patients with possible uterine fibroids. Appreciate importance of MRI in assessment for patients undergoing uterine artery embolisation. **DESCRIPTION:** Uterine leiomyomata, or fibroids, although benign, cause debilitating symptoms in many women. They are the most common tumour of the female reproductive system, occurring in up to 30% of women. Whilst most patients are asymptomatic, up to 50% complain of symptoms including abnormal bleeding, pain, pressure symptoms, dyspareunia, infertility, constipation and urinary frequency. As a variety of other medical conditions present with similar problems, this may present diagnostic difficulty. There are many treatment options available for fibroids now, and an increasingly popular choice is uterine artery embolisation. This is a safe, cost effective alternative to hysterectomy, allowing uterine preservation. UAE induces infarction of leiomyomata, with resolution of symptoms resulting from necrosis, degeneration and size reduction. With the diagnostic challenge in mind, MRI is performed prior to UAE in order to confirm the diagnosis and number, size and location of the fibroids, determining suitability for UAE, and is often performed following treatment to assess response. We present a number of cases where alternative or important second diagnoses, with management implications, were made from MRI performed prior to UAE. This educational presentation highlights the importance of careful assessment of the study. **CONCLUSION:** Alternative or second diagnoses may easily be overlooked at “pre-UAE” assessment but are important to report as diagnosis and patient management may be changed.

e705

**A pictorial guide to the revised FIGO staging system for gynaecological malignancies**Mehta, R.<sup>1</sup>, Narayanan, P.<sup>1</sup>, Rana, K.<sup>1</sup>, Sriharan, M.<sup>1</sup>, and Sohaib, A.<sup>2</sup>*<sup>1</sup>Chelsea and Westminster Hospital, London, UK, <sup>2</sup>Royal Marsden Hospital, London, UK*

**LEARNING OBJECTIVES:** To describe and illustrate the revised FIGO staging system, highlighting recent changes. To describe the reason for the changes to the FIGO staging system. The limitations of the current staging system will be provided. **DESCRIPTION:** The FIGO staging system for cancer of the endometrium and cervix has recently undergone revision to reflect the advances in treatment and changes in prognosis of patients with these malignancies. Though the staging system is not radiological, knowledge of it is crucial when attempting to stage patients with cervical/endometrial carcinoma on MRI. There are limitations of the staging system; for example, involvement of lymph nodes is a poor prognostic factor in cervical carcinoma but lymph node involvement is not a feature of the FIGO classification. Such limitations will be discussed in more detail. **CONCLUSION:** This exhibit will provide the reader with an up to date guide to staging of cervical and endometrial cancer with emphasis on changes to the FIGO staging system and potential limitations.

e706

**Accuracy of CT staging of ovarian cancer when compared to laparotomy staging**

Deshpande, A., Tyagi, R., and Griffin, Y.

*University Hospitals of Leicester, Leicester, UK*

**PURPOSE:** Assess accuracy of CT staging of ovarian cancer compared to laparotomy and follow up CT. **METHODS/MATERIALS:** CT reports of 86 patients from 2005 to date obtained from RIS system retrospectively. Pathology reports obtained from the computerised histopathology system. **RESULTS:** In 24 patients, no tumour site mentioned in pathology report. Of remaining 62, tumour site accurately described in 26 (42%) cases (unilateral 14, bilateral 12). Incorrect site in 8 (unilateral as bilateral in 2, bilateral as unilateral in 3, wrong side 3). No adnexal mass identified in 4. Pelvic mass mentioned in 23 (unilateral 16, bilateral 7). One incorrectly staged as a primary sigmoid tumour. Ovarian cancer stage mentioned in pathology report in 72 patients. On CT, 54 (75%) accurately staged, 11 (15%) understaged, 7 (10%) overstaged. 62 patients had peritoneal washings available. Sensitivity for peritoneal disease 0.438 (C.I. 0.26–0.57) and specificity 0.733 (C.I. 0.57–0.89). PPV 0.636 and NPV 0.55. Positive likelihood ratio was 2.1 and negative likelihood ratio 0.65. Lymphadenopathy reported in 20 of 86 patients. 2 had surgical nodal staging with 1 true positive and 1 true negative. Follow up CT not available in 3 but remainder correctly staged. Metastases suspected in 11 (1 splenic, 3 pleural, 7 liver, 1 bone). All confirmed by reduction on post chemotherapy imaging. 1 false positive where MR showed simple liver cysts and follow up CTs showed stable vertebral lesions thought to be Pagets. **CONCLUSION:** CT staging accuracy of 75%, in keeping with cited references (73–95%). Greatest challenge to diagnose peritoneal disease.

e707

**Revised FIGO staging for cervical cancer: a pictorial review**

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*Maidstone Hospital, Kent, UK*

**KEY LEARNING OBJECTIVES:** To review imaging findings in cervical cancer using the revised FIGO staging system. **DESCRIPTION:** The International Federation of Gynecology and Obstetrics (FIGO) classification of cervical cancer, which is the most widely used staging system for this disease, is based on clinical findings. This system has recently been revised with UK centres to begin application of the new system in January 2010. Although the FIGO system is clinically based, MRI staging of cervical cancer has a significant role to play in the management of these patients. Parametrial, lymphovascular, pelvic wall and vaginal extension can be illustrated on pelvic MRI. CT may still used as part of the primary staging survey and remains of value mainly in extra-pelvic

disease. Since January 2009 our institution has scanned these patients using 3T MRI. In this review, cases of cervical cancer staged using the new FIGO system are demonstrated with surgico-pathological correlation where possible. We also demonstrate the appearances of cervical cancer on a high field scanner. **CONCLUSION:** This pictorial review describes the imaging findings in cervical cancer according to the revised FIGO system and will be of interest to all those who are involved in the care of these patients. It also provides an insight into the appearances of this disease on 3T MRI.

## Musculoskeletal poster

### p801

#### **What is that?! Benign bone lesions – a survival guide for the district general radiologist**

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**KEY LEARNING OBJECTIVES:** Illustrate the commonly encountered benign bone lesions presenting to the general radiology department. Highlight the important characteristic imaging features. Provide an algorithm for stratifying further imaging and tertiary referral. **DESCRIPTION:** Symptomatic and incidentally encountered benign bone lesions frequently present to the district general radiology department. Benign bone tumours represent the majority of these lesions. However, their heterogeneous appearance and presentation can lead to diagnostic dilemmas. It is important to be familiar with the typical and atypical imaging features, understand when to leave alone and when, with appropriate stratification, to image further and or refer to a tertiary unit. We present a comprehensive pictorial review of benign bone lesions affecting both the axial and appendicular skeleton demonstrating their appearance with a broad range of imaging modalities. We illustrate the appearance of aneurysmal bone cysts, giant cell tumours, enchondromas, osteoid osteomas, osteopoikilosis, haemangiomas, eosinophilic granulomas, brown tumours and osteochondromas. We describe potential pitfalls and also illustrate lesions which can mimic benign bone tumours including stress fractures and some malignant conditions. **CONCLUSION:** This pictorial review will help the radiologist gain a strong foundation in the key imaging characteristics of a wide variety of benign bone lesions. The differentiation between skeletal “don’t touch” lesions and those that require further imaging will be made.

### p802

#### **Visual search strategies while interpreting skeletal radiographs in experienced versus novice readers**

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<sup>1</sup>University of Exeter, Exeter, UK, <sup>2</sup>Peninsula Radiology Academy, Plymouth, UK

**PURPOSE:** To identify the perceptual-cognitive differences between experts and novices in interpreting skeletal radiographs. **MATERIALS/METHODS:** To date we have analysed the data of 4 consultant radiologists (experts) and 4 third year radiography students (novices). Participants were presented with 10 cases involving a selection of normal and abnormal radiographs. They were fitted with an ASL Mobile Eye gaze registration system which determined point of gaze to an accuracy of 1° visual angle at 25 Hz. They were asked to interpret the images in their normal manner, and provide a verbal diagnosis as well as an indication of their confidence in their diagnosis (0–10). A number of measures relating to visual search strategy were determined via frame-by-frame analyses. Mann Whitney non-parametric tests were used to assess differences in the dependent variables for each group. **RESULTS:** Experts were significantly quicker than novices in making a diagnosis (19.2 s vs 49.5 s;  $p < 0.05$ ), and were significantly more confident in their diagnosis ( $p < 0.05$ ). They were also 50% quicker to first focus on an abnormality ( $p < 0.05$ ) and spent a greater proportion ( $p < 0.05$ ) of their overall viewing time fixating on the abnormality’s location (experts 20%; novices 14%).

**CONCLUSION:** Visual search measures distinguish between expert and novice interpretation strategies, providing an insight into the processes underlying the expert advantage in interpreting radiographs (e.g. pattern recognition, efficiency of search). Visual search information might therefore be useful as a form of feedback to guide novices’ learning.

### p803

#### **Polytrauma CT**

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Trauma is a leading cause of death in the UK. CT has largely replaced traditional trauma imaging which relied largely on plain films. Recent trends have shown an increasing use of whole body CT encompassing head, cervical spine, chest, abdominal and pelvic imaging for seriously injured patients. A recent study published in the *Lancet* concluded that the inclusion of whole body CT in the care pathway of a patient with multiple injuries could significantly improve survival rates. As a regional trauma centre, the Leeds General Infirmary is receiving an increasing number of trauma patients who subsequently undergo “whole body” or pan CT. We present data from 172 patients who underwent pan CT following significant trauma. Patient demographics along with the mechanism and distribution of injury are discussed. The major over and under calls from the provisional on call Registrar reports are also reviewed.

### p804

#### **Chronic calcified tendinosis of the shoulder: a single centre experience of ultrasound-guided needling**

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**PURPOSE:** Calcified tendinosis of the shoulder is a cause of significant morbidity. Management with ultrasound-guided needling is clinically successful in 60–75% of patients according to published data, those with symptoms lasting 3 months or less tending to respond best. We have assessed our experience by auditing the clinical response of chronic calcified tendinosis of the shoulder to treatment with ultrasound-guided percutaneous needling. **MATERIALS/METHODS:** Data was available for 32 procedures on 29 patients (23 female, 6 men, mean age 46.9 years) with chronic shoulder pain. Treatment with ultrasound-guided percutaneous needling was performed between July 2003 and June 2008. Patient case notes, orthopaedic and PACS databases were evaluated retrospectively for technical details, evidence of symptomatic improvement and progression to surgical decompression with a mean follow-up of 11 weeks, range 4–49 weeks. **RESULTS:** Patients were referred with chronic pain and typically had mature calcific deposits within the supraspinatus tendon. These could not be aspirated and thus were repeatedly punctured. 14 patients (43.8%) experienced symptomatic benefit. In 7 of these patients (21.9%), clinical improvement was sustained and no further intervention was needed. **CONCLUSION:** Ultrasound-guided needling can be clinically successful in the management of calcified tendinosis of the shoulder. It can delay or remove the need for surgical decompression. Our results suggest that chronicity is linked to reduced response rates. An enhanced service model is proposed and prospective re-auditing planned.

### p805

#### **Subacromial discrepancies**

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**KEY LEARNING OBJECTIVES:** The subacromial distance or acromio-humeral interval (AHI) is the smallest measurement between the undersurface of the acromion and the humeral head on AP shoulder radiographs. This distance can be narrowed by many factors and in the absence of rotator cuff disease. **DESCRIPTION:** The normal range of the AHI measured on AP shoulder radiographs is 6–11 mm. A narrow

distance is used as an indicator of rotator cuff disease and often leads to the recommendation of further imaging such as ultrasound examination with consequently normal results. By comparing AHI measured on 30 AP erect shoulder radiographs and follow-up MR scans we found that the AHI was underestimated in 40%. This can be due to technical factors including patient positioning, beam direction and acromion shape. We have proposed a method for assessing film adequacy by observing the degree of humeral abduction and the orientation of the clavicle and acromion prior to measuring the AHI. We also found that rotator cuff disease was present in all cases which displayed disruption of Shenton's line of the shoulder on the plain radiographs. **CONCLUSIONS:** A narrowed AHI should be approached with caution before recommending further imaging. Assessment of film adequacy and Shenton's line of the shoulder is recommended prior to AHI measurement. A narrow AHI in conjunction with a disrupted Shenton line on an adequate film is more sensitive for rotator cuff disease detection than narrow AHI alone.

### p806

#### **Discography. Are patients suffering unnecessarily?**

Gan, C. L., and Lloyd, D.

*University Hospital of Wales, Cardiff, UK*

**PURPOSE:** Lower back pain is one of the most prevalent complaints to healthcare services. Discography is a safe but invasive and painful procedure, often used to aid diagnosis of symptomatic lumbar disc degeneration in conjunction of MRI findings. Positive discography with degenerate discs on MRI helps to differentiate symptomatic from asymptomatic lumbar disc degeneration. We aim to investigate the appropriate use of discography in a UK tertiary centre. **METHODS:** All the requests for discography within Cardiff & Vale Healthcare NHS Trust from 1 November 2008 to 30 April 2009 were studied retrospectively. Electronic letters and test results from Clinical Workstation were reviewed to ascertain the indication for request and management plan following the procedure. **RESULTS:** In total, 73 requests were analysed. 42 patients had positive discography finding, whereas, 21 had negative finding, 1 was inconclusive and the remaining 9 were abandoned either due to technical difficulty or patients' intolerance to procedure. All patients in the positive discography group had positive MRI correlation. However, only 55% of these patients either had operation or on waiting list for it. 36% either were not offered operations or declined operations. Patients' decision towards operation was still awaited in the remaining 9%. 29% from the negative discography group had operations but at different disc level. **CONCLUSION:** Possible implications following either positive or negative discography finding should be discussed with patients prior to procedure. This can avoid patient group with no intention for operation from going through an invasive and potentially painful procedure.

### p807

#### **Auditing referral patterns in MRI of the knee: which orthopaedic surgeon can you afford**

Beale, A. M., Palmer, A. J., Vartadevosyan, D., Satish, V., and Deo, S.

*Great Western Hospital, Swindon, UK*

**PURPOSE:** In our institution, referral patterns between different consultant orthopaedic surgeons vary considerably. To aid the development of referral criteria, and in light of imminent primary care access to MRI, we audited the requesting behaviour of the two principle knee surgeons. **MATERIALS/METHODS:** All patients referred by the 2 surgeons who underwent knee MRI between April and October 2007 were included. MRI requesting was classified as primarily: 1. Diagnostic: Establish diagnosis and thus management. 2. Pre-operative: Confirm diagnosis in patient already listed for surgery. **RESULTS:** Consultant A saw 497 patients, requesting 51 knee MRIs (10%). Consultant B, 904 patients requesting 170 knee MRIs (19%) ( $p < 0.0001$ ). Consultant A listed 128 patients for knee arthroscopy, 98 (77%) without MRI, Consultant B listed 185, 107 (58%) without MRI

( $p = 0.0008$ ). Consultant A requested 28, (55%) to assist diagnosis (type 1 request) and 22, (43%) were pre-operative (type 2 request). Consultant B requested 154 (91%) type 1, 14 (8%) type 2 ( $p < 0.0001$ ). Using national tariffs, MRI costs per 100 outpatients are £1540 for Consultant A compared with £2926 for consultant B, an estimated annual MRI cost of £30,800 for Consultant A compared with £58,520 for Consultant B. **CONCLUSION:** We demonstrate significant differences in MRI requesting between two consultants with similar patients, practices and training. The subsequent difficulties developing referral criteria are clear, both internally and in the primary care setting, but the potential savings are large. With mounting pressure on costs consultants may need to clinically justify their different usage of MRI.

### p808

#### **A new method of TTTG assessment in patients with patellar instability**

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**PURPOSE:** Patello femoral instability is a common cause of anterior knee pain in the adolescent population. Precise diagnosis is necessary for management and corrective treatment. However, determination of TTTG (tibial tuberosity to trochlear groove distance) is difficult. There is little consensus in the literature on imaging protocols, and pathological TTTG distance. One of the anatomically relevant factors for these disorders is a lateralised tibial tuberosity, or a medialised trochlear groove in the case trochlear dysplasia. The off-set of the tibial tuberosity in relation to the trochlear groove measured as the TTTG distance on CT is used in radiological assessment of these patients. Excessive TTTG ( $> 20$  mm) in symptomatic patients is an indication for treatment such as distal femoral realignment surgery. **SUMMARY:** We present our experience of measuring of the TTTG through a pictorial review. We describe patient positioning, CT scanning technique and image assessment and outline the method of determination of TTTG. The imaging protocol has been established and validated by two experienced musculoskeletal radiologists in conjunction with an orthopaedic knee surgeon.

### p809

#### **Femoroacetabular impingement, do we know enough?**

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**PURPOSE:** To raise awareness among radiologist regarding the importance of considering FAI as a common cause of hip pain in the young. **LEARNING OBJECTIVES:** To outline the pathophysiology and the classification of the different types of FAI. To illustrate the radiographic appearance of FAI and signs of impingement visible on imaging. **BACKGROUND AND DESCRIPTION:** Femoroacetabular impingement is a relatively recently recognised condition that mainly affects young adults. It is thought to be one of the major causes of hip joint arthritis in this usually healthy age group. It has also been suggested that FAI contributes significantly to the aetiology of osteoarthritis in later age. Three types have been recognised: Cam, pincer and mixed impingement. In all types there is early contact between the femoral head/neck and the acetabular rim, during hip motion. This usually leads to entrapment of the acetabular cartilaginous labrum with resulting damage and pain. FAI can be diagnosed on hip radiographs. More subtle changes can be clearly demonstrated on MRI. Considering the increasing awareness of this not so uncommon condition, it is important to be aware of the radiological findings associated with this condition. **CONCLUSION:** FAI is emerging as a recognised and potentially treatable cause of hip pain in young adults. Radiologists should be able to diagnose the different types of FAI to aid appropriate and early management.



p810

**Does an internal rotation radiograph improve the evaluation of displacement in hip fractures?**Almazed, B.<sup>1</sup>, Smith, C. D.<sup>2</sup>, Thomas, G.<sup>3</sup>, and Morgan, D.<sup>3</sup><sup>1</sup>The Leeds Teaching Hospitals NHS Trust, Leeds, UK,<sup>2</sup>University of Warwick, Coventry, UK, <sup>3</sup>University Hospitals Coventry and Warwickshire NHS Trust, Coventry, UK

**PURPOSE:** The advantage of an internal rotation over a standard anteroposterior (AP) radiograph is that the natural femoral neck anteversion is negated by the internal rotation of the leg. This allows X-rays to be truly perpendicular to the femoral neck enhancing its radiographic projection. The aim of the study was to compare the effectiveness of internal rotation AP views against standard AP views when assessing for displacement in intracapsular femoral neck fractures. **METHODS:** 75 standard AP pelvic radiographs were compared to 75 internal rotation AP radiographs in patients with intracapsular femoral neck fractures. All radiographs were reviewed independently by three blinded observers who classified the fractures into displaced or undisplaced. This was compared with the intraoperative diagnosis used as gold standard. For statistical analysis Cohen's kappa coefficient of agreement was calculated and chi-square test was used. **RESULTS:** The correlation with the intraoperative diagnosis increased in both undisplaced and displaced fractures for all reviewers in the internal rotation group compared to the standard AP group. (Kappa values for each reviewer; undisplaced fractures: 0.75, 0.76, 0.82 increased from 0.55, 0.61, 0.44. displaced fractures: 0.73, 0.70, 0.76 increased from 0.48, 0.65, 0.60). Overall inter-observer agreement was 0.76. The internal rotation group showed a higher rate of correct diagnosis by the reviewers combined compared to the standard AP group (88.67% versus 81.33%, respectively). This difference was statistically significant ( $p=0.024$ ). **CONCLUSION:** The internal rotation radiograph is significantly superior to the standard unpositioned AP radiograph when determining displacement in intracapsular femoral neck fractures.

p811

**Incidental findings detected at MR arthrography of the hip joint**

Galea-Soler, S., Sharpe, J., Chandramohan, M., and Groves, C. Bradford Royal Infirmary, Bradford, UK

Magnetic resonance arthrography (MRA) is an established procedure performed by musculoskeletal radiologists all over the country, with essentially all of the major joints being amenable to this kind of investigation. Distension of the joint space leads to enhanced visualisation of intra-articular anatomy and higher sensitivity with respect to detection of clinically relevant pathology. In the case of the hip joint, common indications include assessment for femoro-acetabular impingement, and of labral/articular cartilage integrity. However, hip pain is not always due to impingement or labral pathology. We present a pictorial review of cases where unsuspected pathology was detected, either at the time of fluoroscopy, or alternatively, after the patient had undergone the MR examination. These include a displaced proximal femoral subcapital fracture, femoral head osteonecrosis, symphysis pubis, sacro-iliitis, adductor muscle tear, bilateral adductor enthesopathy, synovial osteochondromatosis as well as a rectus femoris tendinous avulsion injury. An interesting case showing sports-related, stress responses in the right sacro-iliac joint, symphysis pubis and hip following a stress fracture of the ipsilateral superior pubic ramus is also presented.

p812

**Atypical location of osteoid osteoma – a pictorial review**

Galea-Soler, S., Sharpe, J., Chandramohan, M., and Groves, C. Bradford Teaching Hospitals NHS Trust, Bradford, UK

**PURPOSE:** Osteoid osteomas are one of the more common benign bone tumours, their classical presentation being predominantly pain relieved by non-steroidal anti-inflammatory medication. The most common skeletal sites are the metaphysis or diaphysis of long bones, which are affected in 73% of patients. The spine is affected in 10–14%

of patients; usually involving the posterior spinal elements. Osteoid osteomas are found in the hands in 8%, and the feet in 4%. However, the tumour has been reported in all parts of the skeleton. An atypical location of an osteoid osteoma may provoke a confusing radiological picture, particularly when the lesion is situated within an apophysis or is intra articular. Lesions in the posterior elements of the spine may be subtle, particularly with MR. Osteoid osteoma should be considered in all cases of focal bone pain. It is important to make this diagnosis as minimally invasive radio-frequency ablation is readily available at specialist centres. **CONCLUSION:** We present a multimodality, pictorial review of osteoid osteomas in unusual positions, with a discussion of the differential diagnosis from the radiological perspective. The intention is to raise awareness of the wide spectrum of abnormalities which can result from these bone tumours.

p813

**Imaging of the myxoid sarcomas and imaging based differential diagnosis: a pictorial review**

Haroon, A., Syed, M. A., Rennie, W., and Ashford, R. University Hospitals of Leicester, Leicester, UK

**AIM/OBJECTIVE:** The aim of this educational abstract is to: familiarise the reader with classification of liposarcomas. Study pathological feature of myxoid tumours, a subtype of liposarcomas. Highlight radiological appearances of myxoid tumours. **CONTENT ORGANISATION:** Introduction; anatomy and pathology of myxoid tumours; Illustrations covering spectrum of myxoid tumours. Pathological basis of radiological appearances; Differential diagnosis: Myxoid Neurofibroma; Leiomyosarcoma; Retroperitoneal sarcoma; Haematoma; CT and MR appearances of myxoid tumours. **SUMMARY:** Myxoid tumours are subclassified under liposarcomas. This poster demonstrates the radiological features of myxoid sarcomas. The reader will be able to describe pathological basis of CT and MR appearances.

p814

**Bone infection imaging in adults and paediatrics – the pearls and pitfalls**

Narang, G., and Graham, R. Royal United Hospital, Bath, UK

Osteomyelitis is an infective process of bone associated with high morbidity. It is commonly caused by *Staphylococcus aureus* and most frequently involves ends of long bones. Radiological assessment of osteomyelitis is performed: (1) To evaluate extent of bone involvement (intramedullary involvement, formation of abscess, sequestrum and fibrosis) and (2) to assess extent of soft tissue involvement. Plain radiographs, ultrasound, CT, MRI, nuclear scintigraphy and 18F-FDG PET provide anatomic and functional imaging, but are fraught with individual limitations. There are multiple benign and malignant conditions involving bones and soft tissues that can produce similar appearances on images therefore the radiological impression can be suspicious/non diagnostic and relies heavily on clinical findings. We review imaging of osteomyelitis by various techniques and their individual strengths and weaknesses, with particular emphasis on PET imaging of septic and non-septic arthritis in the context of joint replacement.

p815

**Autologous blood vs steroid injection in epicondylitis of elbow**

Pandya, S., Dick, E., and Walker, M. St. Mary's Hospital NHS Foundation Trust, Imperial Trust, London, UK

**PURPOSE:** Autologous blood injection promotes stem cell recruitment, angiogenesis and fibroblast stimulation, thus initiating the healing cascade in tendinosis. The purpose of this study was to retrospectively compare effects of autologous blood or steroid injection into the common extensor/flexor tendon in patients with refractory tendinosis. **MATERIALS/METHODS:** All patients undergoing ultrasound guided dry needling (repeatedly passing a needle through



the tendon to disrupt the fibres and cause bleeding) and injection of either autologous blood or steroid into the common extensor/flexor tendon of the elbow were included. After the procedure, pain rating was recorded using visual analogue score (VAS) by telephonic conversation. RESULTS: 12 patients with refractory epicondylitis of the elbow were injected with autologous blood and 12 with combination of steroids and local anaesthetic. The mean patient age was 45 years. Multiple (two) injections were given to two patients in the autologous blood group and three in the steroid group. VAS scores decreased from an average of 7.1 to 3.7 at 4 weeks ( $p=0.04$ ) and 2.3 at mean follow up of 16 months ( $p=0.014$ ) in the blood injection group and from 8.1 to 2.7 at 4 weeks ( $p=0.0001$ ) and 4.2 at mean follow up of 17.5 months ( $p=0.0009$ ). CONCLUSION: Ultrasound guided injection improves probability of hitting the pathological area/monitor subsequent changes to the tendon. Both autologous blood and steroid injections offer long lasting pain relief. This study offers encouraging results of an alternative treatment for epicondylitis of elbow.

## Musculoskeletal e-poster

e816

### Early identification of stress fractures

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PURPOSE/AIM: The purpose of this exhibit is: to review the pathophysiology of stress fractures; to demonstrate the various sites affected; to illustrate the imaging characteristics in the form of a pictorial review; to review the literature in terms of diagnosis and treatment. CONTENT ORGANISATION: Clinical Features; Pathophysiology; Fatigue fracture in normal bone; Insufficiency fracture in abnormal bone; Pictorial review of sample cases; Plain film; CT; Bone scan; Emphasis on MRI and grading stress fractures; MRI Grading; Samples of Kiuru grades; Length of rest required for each grade. SUMMARY: Stress fractures commonly occur in athletic individuals due to repetitive actions. They usually affect the lower limb and, with an appropriate clinical history, imaging plays a pivotal role in diagnosis. The most sensitive and specific modality is MRI, which allows grading of the injury dictating the appropriate rest period to allow healing and preventing overt fracture.

e817

### Classification of phalangeal fractures: a pictorial review

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KEY LEARNING OBJECTIVES: 1. To be aware of the radiological grading of four phalangeal injuries – Mallet fracture, volar plate injuries, flexor digitorum profundus (FDP) avulsion and proximal phalanx condyle fracture – through a pictorial review. 2. To understand how radiological fracture patterns can indicate prognosis. 3. To be aware of radiological features favouring operative treatment. DESCRIPTION: Phalangeal fractures may be easily missed or underestimated, and yet accurate diagnosis is critical to long-term function. We illustrate this by reviewing four intra-articular injury types and common radiological classifications. (i) The volar plate is a stabilising fibro-cartilaginous structure at the proximal interphalangeal joint (PIP) joint. With bony injuries, the radiology may be subtle. (ii) Mallet finger is the most common closed tendon injury in sports: it often involves a dorsal fracture of the distal phalanx base. The vast majority of these cases may be treated non-operatively. (iii) The proximal phalangeal condyles are important in facilitating PIP joint motion: when fractured, operative intervention is frequently indicated. (iv) FDP avulsion may or may not be associated with fracture: the size and location of an avulsed fragment of bone can determine prognosis and appropriate treatment. CONCLUSION: Phalangeal fractures can be both subtle and complex. An initial diagnosis of soft tissue injury may result in a debilitating loss of long-term function. Knowledge of radiological fracture patterns can establish severity, indicate prognosis and ensure a patient to receive treatment that provides the best functional outcome.

e818

### Ultrasound of the hand: a complete guide

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KEY LEARNING OBJECTIVES: The hand is a complex musculoskeletal unit, both anatomically and functionally. AIM OF EXHIBIT: To illustrate ultrasound technique and anatomy. To demonstrate the utility of ultrasound in diagnosing common disorders. To demonstrate the technique for joint aspirations and injections. DESCRIPTION: We are presenting a thorough demonstration of: Normal anatomy and ultrasound techniques. Common pathologies encountered, including characteristic features of cystic lesions on ultrasound: synovial, sebaceous or epidermoid cysts. Classical features of inflammatory arthritides including effusions, bursitis synovitis, bony erosions and tenosynovitis. Tumours – Giant cell tumours of tendon sheath, histiocytic fibromas, schwannomas. Flexor tendon sheath pulley system and associated pathologies. Acute trauma – paediatric injuries, foreign bodies. Role of hand ultrasound in guiding interventional procedures. CONCLUSION: Major teaching points are: Hand ultrasound technique and normal anatomy. Classical appearances of common pathology within the hand. Technique of ultrasound guided interventions of the hand.

e819

### Patient related outcome measures (PROMs) following ultrasound guided aspiration for supraspinatus calcific tendinitis in a district hospital in UK

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PURPOSE: 1. To find out Patient Related Outcome Measures (PROM's) who underwent US-guided percutaneous treatment for supraspinatus calcific tendinitis in our hospital by a single radiologist. 2. To compare immediate and short-term outcomes (6 weeks) of patients with rotator cuff calcific tendonitis who had undergone ultrasonographically (US)-guided percutaneous treatment. MATERIALS AND METHODS: Informed patient consent were obtained for taking part in this patient satisfaction survey and follow up study. 16 (4 men, 12 women; mean age, 39 years) were treated of the patients referred for US-guided treatment of rotator cuff calcific tendonitis. After local anesthesia, a single 16-gauge needle was inserted into the calcific deposit. We needed the calcification and injected saline into the calcification followed by the aspiration of the calcification via same needle. 40 mg of kenalog injection (steroid) and local anaesthetic was given into the bursa during the same setting. This technique is less invasive than the double needling procedure. All patients were given questionnaires asking them about their pre-procedure discomfort and the symptomatic relief immediately, one-two weeks by post and six weeks following the procedure in clinic. RESULTS: All our patients had significant pre-procedure discomfort as evident by their scores. Only 33% patients reported some relief in symptoms after the procedure but all our patients reported a significant decrease in symptoms at six weeks. CONCLUSION: US-guided percutaneous treatment facilitated prompt shoulder function recovery and pain relief. Treated patients had better outcomes at 6 weeks and we are still following them up at 12 months to know the long term results.

e820

### Ultrasound guided percutaneous needle lavage, an effective management of rotator cuff calcific tendinitis

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KEY LEARNING OBJECTIVES: 1. Discuss rotator cuff calcific tendinitis and the different therapeutic approaches. 2. Describe the

different techniques of ultrasound-guided percutaneous needle lavage through a step by step pictorial presentation. 3. Compare the results of this procedure with other available treatments. **DESCRIPTION:** Calcific tendinitis is a result of deposition of calcium in a tendon. In the shoulder, it most commonly affects the rotator cuff which causes episodes of pain with limitation in shoulder movements. Symptomatic treatments such as analgesia, physiotherapy and steroid injections are the first line of management in acute phases of pain. If symptoms progress or routine daily activities are affected by pain, despite conservative treatment, elimination of the calcium deposit appears to be the only treatment option. There are different removal techniques such as surgical and arthroscopic removal, shockwave lithotripsy, ultrasound, etc. However, ultrasound-guided percutaneous needle lavage is less invasive with fewer complications and better short- and long-term results. Ultrasound can also detect early calcification. Hence, the procedure can be performed before the calcium deposit becomes too solid. In such cases, we can even avoid physiotherapy or steroid injections. In this presentation we describe the one- and two-needle techniques by using diagrams and pictures. We also discuss the results of this procedure compared to the conventional treatments. **CONCLUSION:** Ultrasound guided percutaneous needle lavage is a promising therapeutic approach for rotator cuff calcific tendinitis in terms of simplicity of the procedure and outcomes. It also provides the opportunity for early intervention to avoid unnecessary treatments.

### e821

#### **Pictorial review of the abduction and external rotation view in MR shoulder arthrography**

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**KEY LEARNING OBJECTIVES:** To understand the anatomy and pathology that can be visualised in the abduction and external rotation (ABER) view in MR shoulder arthrography. **DESCRIPTION:** The ABER view in MR shoulder arthrography is a useful addition to the standard views. It is acquired quickly and results in differing morphology to the shoulder structures. As a result it can demonstrate pathology not seen on the standard views. The patient is supine with the arm behind the head and images are acquired in the oblique axial plane parallel to the humeral shaft. For accurate interpretation the radiologist must be able to recognise the normal anatomy on the ABER view. The inferior joint stabilisers come under tension. In particular the inferior glenohumeral ligament is pulled taught and tears of this are better visualised. The superior joint stabilisers become lax and the rotator cuff tension is loosened. This causes the rotator cuff to appear kinked and as a result articular sided tears become more apparent than on the standard views. The glenoid labrum comes under differing stress than on the normal views and labral tears, in particular of the antero-inferior glenoid labrum, can become more apparent. **CONCLUSION:** The ABER view is a useful addition to the MR shoulder arthrography examination. Understanding the anatomy and pathology that can arise allows the radiologist to use this view to increase diagnostic efficacy.

### e822

#### **A pictorial overview of the Schatzker classification of tibial plateau fractures illustrated with CT images**

Sharpe, J., Groves, C., and Chandramohan, M.

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**KEY LEARNING OBJECTIVES:** To understand the Schatzker classification of tibial plateau fractures and apply this classification system to CT studies. **DESCRIPTION:** Fractures of the tibial plateau are classified according to the Schatzker classification system which divides these fractures into six different types. This classification system is relevant as it is commonly used by orthopaedic surgeons to communicate the type of injury sustained, in addition, classification influences treatment planning and may be used to predict the patient's outcome. It has been demonstrated by multiple previous studies that surgical planning based on plain film studies is frequently modified following evaluation with CT. It is therefore important that radiologists

who may be called upon to interpret CT examinations of the knee, which have been performed following trauma are familiar with the Schatzker classification and the appearance of the different fracture types on CT. We aim to present a pictorial overview of the Schatzker classification system, illustrated with high quality CT images. **CONCLUSION:** Following review of this electronic education poster delegates should be familiar with the Schatzker classification system and its application in CT.

### e823

#### **Chondroid syringoma presenting as clinical soft tissue mass: MRI findings with pathologic correlation**

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**KEY LEARNING OBJECTIVES:** To describe the primary imaging features of chondroid syringoma (CS) of soft tissue and entertain the many differential diagnostic considerations that provide clues to correct diagnosis. To correlate the MRI findings of CS with histopathologic features. **DESCRIPTION:** Chondroid syringoma of skin is a rare type of soft tissue tumour originating from the sweat glands. The vast majority of CSs occur at the head and neck region where the cheek and nose are usually involved. The tumour shows a predilection for men. The malignant counterpart of CS however, occurs in the trunk and the extremities and is exceedingly rare. Unlike the benign form of tumour, malignant CS occurs in women usually of an older age. Radiographs may disclose a non-specific soft-tissue mass. Ultrasound depicts an inhomogeneous soft tissue mass. On MRI, a subcutaneous, well-circumscribed and lobulated mass of heterogeneous signal intensity is seen. On  $T_1$  weighted images, the lesion shows the same signal intensity as skeletal muscle, with interspersed nodular areas of high signal intensity similar to that of subcutaneous fat. On the corresponding  $T_2$  weighted images, the lesion has a mixed low and intermediate-to-high signal intensity suggestive of chondroid material. At histological analysis, these changes correspond to mature fatty tissue and irregular sweat glands, in a chondromyxoid stroma. **CONCLUSION:** Although the MRI appearance of CS is relatively non-specific, the signal intensity characteristics of the lesion (mixed fat tissue and fluid), allow for analysis of the consistency of the tumour and a limited differential diagnosis.

### e824

#### **Cauda equina syndrome: understanding its aetiology via MRI imaging features**

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Cauda equina syndrome is a well known condition with serious outcomes. However, its true incidence is still a rare medical emergency. The serious sequelae of this condition, limited clinician experience of referrers, especially out of hours, as well as increasing availability of out of hours spinal MRI appears to have lowered threshold for referrals. **KEY LEARNING OBJECTIVES:** The aim of this pictorial review is to present a series of MRI features that correlate to signs and symptoms of cauda equina syndrome. It is important to differentiate radiculopathy or myelopathy from cauda equine syndrome and we present correlation between imaging findings and these different presentations. **CONCLUSION:** Successful clinical diagnosis of cauda equina syndrome is a result of thorough history taking, full neurological examination and experience. A better understanding of the aetiology of symptoms by understanding their imaging features should aid the clinician in confidence of referrals and ultimately improve patient management and allocation of resources.

e825

**Efficacy and safety of percutaneous vertebroplasty in malignancy: a systematic review**Chew, C.<sup>1</sup>, Craig, L.<sup>2</sup>, Edwards, R.<sup>1</sup>, Moss, J.<sup>1</sup>, and O'Dwyer, P. J.<sup>2</sup>  
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**PURPOSE:** A systematic review on the safety and efficacy of percutaneous vertebroplasty in patients with malignant disease. **MATERIALS/METHODS:** Search strategy developed with the University Subject Librarian using MESH and text words, including "vertebroplasty", "malignancy", "oncology" and "metastasis". MEDLINE, EMBASE and CENTRAL databases were searched in April 2009. All trials and observational studies where patients with malignancy undergoing vertebroplasty were included. Studies were included if they reported at least one outcome: efficacy, pain relieve, functional quality of life, complication, cement leakage and safety. Vertebroplasty in benign condition was not considered. Two reviewers independently reviewed the title and abstracts of all the references. Potentially relevant papers were retrieved and data collected on a pre-designed data extraction form. **RESULTS:** 756 abstracts were generated by the search. 41 papers were retrieved for evaluation, of which 25 were included for this review. Handsearching produced a further additional study. 6 were prospective and 18 were retrospective studies. Total number of patients undergoing vertebroplasty was 832, mainly for pain. 5 (0.6%) deaths were attributable to the procedure and there were 18 (2.2%) serious complications. There was an association between cement volume used (4 ml) and the incidence of complication ( $p=0.001$ ). Pain scores fell from a mean of 8.0 to 2.8 post procedure. No relationship between cement volume and pain relieve was demonstrated. **CONCLUSION:** This systematic review shows an average reduction of 5 point on a 10-point VAS. It highlights the invasive nature of percutaneous vertebroplasty. There is a significant correlation between the average cement injected and overall complication.

e826

**A multi-site bone mineral density evaluation in patients with advanced ankylosing spondylitis: DXA and QCT findings**Theodorou, S. J.<sup>1,2</sup>, Theodorou, D. J.<sup>2</sup>, Ashby, R.<sup>3</sup>, and Adams, J. E.<sup>2</sup>  
<sup>1</sup>UHI, Ioannina, Greece, <sup>2</sup>University of Manchester, Manchester, UK, <sup>3</sup>University of York, York, UK

**PURPOSE:** Low bone mineral density (BMD) is a known feature of ankylosing spondylitis (AS) associated with fractures. We investigate the relationship between BMD measurements acquired at multiple skeletal sites using different techniques, in patients with advanced AS. **MATERIALS/METHODS:** In 25 patients (20M, 5F) BMD was measured in the lumbar spine (L-spine) using dual energy X-ray absorptiometry (DXA) and quantitative computed tomography (3D-QCT). It was also measured in the proximal femur using DXA, and in the distal and ultradistal forearm using single energy X-ray absorptiometry (SXA). **RESULTS:** The median BMD Z score was -1.1 in the distal forearm, -0.8 in the ultradistal forearm, 0 in the L-spine using DXA; -2.1 in the L-spine using 3-D QCT; -0.9 in the femoral neck; -1 in the total hip; and, -0.8 in the trochanter. 60% of patients had a BMD Z score of -2 or less at one or more skeletal sites. Strong correlation was noted between BMD Z scores in the trochanter, femoral neck, total hip, and ultradistal forearm, and also between the femoral neck and the total hip ( $p=0$ ). Measurements obtained by 3D-QCT showed no correlation with all other sites except the femoral neck ( $p=0.001$ ). **CONCLUSION:** Low BMD is prevalent in patients with AS and predominates in the L-spine. BMD is also reduced in the peripheral skeleton. Discrepancy between BMD measurements at the L-spine and other sites ( $p\leq 0.001$ ) obtained with 3D-QCT indicates that 3D-QCT may be more appropriate for evaluating spinal osteoporosis in advanced AS than other methods.

e827

**Dual-energy X-ray absorptiometry (DXA) and quantitative computed tomography (QCT) findings in ankylosing spondylitis of the axial skeleton: bone densitometry and beyond**Theodorou, S. J.<sup>1,2</sup>, Theodorou, D. J.<sup>1,2</sup>, and Adams, J. E.<sup>1,2</sup>  
<sup>1</sup>Manchester Royal Infirmary, Manchester, UK <sup>2</sup>University of Manchester, Manchester, UK

**PURPOSE:** Although the fundamental imaging features of AS have been described in detail, the manifestations of AS on bone densitometry have not been previously reported. We present the musculoskeletal findings and complications in the axial skeleton of patients with ankylosing spondylitis (AS), using DXA supplemented by 3D-QCT. **MATERIALS/METHODS:** In 25 patients with advanced AS referred for BMD assessment, 2-site DXA scan and 3D-QCT images supplemented with 3D-Pro software were thoroughly reviewed. **RESULTS:** DXA scan images revealed extensive syndesmophytosis ( $n=11$ ) giving rise to bamboo spine ( $n=9$ ). Fractures were evident as decreased vertebral height associated with increased BMD ( $n=9$ ). Ossification of paraspinal ligaments manifesting as the "trolley-track" ( $n=6$ ), or the dagger sign ( $n=11$ ) was also identified. Supplementary to DXA, QCT scans facilitated assessment of discovertebral destruction (Andersson lesions) ( $n=6$ ), sclerosis at the vertebral corners ("shiny corner" sign) ( $n=4$ ), dural ectasia with widening of the neural canal ( $n=1$ ), discal ballooning ( $n=8$ ) and calcification ( $n=7$ ), and squaring of vertebrae ( $n=11$ ). The apophyseal joints appeared narrowed ( $n=9$ ) and fused ( $n=7$ ). In the hip, osteophytes around the femoral neck ( $n=8$ ), and joint space narrowing ( $n=9$ ) were associated with ankylosis ( $n=8$ ). **CONCLUSION:** DXA with its near-radiographic resolution and 3D-QCT may document abnormalities whose recognition is critical to optimal interpretation of BMD results and assessment of the disease stage. DXA and 3D-QCT scan interpretation should consist of analysis of both the printout image and numeric data. Failure to recognise potential sources of diagnostic error on the scan image may invalidate examination results.

e828

**A to Z guide to blunt and penetrating orbital trauma on CT**Mehrhad, H., and Michaelides, D.  
University Hospitals Coventry and Warwickshire, Coventry, UK

**KEY LEARNING OBJECTIVES:** We present an A to Z guide to the range of different pathology seen in blunt and penetrating orbital injury. We also review what the clinicians need to know to better manage these injuries. **DESCRIPTION:** These injuries can occur frequently at the work place, due to assaults or major trauma situations. These types of injuries present a diagnostic challenge to the radiologist due to our unfamiliarity with these injuries and the fact that they can be overlooked at the time of major trauma. However, they can have a poor outcome and therefore it is essential to be aware of the different types of injury as delayed diagnosis can have a significant impact on the patient's outcome. We will look at orbital wall fractures, retinal detachment, lens injuries, optic nerve injuries, different types of orbital haemorrhage and penetrating injuries due to glass, metal and wood. Always keeping in mind the relevance to the clinician. **CONCLUSION:** We present our CT findings of both blunt and penetrating injuries. The use of multi planar reformatting is a crucial part of the assessment and increases the sensitivity substantially as well as giving more information to aid the clinicians. This review is designed to remind the radiologist to maintain a high index of suspicion and carefully evaluate these types of injuries.

e829

**A pictorial review of traumatic diaphragmatic injury**Mehrhad, H., Alam, K., Parsons, C., and Christie-Large, M.  
University Hospital Coventry and Warwickshire, Coventry, UK

**KEY LEARNING OBJECTIVES:** We present a pictorial review of our experience in a busy trauma centre of blunt and penetrating diaphragmatic injury. **DESCRIPTION:** These injuries occur in up to 8% of blunt trauma, most occurring in lateral or frontal road traffic impacts. These types of injuries present a diagnostic challenge to the radiologist and can be overlooked at the time of major trauma. However, diaphragmatic injury can have a poor outcome with a mortality rate ranging from 14–50% and rising up to 77% when associated with shock and head injury. Therefore it is essential to be aware of these types of injury as delayed diagnosis has a significant impact on the patient's prognosis. CT signs include discontinuity of the diaphragm, intrathoracic herniation of abdominal contents, bottleneck type constriction of the herniated contents and abdominal organs directly abutting the posterior ribs. **CONCLUSION:** We present our CT findings of both blunt and penetrating diaphragmatic injuries of varying sizes with their associated injuries. The use of multi planar reformatting is a crucial part of the assessment of these types of injuries and increase the sensitivity rate substantially. This review is designed to remind the radiologist to maintain a high index of suspicion and careful evaluation for the signs of traumatic diaphragmatic rupture.

## Neuroradiology poster

### p901

#### **Extradural vs intradural extramedullary spinal lesions causing canal compromise: the importance of getting the compartment right**

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**KEY LEARNING OBJECTIVES:** 1. To highlight the importance of determining the spinal compartment in the interpretation of spinal lesions causing canal compromise on MRI. 2. To review the imaging characteristics of common and unusual extradural and intradural extramedullary spinal lesions. **DESCRIPTION:** The interpretation of spinal imaging performed for cord compression can present a diagnostic challenge to radiologists. Identification of the spinal compartments (extradural, intradural extramedullary or intramedullary) is instrumental in formulating a differential diagnosis of the presenting spinal lesion. In particular it can be difficult to distinguish whether a lesion lies extradurally or intradural extramedullary; information which is vital for neurosurgical planning and patient management. This pictorial review will illustrate the ways of differentiating extradural and intradural extramedullary lesions of the spinal canal on MRI. We will demonstrate with pictorial examples the radiological features of common causes of cord compression such as intervertebral disc prolapse and metastases, and also the more unusual spinal lesions including arachnoid cyst, meningioma, schwannoma and neuroenteric cyst, cavernous malformations and angioliipoma. **CONCLUSION:** The differential diagnosis of spinal cord lesions is wide and it is not always possible to gain a definitive diagnosis radiologically. However, identification of the spinal compartment involved can aid radiologists in narrowing the differential diagnosis and guide neurosurgical management.

### p902

#### **Imaging of the post-operative spine- a pictorial review**

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**KEY LEARNING OBJECTIVES:** To provide a pictorial review of various imaging (mainly MRI and CT) appearances of the post-operative spine. **DESCRIPTION:** Chronic low back pain is a common and important symptom complex which constitutes a great societal and NHS burden. Spinal surgery is not an uncommon event/endpoint in the management of these patients. In the UK, up to 20,000 spinal surgeries are performed yearly. Some of these include micro-discectomy, facetectomy, discectomy, laminectomy, spinal fusion, etc. Many of these patients require repeated imaging for a variety of reasons such as post-operative complications (dural tear, CSF leak, post-operative discitis, epidural haematoma, cauda equina), ongoing

or recurrent symptoms, repeat surgery etc. The neurosurgeon and orthopaedic surgeon rely considerably on imaging findings in patient management. It is important that the radiologist is familiar with the varying normal and abnormal imaging appearances of the spine following surgery. **CONCLUSION:** We provide a review of imaging appearances of the post-operative spine.

### p903

#### **The eyes have it!**

Djoukhadar, I. K., Wilkinson, C., and Macmullen-Price, J.  
*Leeds General Infirmary, Leeds, UK*

**KEY LEARNING OBJECTIVES:** 1. Using clear cross sectional images and accompanying illustrations we outline the anatomy of the globe and retro-orbital area on CT and MRI. 2. We briefly identify the normal variants and common pathological processes that affect the globe, demonstrating the importance of an understanding of the orbits as a review area. **DESCRIPTION:** CT heads constitute a large percentage of the workload of any radiology department. The orbit and the retro-orbital area (including the optic nerve and the extra-ocular muscles) are frequently overlooked as review areas where serious pathology could be missed. We briefly, but clearly, outline the anatomical landmarks of the globe and retro-orbital area using cross-sectional images with accompanying illustrations. We include examples of commonly encountered normal variants and pathologies such as tumours, trauma related findings and manifestations of systemic disease. **CONCLUSION:** Appearances of the globe and the retro-orbital area vary greatly ranging from normal variants to rare but important pathological diseases. These could be easily overlooked unless one has a clear understanding of the anatomy and appreciation of certain subtle signs that we outline in this clear but concise review.

### p904

#### **Imaging of orbital cellulitis**

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Orbital cellulitis is a real threat to the visual acuity and in some instances, has life threatening complications particularly when a delay in diagnosis is encountered. We present the radiological appearances of orbital cellulitis together with its complications. An emphasis is made to highlight the optimal imaging techniques ranging from plain CT scans to MR venograms. Both common and rare findings are illustrated in these images. We also discuss the common pitfalls in the interpretation of these images.

### p905

#### **The facial nerve: anatomy as a diagnostic aid**

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**KEY LEARNING OBJECTIVES:** 1. Using clear cross sectional images and accompanying illustrations we outline the anatomy of the facial nerve on CT and MRI. 2. We briefly identify the common pathological processes that affect the facial nerve, demonstrating the importance of an understanding of facial nerve anatomy. **DESCRIPTION:** CT images were shown to 20 radiology trainees (1st–4th year), of whom only 7 managed to correctly identify the anatomical landmarks for the facial nerve and all trainee agreed that having a pictorial cross sectional reference would be a useful educational resource. The facial nerve is responsible for much of what makes us individual. It is a complex nerve with motor, sensory and autonomic fibres. We outline the anatomy of facial nerve divided into 4 main segments: 1. The motor, sensory and parasympathetic nuclei. 2. The cisternal segment. 3. The intra-temporal segment. 4. The extra-temporal segment. We briefly but clearly outline the anatomical course of the facial nerve using cross-sectional images with accompanying illustrations. We include examples of commonly encountered pathological findings, which serve to highlight the importance of a good understanding of

facial nerve anatomy at each stage of its course. **CONCLUSION:** A great variety of pathologies may affect the facial nerve. These may not be fully appreciated unless one has a clear understanding of its precise course. This brief review will provide the basis for such knowledge in a simple and concise format.

**p906**

#### **Investigation of CT negative subarachnoid haemorrhage**

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**PURPOSE:** It is recognised that if CT brain scan is normal in the investigation of subarachnoid haemorrhage (SAH), lumbar puncture (LP) must be performed. Missed SAH carries a poor prognosis and 3% of patients with negative CT examination have angiographic evidence of SAH. Our aim was to assess use of LP in patients with negative CT. **MATERIALS/METHODS:** We identified 50 cases over a 2-month period where head CT was performed specifically questioning SAH. In patients with negative CT, we recorded if the CT report advised LP and reviewed case notes to ascertain the subsequent investigations performed. **RESULTS:** One CT was positive for SAH. 34 of the remaining 49 had LP. Two LPs were suggestive of SAH, 31 were negative and one sample was inadequate. In 15 (30%) LP was not performed in the context of a negative CT. Two patients' clinical pictures altered, making SAH less likely. Four self-discharged/withdrew consent before LP was performed. The remaining nine were discharged with only a negative CT. On further analysis, if the CT report advised LP, the patient was more likely to have this performed. Of the 34 patients who had LP, 21 had LP recommended by the reporting radiologist. In contrast, the report suggested LP in only 1 of the 15 patients who did not have LP ( $p=0.0012$ , Fisher's Exact Test). **CONCLUSION:** It is concerning that 30% of CT negative patients do not have LP. We have shown that by suggesting LP, a radiologist can influence the patient journey.

**p907**

#### **Can neuroimaging show progression in schizophrenia?**

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**KEY LEARNING OBJECTIVES:** To review several longitudinal brain MRI studies on schizophrenic patients to demonstrate a progressive rather than a static course for the disease. **DESCRIPTION:** There is now sufficient evidence to conclude that schizophrenia is inextricably associated with structural abnormalities in the brain. Recent neuroimaging studies have focused on bridging the gap between known molecular abnormalities in schizophrenic brains and deteriorating cognitive dysfunction. This review has brought together several recent longitudinal brain MRI studies of schizophrenic patients focusing on structural abnormalities in different age groups. Patterns of deterioration have been found in adolescent patients demonstrating a degenerative course in brain development. A wave of grey matter reduction beginning in the parietal lobes and spreading to the frontal lobes has been widely found. This supports the model of exaggerated synaptic pruning in the developing schizophrenic patient's brain. **CONCLUSION:** The use of neuroimaging in the form of longitudinal MRI studies has demonstrated a progressive deterioration of structural abnormalities in adolescent schizophrenic patients' brains. This supports the neurophysiological model of exaggerated synaptic pruning in describing the pathophysiology of the disease.

**p908**

#### **Imaging in dementia**

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**KEY LEARNING OBJECTIVES:** 1. To discuss the typical appearances of the different types of dementia on structural and

functional imaging modalities. 2. To illustrate the imaging features of the dementia subtypes using various imaging modalities including CT, MRI, HMPAO, and DaTSCAN SPECT. **DESCRIPTION:** Dementia is a common disorder which affects 700,000 people in the UK with numbers set to double over the next 30 years as the population ages. It is important to distinguish the different dementia subtypes as the prognosis and management strategies differ. Structural imaging is used to assist in the diagnosis of dementia, not only to exclude other cerebral pathology but increasingly to aid in the differentiation of sub-type of dementia. Neuroimaging is increasingly playing a role in differentiating Alzheimer's disease, vascular dementia, frontotemporal dementia and Lewy body dementia. Atrophy of the hippocampus is an early and sensitive marker for Alzheimer's disease. Cortical infarcts and subcortical white matter lesions are characteristic of vascular dementia. Asymmetrical atrophy of the anterior and medial parts of the temporal lobe is seen in frontotemporal dementia. Single photon emission computed tomography (SPECT) and positron emission tomography (PET) are used to diagnose and differentiate dementias. Study of the dopamine transporter (DaTSCAN) is used to distinguish Lewy body dementia from Alzheimer's disease. **CONCLUSION** The separation of the dementia subtypes is important in determining the appropriate management from which the patient is most likely to receive maximum benefit. We aim to discuss and illustrate the imaging features of the dementia subtypes using various imaging modalities.

**p909**

#### **Acute basilar artery thrombosis: a pictorial review of CT and MR imaging features**

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**KEY LEARNING OBJECTIVES:** Acute basilar artery (BA) thrombosis is an uncommon but potentially fatal condition and imaging findings can be subtle. It is vital that cases are diagnosed promptly, as immediate recognition may lead to early angiography and thrombolytic therapy that may improve survival. We reviewed the imaging features associated with clinically proven cases based on a series of 11 patients collected over 6 years. **DESCRIPTION:** All patients (age range 56–84, mean 68.5 years) underwent CT scanning within 24 h of onset of symptoms, with two patients having a further CTA and four patients having further MRI with one MRA. Six patients showed a hyperdense BA on plain CT. Five of these patients died within 2 days supporting the notion that this is a poor prognostic sign. Four patients showed plain CT evidence of cerebellar or occipital infarction. CT angiography showed either poor flow or thrombus in the BA. MRI was used when the diagnosis was not clear. Scans showed hyperintensity on  $T_1$  images or loss of flow void on other sequences indicative of thrombus within the BA. MRA can be used to confirm thrombus. MR can demonstrate infarct on  $T_2$  images within the brainstem, cerebellum or occipital lobes. **CONCLUSION:** With strong clinical suspicion, plain CT can help make the diagnosis. Either CTA or MRI can add further strength to the diagnosis if not initially clear. Recognition of imaging signs is vital if prompt therapy is to be instituted.

**p910**

#### **The developing brain: normal CT and MRI appearances**

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**KEY LEARNING OBJECTIVE:** To familiarise the observer with the differing appearances of the normal developing brain on CT and MRI. **DESCRIPTION:** The development of the brain is complex and generally poorly understood by radiologists. Most of the postnatal growth and differentiation of the brain occur during the first 2 years of life. Brain development involves complex processes including neural migration, sulcation and myelination. The foetal, neonatal and infantile brains develop in an organised, predetermined pattern. Brain maturation commences in the brain stem and progresses centrifugally to the cerebellum and supratentorial level. Radiologists are not infrequently presented with imaging studies of the developing brain in an "on-call" setting. Potential indications are varied and

include trauma, non-accidental injury, neurosepsis and hypoxic injury. To avoid misinterpretation of perceived abnormalities, it is important to be familiar with the normal appearances of the developing brain. Here, using high quality images, we provide a pictorial review of the developing brain on CT and MR. Relevant examples of common pathology will also be included to illustrate how knowledge of normal appearances aids image interpretation. **CONCLUSION:** Although paediatric neuroradiology remains the preserve of the specialist radiologist, it is not uncommon for the general radiologist to be presented with a cross-sectional imaging study of the developing brain in an "on-call" setting. It is therefore vital to familiar with normal appearances in order to appreciate evident pathology.

## Neuroradiology e-poster

### e911

#### Acute stroke imaging: are thin slices useful?

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**KEY LEARNING OBJECTIVES:** To demonstrate the clinical utility of thin axial reconstructions in plain helical CT in acute ischaemic stroke. To illustrate cases where diagnostic accuracy is improved in the diagnosis and assessing the extent of infarction. **DESCRIPTION:** Hyperacute infarction produces subtle cortical hypoattenuation and occluded vessels may become hyperdense. Accurate assessment of the extent of infarcted tissue is important in identifying the core of an infarct and in deciding whether the patient is eligible for thrombolysis. In elderly patients with widened sulcal spaces and mural calcification in vessels, thicker slice reconstructions may result in partial volume artefact mimicking cortical hypoattenuation or arterial luminal hyperattenuation, while thinner slices are noisier. We retrospectively compared 0.625 mm and 5 mm/10 mm axial reconstructions from helical acquisitions in 56 consecutive acute stroke patients. In 9 of 56 cases, signs of stroke were equivocal on thick slice axial reconstructions. These included hyperdense proximal arteries, loss of the insular ribbon and cortical hypodensity. These were confirmed on the thin reconstructions. **CONCLUSION:** Use of both 0.625 mm and 5 mm reconstructions improves diagnostic accuracy in early stroke and is recommended for routine use.

### e912

#### Arterial dissections of the head and neck: a pictorial review

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*Barts and The London NHS Trust, London, UK*

**KEY LEARNING OBJECTIVES:** 1. To appreciate that intra- and extra-cranial dissections involving the head and neck arterial tree are an important cause of cerebral ischaemia. 2. To recognise that this clinical entity is not infrequently misdiagnosed and that potentially preventable deleterious clinical sequelae may develop. 3. To review the spectrum of imaging appearances in dissections of the head and neck arteries (with an emphasis on CT) and be aware of the implications of early recognition. **DESCRIPTION:** Dissection involving the intra- and extra-cranial cerebral arterial tree is a potentially grave clinical entity with life-threatening consequences if left untreated. However, it is often underdiagnosed and therefore presents a significant clinical problem. Early diagnosis is crucial as prompt therapeutic intervention is known to improve outcome and reduce the likelihood of irreversible complications. Reasons for diagnostic delay and misdiagnosis are multifactorial; being relatively rare, dissection is often not thought of at the point of presentation in the emergency setting. In addition, the diagnosis relies heavily on imaging techniques which may not be instantly accessible. With this review, we aim familiarise the reader with the spectrum of imaging appearances occurring in this condition by presenting several cases which have recently encountered at our institution. **CONCLUSION:** Intra- and extra-cranial arterial dissection is an underdiagnosed yet clinically significant entity with potentially

profound implications if left untreated. It is important to be familiar with the spectrum of imaging appearances as timely intervention improves outcome. Diagnosis need not be delayed as powerful non-invasive imaging modalities are becoming increasingly accessible.

### e913

#### Can the cause of stroke in young be dissected out by imaging? A pictorial review

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**KEY LEARNING OBJECTIVES:** To illustrate the clinical and imaging characteristics of carotid and vertebral artery dissection and discuss multimodality imaging algorithm in a tertiary referral Stroke centre. **DESCRIPTION:** Dissection of the internal carotid and vertebral arteries in the neck are now recognised as a relatively underdiagnosed cause of stroke – especially in young adults which could result in permanent disability. It accounts for about a fifth of strokes in the young compared to 2.5% of strokes in older patients. Dissections can lead to ischaemic strokes through artery-to-artery embolism or by causing significant stenosis and occlusion of the vessel. Diagnosis and appropriate management of dissection relies on prompt imaging and timely intervention. Initial assessment methods currently include Doppler ultrasound, MR angiography or CT angiography. We provide through this educational pictorial tour a selection of common and interesting clinical cases of carotid and vertebral artery dissection to familiarise the reader with their radiological appearances. This review discusses the modes of clinical presentation, diagnostic algorithm and follow-up in a tertiary referral centre for Stroke. **CONCLUSION:** Prompt and accurate recognition of dissection as the cause for stroke is crucial for timely management of this group of mostly young patients with stroke to prevent significant mortality and morbidity.

### e914

#### Imaging of the cavernous sinus

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The cavernous sinuses are paired structures on either side of the sella turcica. They contain internal carotid arteries, sympathetic plexus, third, fourth, and ophthalmic and maxillary branches of fifth and sixth cranial nerves. The cavernous sinuses are affected by different disease entities with resultant dysfunction of the cranial nerves and blood vessels. These diseases include, lymphoma, metastases (breast, prostate, lung), pituitary and nasopharyngeal tumours and primary intracranial tumours such as meningiomas, neurofibromas and chondromas. Inflammatory and infective pathologies may also affect the cavernous sinus such as sarcoidosis, herpes zoster and Tolosa-Hunt syndrome. Vascular lesions such as carotid-cavernous fistulae, carotid-cavernous aneurysm and cavernous sinus thrombosis. We will provide a comprehensive pictorial review of the imaging features of the diseases affecting the cavernous sinus. We will highlight the important imaging features that help differentiate between the different disease entities.

### e915

#### Paediatric cerebral venous sinus thrombosis – spectrum of radiological findings and its complications

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**LEARNING OBJECTIVES:** To identify the clinical manifestations of paediatric cerebral venous sinus thrombosis. Describe the spectrum of radiological appearances of paediatric cerebral venous sinus thrombosis and its complications. **BACKGROUND:** Cerebral venous thrombosis in children is a serious disease that is being increasingly diagnosed, mainly because of more sensitive imaging and increasing clinical awareness. It can occur in various clinical settings, including infection, dehydration, renal failure, trauma, cancer and haematological

disorders. Clinical manifestations of CSVT are non-specific and may be subtle. Its prognosis remains largely unpredictable. **IMAGING FINDINGS:** CT is an important imaging technique, as it is often the first investigation. It may show non opacification of venous sinuses or a parenchymal infarction that does not correspond to an arterial distribution. It is also useful in ruling out other conditions such as neoplasms, demonstrating causes like sinusitis and complications such as a brain abscess. MRI is more sensitive for showing parenchymal changes and may show absence of flow voids in venous sinuses. CT venography is superior to MRV in identification of cerebral veins and dural sinuses, but incurs a higher radiation dose. We have aimed to show a spectrum of imaging findings on all of the above mentioned modalities. **CONCLUSION:** Paediatric CVST is an uncommon but important cause of cerebral infarction due to its potential morbidity and so should be considered in the differential diagnosis in an appropriate clinical setting. Awareness of typical imaging findings will enable a confident diagnosis and help direct appropriate patient management.

e916

#### **Discriminating cerebral abscess from tumour: drawbacks in the reliance upon diffusion weighted MRI**

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**KEY LEARNING OBJECTIVES:** Differentiating ring enhancing lesions into intra-cerebral abscesses or necrotic tumours is often difficult or impossible with contrast enhanced CT or conventional MRI. Diffusion weighted imaging (DWI) provides unique information about water diffusion and is a valuable test that is now routinely used in an attempt to resolve this diagnostic dilemma. However, there are situations in which tumours behave atypically with DWI and we explore this with reference to a particular case. **DESCRIPTION:** As a rule, on both visual and quantitative assessment of diffusion-weighted imaging, all brain abscesses are hyperintense, secondary to restricted diffusion, with corresponding low intensity on ADC map images. Conversely, the necrotic components of cerebral tumours show a reduced signal intensity on diffusion weighted images and increased ADC values compared with normal brain parenchyma as in most cases, water diffusion is not restricted. We present a case of a cerebral lesion that had had DWI features of a cerebral abscess but was in fact a squamous cerebral metastasis from a primary lung malignancy. Theories accounting for the behaviour of the tumour on DWI are discussed with reference to the histology. Alternative methods for ensuring maximal accuracy in differentiating cerebral lesions through the additional use of MR spectroscopy are also discussed. **CONCLUSION:** Although DWI can be used in conjunction with clinical information to make a diagnosis, it is not infallible, and tumours can mimic abscesses in their behaviour. MR spectroscopy may help further differentiate these lesions.

e917

#### **Cerebral CT perfusion studies: indications, technique, interpretation and pitfalls**

Odedra, B., Roy, A. A., Joshi, Y., Chandrashekhar, H., Kraus, B., and Evanson, J.  
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**KEY LEARNING OBJECTIVES:** 1. To appreciate the time-urgency in accurate diagnosis of cerebral ischaemia. 2. To understand the indications for CT perfusion (CTP), the steps involved in performing a CTP scan, image processing and effective image interpretation. 3. To review important CTP imaging appearances in acute stroke and appreciate the common pitfalls in image processing and interpretation. **DESCRIPTION:** Stroke is a sudden, rapidly progressive illness with potentially devastating consequences. It is the third most common cause of death in the UK and results in more severe long term disability than any other recognised condition. The overriding principle in diagnosis and management is time; in untreated stroke 1.9 million neurons are lost each minute. However, the seemingly-unstoppable process of progressive cell death may be arrested. Prompt

diagnosis followed by timely and appropriate clinical intervention significantly improves outcome. Cerebral CT perfusion has emerged as an invaluable technique in differentiating tissue that is potentially salvageable from that already lost and as such permits more intuitive selection of patients for thrombolysis. **CONCLUSION:** The increasing availability of both multi-slice CT scanners and powerful processing software has made CT perfusion imaging an accurate and effective first-line investigation in acute stroke. In this presentation we outline the indications for perfusion imaging and present an algorithm for reliable and rapid interpretation utilising examples from our institution. In addition, we demonstrate the potential pitfalls and common sources of error one may encounter in reporting.

e918

#### **Correlation of interpretation of out-of-hours CT scans of head by accident and emergency physicians and radiologists**

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**PURPOSE:** The recorded initial findings of the CT scans of head performed out of hours by emergency department physicians were compared with the final radiologist report. These physicians were eligible for independent assessment of the scans under locally agreed criteria in a medium-sized district general hospital. **MATERIALS/METHODS:** All the CT scans of head which were interpreted by eligible A&E physicians over 2 year period were included. Their findings and subsequent action taken were then compared with the formal reports issued next day by the consultant radiologists. Case notes in cases of significant discrepancy between the two, were retrieved to analyse the effects of these decisions on patient's further management. **RESULTS:** 218 CT scans of head were included for this audit. In 10 (4.58%) cases, there was significant discrepancy between the two groups. These included 4 cases of subtle SAH, 3 cases of skull base fractures, 1 case of isodense SDH, 1 case of diffuse intracranial swelling and a case of intra-orbital foreign body. In 6 of these cases (2.75%), this resulted in delay in transfer of the patients to the specialist care with increased morbidity in 1 case of skull base fracture by infection. In other 3 cases, no significant changes in patient outcome were noted. **CONCLUSION:** With carefully agreed criteria, emergency physicians have a low rate of misinterpretation. Only other significant finding was increased rate of referral to the Neurosurgery team for suspected subtle findings, most of which could have been avoided by a radiologist's assessment.

e919

#### **A pictorial review of abnormalities of the globe**

Roy, A. A., Quigley, S., Shawyer, A., Chandrashekhar, H., and Evanson, J.  
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**KEY LEARNING OBJECTIVES:** 1. To understand the importance of the globe as a "review area" on head and neck imaging. 2. To recognise the imaging appearances of ocular emergencies such as retinal haemorrhage and detachment and ocular rupture. 3. To review the common CT and MR imaging appearances of both primary and secondary malignant processes manifesting in the globe. **DESCRIPTION:** Despite its small anatomical size, the globe may be involved in numerous and varied local and systemic pathological processes. Although infrequent, radiologically discernable globe abnormalities are often overlooked on account of unfamiliarity with both the anatomy and physiology in this region and the appearances of common ocular pathologies. Recent advances in imaging technology allow the globe to be visualised in ever more detail and thus extend an increasing role to the radiologist in diagnosis. Although patients with ocular abnormalities are often managed at specialist centres with specific expertise in this area, certain conditions may also be identified incidentally on non-dedicated imaging. With this review, we aim to familiarise the reader with the imaging appearances encountered in a range of common ocular pathologies which we have recently encountered at our institution. **CONCLUSION:** Potentially treatable



and clinically significant abnormalities affecting the globe are increasingly diagnosed at non-specialist centres as powerful imaging techniques are becoming more readily accessible. It is important for the general radiologist to be familiar with the imaging appearances of common ocular pathologies and diagnosis need not be the remit of specialist centres.

### e920

#### **Orbital lymphoma – imaging characteristics and conundrums**

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**KEY LEARNING OBJECTIVES:** To provide salient examples of intraorbital lymphoma which show common and uncommon imaging characteristics. To highlight diagnostic conundrums and suggest which conditions may require histological confirmation. **DESCRIPTION:** Intraorbital lymphoma is uncommon in general radiological practice. It is often difficult to distinguish it from non-neoplastic pathologies. Inflammatory, auto-immune and metabolic conditions can mimic the disease clinically and radiologically. We provide a multi-modality review of cases highlighting intraorbital and ocular disease with a pictorial case review of the common differential diagnoses. **CONCLUSION:** Intraorbital lymphoma is uncommon both as a primary and secondary manifestation of any lymphomatous process. Prompt recognition of salient imaging characteristics can therefore lead to early diagnosis and disease modifying treatment.

### e921

#### **Orbital implants and surgical devices: a pictorial review**

Syed, M., Thomas, A., and Vaidhyanath, R.

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**KEY LEARNING OBJECTIVES:** Imaging features of various surgical implants and devices used in the treatment of orbital pathology will be reviewed. **DESCRIPTION:** Surgical devices and implants are now used routinely to treat various conditions in the orbit. The most common orbital surgical device used is intra-ocular lens implant followed by repair of orbital wall fracture. A pictorial review of common and some rare surgical devices and implants will be presented. These include intra-ocular lens, orbital micro plate and mesh repair, scleral buckle, orbital prosthesis and gas tamponade. **CONCLUSIONS:** An understanding of imaging features of various surgical implants and devices will help the radiologist differentiate normal post operative appearance from post surgical complications.

### e922

#### **Medulloblastoma: pre and post surgical imaging characteristics on CT and MRI**

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**KEY LEARNING OBJECTIVES:** The exhibit will allow the reader to become familiar with the typical and atypical CT and MRI characteristics of medulloblastomas. **DESCRIPTION:** Typically, approximately two-thirds of medulloblastomas in children are located in the vermis, in contrast to adolescents and adults, in whom medulloblastomas are most often found in the cerebellar hemispheres. Vermian masses impinge anteriorly upon the roof of the fourth ventricle and can cause partial/complete obstruction of CSF flow. Posteriorly, they can reach to the level of upper cervical cord. Invasion of the leptomeninges via the CSF is frequent. The exhibit will demonstrate these common features and the classical CT appearances: (pre-contrast hyperdense mass with diffuse post-contrast enhancement) and hydrocephalus (in approximately 95% of patients). The poster will also address, with examples, the typical MRI:  $T_1$  weighted,  $T_2$  weighted, post-contrast and diffusion imaging findings. Demonstration of more widely recognised atypical features, including calcification and cystic or necrotic, non-enhancing regions, as well as other less well recognised presentations, such as predominantly subarachnoid and nodular tumours will be included. We shall also

discuss the role of imaging in the post-treatment evaluation of residual/recurrent disease. Finally, the relevant differentials and useful imaging features to help differentiate between these will be addressed. **CONCLUSION:** Prompt recognition of medulloblastomas enables appropriate management steps to be expedited, such as searching for leptomeningal spread. As extent of disease at diagnosis is the feature most predictive of prognosis in children, it is imperative to recognise the spectrum of imaging characteristics of this highly malignant tumour.

### e923

#### **The spectrum of imaging findings in neurosarcoidosis**

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Neurosarcoidosis is a multisystem non-caseating granulomatous disease of unknown aetiology. The neurological manifestations are termed neurosarcoidosis and generally occurs in patients with extensive systemic sarcoidosis and can be life-threatening. Therefore, early diagnosis is important to reduce the morbidity and mortality associated with this disorder. The clinical presentation typically includes; cranial nerve palsies, eye movement disorder, blindness, aseptic meningitis, hydrocephalus, peripheral neuropathy, myopathy or disturbances of the pituitary-hypothalamic axis or focal neurological deficits. The imaging features of neurosarcoidosis are protean. They include; thickening and enhancement of the leptomeninges, thickening and enhancement of the cranial nerves, communicating hydrocephalus, dural enhancement and enhancing brain parenchyma often associated with adjacent leptomeningeal enhancement. Vasculitis is also described in neurosarcoidosis though infarction is rare. Spinal cord involvement is rare (0.4% of systemic sarcoidosis) and may be manifested as intramedullary enhancing masses, leptomeningeal or dural enhancement. We will provide a comprehensive pictorial review of the imaging features of neurosarcoidosis. We will describe the important imaging features that help the distinguish neurosarcoidosis from the important differential diagnoses.

### Head & Neck poster

#### p1001

##### **"Back to the basics" – anatomy of the thyroid gland**

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**KEY LEARNING OBJECTIVE:** Head and neck imaging is advancing at a rapid pace and often not fully understood, nor taught due to the complexity of the anatomy. The aim of this exhibit is to be a comprehensive review of the anatomy of the thyroid gland using imaging modalities such as ultrasound, CT and MRI and to illustrate a systemic approach to looking at the thyroid gland with anatomical correlation. The information will be displayed in an easy to understand bite-sized widgets with important learning points, pearls and common pitfalls. **DESCRIPTION:** The close proximity of the thyroid gland to neurovascular structures in the neck, its variant anatomy and various pathologies have always proved a challenge. Knowledge of anatomy of the thyroid gland is important not only to avoiding improper diagnosis but also crucial when doing interventional/invasive procedures so that one does not cause unnecessary harm. We aim to provide a pictorial review of the anatomy of the thyroid gland in particular its relation to vascular structures and common variants seen in daily radiological practice. 1. Normal anatomy; 2. anatomical variants; 3. common pathologies on ultrasound, CT and MR; 4. pitfalls in diagnosis. **CONCLUSION:** We hope that our exhibit will provide an easy to remember guide to anatomy of the thyroid gland on commonly used modalities such as ultrasound, CT and MRI and to demonstrate common pathologies encountered on ultrasound as well as a methodical approach in identifying the salient findings in order to reach correct diagnosis.



University Hospital Birmingham NHS Trust, Birmingham, UK

**PURPOSE:** The occult course of the facial nerves vertical segment necessitates that area is approached cautiously in mastoid surgery. It is often considered by ENT Surgeons that the facial nerve will not be compromised as long as the surgery is confined lateral to the tympanic membrane. **METHODS:** High-resolution CT images of the temporal bone of 50 patients were prospectively assessed, with reconstructed coronal views. Data were collected on the angle of descent of the vertical segment in coronal plane, its position in relation to other anatomical structures and the thickness of the bone overlying it at the level of the pyramidal eminence and its proportion lying lateral to the inferior margin of the tympanic membrane. **RESULTS:** 126 temporal bone scans were analysed (mean age 52). There was an angle to the descent of the vertical segment in the coronal plane observed in 50% of facial nerves (mean 10.6°). The angle ranged from 4–18°. The thickness of the bone overlying the pyramidal eminence ranged from 1–5 mm (mean of 1.5 mm). 4 facial nerves were dehiscent at the pyramidal eminence. 104 nerves (82.5%) were found to lie lateral to the inferior margin of TM, 21 in the same sagittal plane with only 1 nerve medially. 40%, had chronic middle ear disease, facial nerve schwannoma found in one case and a dehiscent jugular bulb in another. **CONCLUSION:** This study highlights the potential threat to the vertical segment of the nerve in middle ear and mastoid surgery.

### p1005

#### Face facts – what not to miss on facial trauma radiographs

Miles, G., Sankaye, P., and Porter, G.

*Peninsula Radiology Academy, Plymouth, UK*

**KEY LEARNING OBJECTIVES:** Aim of exhibit: To review the radiographic appearances of subtle facial fractures that may be encountered in general accident and emergency reporting. **DESCRIPTION:** Facial injuries are a common occurrence with at least half a million occurring in the UK per annum. A population of 500,000 yields annually in excess of 4000 facial injuries of which 250 will be fractures. There is a degree of anxiety in reporting facial radiographs amongst junior radiology trainees and emergency department doctors. The aim of this poster is to clearly demonstrate the key signs not to miss in the interpretation of facial radiographs and to illustrate these signs by providing examples of subtle facial fractures. **CONCLUSION:** Knowledge of the appearances of subtle fractures is important when reporting facial trauma radiographs. By providing examples of subtle fractures, our poster illustrates these signs and reminds radiologists of their appearance.

### p1006

#### MRI of squamous cell carcinoma of the tongue: a pictorial essay

Depasquale, R., Chaudhry, M., Prowse, S., Hanlon, R., and Lewis-Jones, H.

*University Hospital Aintree, Liverpool, UK*

**KEY LEARNING OBJECTIVES:** Relevant normal anatomy and essential diagnostic features of tongue carcinoma that affect accurate staging. **DESCRIPTION:** Squamous cell carcinoma of the tongue is one of the more common of oral cavity carcinomas. The purpose of the poster is to display the diagnostic features of carcinoma of the tongue both on CT and MRI and to present imaging features of all the T stages of this particular pathology. We illustrate the relevant anatomy by normal MR studies. Treatment options are very different for oral tongue carcinomas versus tongue base carcinomas. We emphasise those features that allow accurate staging and contribute to appropriate management decisions through the head and neck MDT. We present data from a 12 month period of MDT verified cases of tongue squamous cell carcinoma which includes 42 consecutive cases. We present the TNM staging of these cases and the outcomes for treatment. We discuss the nodal staging and the predilection for such tumours is spread to lymph node areas 1 and 2. We also consider differential diagnoses for tongue masses which includes abscesses and neural based tumours. **CONCLUSION:** This pictorial review of a

### p1002

#### Unsuspected solitary "cold nodules" in Graves' disease and the prevalence of cancer

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**PURPOSE:** The presence of solitary cold nodules (CN) in patients with Graves' disease (GD) raises concern about associated malignancy. The purpose of this study was to assess the frequency of scintigraphic cold defects in patients with GD, and to determine the prevalence of thyroid cancer in such patients. **MATERIALS/METHODS:** A retrospective review of 1536 patients who underwent thyroid scintigraphy during a 5-year-period was performed. Of these, patients with biochemical and scintigraphic diagnosis of GD and presence of a solitary CN were selected for further evaluation for cancer, which included: wording in the report, follow-up ultrasound, FNA/biopsy and clinical follow-up. **RESULTS:** 697/1536 (45.4%) patients had GD, of whom 43 (6.2%) patients had single CN. 40/43 reports (93%) suggested further evaluation to exclude malignancy. 21 (48.8%) patients with CN had an ultrasound. 12 patients had FNA/biopsy, of whom 3 (7.0%) patients had thyroid cancer. Of 22 (51.2%) patients with CN who did not have an ultrasound, 6 patients did not require it for other reasons. In the remaining 16 (37.2%) patients with CN there was no documented reason/s for not having an ultrasound or FNA. No untoward finding however was reported in these patients on 5-year follow-up. **CONCLUSION:** We conclude that thyroid scintigraphy is an important preliminary test in the evaluation of patients with GD, and that the prevalence of thyroid cancer in the location corresponding to a focal cold SC defect provides justification for further diagnostic evaluation or surgical management.

### p1003

#### Ultrasound and sestamibi scanning for preoperative localisation of abnormal parathyroid glands in patients with hyperparathyroidism

Narang, G., Laugharne, M., Hagan, I., Loveday, E., and Darby, M.

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**LEARNING OBJECTIVES:** Primary hyperparathyroidism results from overproduction of parathyroid hormone by parathyroid glands causing hypercalcaemia. The underlying pathology is usually adenoma and rarely carcinoma. Surgery offers cure, but parathyroid glands have unpredictable anatomy, 85% lying behind the thyroid. In preparation for surgery, following tests aid localisation: scanning with technetium-99-m sestamibi and high resolution ultrasound. These techniques have been reported to reduce the need for bilateral exploration, shorten the length of the incision, surgical time, hence reducing post-surgical morbidity, surgical cost, and length of hospital stay with a quicker return to normal life. **METHODS:** 103 patients undergoing neck exploration for hyperparathyroidism had high-resolution ultrasound, and 100 of these had sestamibi scanning; all patients underwent neck exploration by a single surgeon. If the 2 scans were concordant for single side abnormality, a unilateral exploration was performed. **RESULTS:** Separately, the sensitivity of ultrasound and sestamibi scanning was only 71% and 69%, respectively. However, if considered as a single test, sensitivity for imaging in patients with primary hyperparathyroidism reached 93%. Both imaging modalities had lower sensitivities in the setting of hyperplasia. Our localisation protocol allowed a unilateral approach in 70% of patients (73 of 103). 97 patients were cured of hypercalcaemia; 6 who recurred were found to have hyperplasia. **CONCLUSIONS:** Results confirm the value of preoperative localization in patients with hyperparathyroidism. A unilateral approach can be used with a high degree of success in cases when ultrasound and sestamibi scanning are concordant in identifying a single side abnormality.

### p1004

#### Computerised tomography features of the vertical segment of the facial nerve

Srivastava, S., Senthil, L., and Chavda, S.

defined volume of cases of tongue carcinoma will aid the radiologists reporting head and neck cancer cases and will help to identify the crucial features that affect accurate staging along the route to correct management decisions.

**p1007**

**Pseudolesions in the head and neck: pitfalls in diagnosis**

Chawla, S., Mullett, R., Jayan, R., MCCann, C., Jones, H., and Hanlon, R.

*University Hospital Aintree, Liverpool, UK*

**KEY LEARNING OBJECTIVES:** Imaging of the head and neck is a difficult diagnostic challenge to the radiologist. Our unit is a tertiary referral head and neck cancer centre supported by a multidisciplinary team, which reviews imaging from all potential cancer in the Mersey and Cheshire Cancer Networks. **DESCRIPTION:** We present this educational poster illustrating the imaging findings of the radiological pitfalls and contrast them with cases of actual pathology in the same anatomical site. The following areas can be falsely interpreted as tumour: 1. Asymmetry of the oropharyngeal tonsils. 2. Asymmetry of the base of tongue. 3. Absence of the submandibular gland: giving rise to an apparent mass on the contra lateral side. This can be related to congenital absence of one gland or surgical removal, as part of a radical neck dissection. 4. Vocal cord palsy falsely interpreted as a laryngeal mass. 5. The skull base and petrous temple bones: (a) CT reported asymmetry of the jugular foramen reported indicative of underlying pathology. (b) MR high signal within the petrous apex frequently reported for significant pathology, related to benign pathology or normal variant of the jugular bulb. 6. Neural injury to innervations of the tongue due to radiotherapy and/or surgery. In such cases atypical fat atrophy can occur on the affected tongue side resulting in signal change and sometimes swelling of the tongue giving a pseudo lesion appearance. **CONCLUSION:** This poster illustrates significant pitfalls that the reporting Radiologist tackling head and neck pathology should be aware of. We believe this will help in more accurate diagnosis in difficult diagnostic areas.

**p1008**

**Metastatic neck lymphadenopathy: a review of anatomy, patterns of spread, and imaging characteristics**

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Cross sectional imaging is important not only is assessment of primary head and neck malignancies, but also in the assessment of neck lymphadenopathy and N staging. Knowledge of the anatomy of neck node levels, patterns of spread from known tumours, and imaging characteristics of metastatic adenopathy using varying modalities and techniques is vital for radiologists to accurately assess head and neck malignancy, and assist in optimal treatment planning. This poster provides a review of neck lymph node anatomy, patterns of spread from common malignancies, and the imaging features of metastatic lymphadenopathy on ultrasound, CT and MRI.

**p1009**

**Cystic neck masses: branchial cyst or squamous cell carcinoma?**

Prowse, S. J., Depasquale, R., Findlay, J., Hanlon, R., Weishmann, H., and Lewis-Jones, H.

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Cystic neck lumps presenting in early to late adulthood can pose a significant radiological and surgical dilemma. We present a series of 8 patients referred to the head and neck MDT for the Mersey and Cheshire Cancer Network Group. 6 cases presented initially with imaging features interpreted as a branchial arch cyst. Subsequent follow-up indicated malignant head and neck pathology, 5 squamous cell carcinoma and 1 papillary thyroid carcinoma. 2 cases proved to be benign branchial arch cysts at resection. We discuss and describe the imaging features of these cases as well as the classic features of

branchial arch cyst. We emphasise the imaging features that would elevate metastatic lymph node disease up the patient's differential diagnostic list. The cases illustrate the difficulty on imaging grounds alone to differentiate between a branchial cleft cyst and metastatic squamous cell carcinoma. Fine needle aspiration is discussed. In a number of these cases there were false negative FNA findings. Our unit has recently discussed such cases and in patients over the age of 40 it has been decided that all such cystic neck lumps should be assumed to be metastatic until proven otherwise. We discuss and present our imaging protocol which includes the recent addition of PET CT on the basis that the patient may have an undiagnosed occult primary head and neck tumour. This poster will help radiologists interpreting head and neck imaging by making them aware of the potential pitfall of interpreting a cystic neck lesion as a definite benign pathology.

**p1010**

**The NHS Newborn Hearing Screening Programme (NHSP) – are there implications for radiology?**

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*Bradford Teaching Hospitals Foundation Trust, UK., Bradford, UK*

The NHS Newborn Hearing Screening Programme (NHSP) was commissioned by the Department of Health following a report in 1997. Early identification of deafness, via the programme, gives babies a better chance of developing speech and language skills, and of making the most of social and emotional interaction from an early age. Bradford Teaching Hospital NHS Trust was an early adopter of the Programme, commencing in 2002. Multiple services are involved in its establishment including Audiology, ENT, Paediatrics, Speech and language therapists, Support team for deaf children and Social services. The role of radiology in this process is barely mentioned in supporting documentation, although it can be a vital part of establishing the aetiology of Congenital Hearing Loss in this Group. There is little in the literature to date on the role of this service. We present our findings in children identified with hearing loss through the programme and the implications on local radiological services. How/when is imaging used and what impact does this have on the children involved?

**Head & Neck e-poster**

**e1011**

**Medial canthus of the orbit-Imaging anatomy and pathology review**

Botchu, R. and Vaidhyanath, R.

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**KEY LEARNING OBJECTIVES:** Imaging features of medial canthal lesions will be reviewed. **DESCRIPTION:** The medial canthus is defined as the medial angle formed by the eyelids. This space is not considered as a separate compartment although some distinctive disease process affects this region. The purpose of this presentation is to review the imaging anatomy of the medial canthus. CT and MRI features of common and some rare conditions that affect this region will be presented. These include dacryocystitis/dacryocystocele, dermoid, epidermoid, basal cell carcinoma, squamous cell carcinoma, lymphoma, oncocytoma and metastasis. **CONCLUSIONS:** Understanding the anatomy of the medial canthal compartment and the imaging features of various conditions that affect this region helps provide a practical differential diagnosis to the clinicians.

**e1012**

**64 slice MDCT and MR appearances of the Meckel's cave and Gasserion ganglion: revisiting anatomical landmarks with state of the art imaging**

Haroon, A. and Vaidhyanath, R.

*University Hospitals of Leicester, Leicester, UK*

**AIM/OBJECTIVE:** This abstract is primarily aimed at residents and trainees who would like to familiarise with and important neuroradiological and neurosurgical landmark, *i.e.* Meckel's cave.

We aim to: highlight the anatomy of the Meckel's cave; anatomical relationships and normal appearances of Gasserian ganglion; study different disease entities surrounding the Meckel's cave. CONTENTS: Clinical manifestations of disease process involving Meckel's cave; 3D MDCT illustrations utilising 64 slice scanner; MRI images of Meckel's cave with particular emphasis on CISS sequence; normal anatomical variants of Meckel's cave; pathological process surrounding the cavernous sinus and Meckel's cave: 1. Vascular loops; 2. Idiopathic Inflammatory appearances; 3. Benign tumours; 4. Malignant tumours. SUMMARY: Meckel's cave is an important landmark for different pathological processes. Identification of normal anatomy, variants and disease process will help the reader to formulate a practical radiological differential diagnosis.

### e1013

#### State-of-the-art imaging of middle ear cholesteatomas

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**PURPOSE:** Evaluation of the middle ear cleft for primary and in particular, for recurrent cholesteatoma, is challenging. We review the role of imaging, radiological appearances and the weighting of the new imaging techniques in detection of primary and recurrent cholesteatomas. We also look at advantages and limitations of these techniques. **MATERIALS/METHODS:** PubMed literature search was performed to identify studies evaluating different imaging techniques and MRI applications for evaluation of recurrent cholesteatoma. Sensitivity, specificity, positive predictive value and negative predictive values for echo-planar, non-echo-planar diffusion weighted imaging and delayed post-gadolinium MRI were compared and mean sensitivity and specificity was calculated. **RESULTS:** Four relevant studies evaluating non-echo-planar diffusion weighted imaging were identified, with the mean sensitivity 95.6 and specificity of 97.8. Four studies assessing echo-planar diffusion weighted imaging were identified and evaluated and the mean sensitivity was 53.2 and specificity 90.1. Five delayed post-Gadolinium studies were evaluated, with mean sensitivity of 71.6 and specificity of 76.4. Echo-planar diffusion weighted imaging failed to detect cholesteatomas less than 5 mm and was prone to susceptibility artefacts at bone-air interfaces obscuring detail. The non-echo-planar diffusion weighted imaging allowed detection of small cholesteatomas, but was susceptible to motion artefacts. **CONCLUSION:** Non-echo-planar diffusion weighted MRI performs well in detecting recurrent cholesteatomas, and is becoming an accepted modality for accurately predicting the presence of recurrent cholesteatomas. This may in future lead to change in practice for cholesteatoma follow-up, replacing the "second-look surgery" with imaging.

### e1014

#### Multimodality imaging findings of central skull base osteomyelitis as a complication of malignant otitis externa (MOE)

Adams, A., Gademsetty, C., Gayed, J., Gayed, W., and Richards, P. Barts and The London NHS Trust, London, UK

**KEY LEARNING OBJECTIVES:** Increase awareness of central skull base osteomyelitis as a potential complication of malignant otitis externa. Review the imaging appearances on CT and MRI and discuss the role of other imaging modalities. Unless familiar with its appearances it can be misdiagnosed for malignancy and biopsy may be required to secure a diagnosis. **DESCRIPTION:** Skull base osteomyelitis is a complication of MOE which, if left untreated, results in progressive bony destruction of the central skull base. The situation may be further complicated by the fact that imaging appearances can be misinterpreted as malignancy. The aim of this exhibit is to raise awareness of this potentially devastating condition, review the imaging appearances on CT and MRI and to discuss the role of other imaging modalities: 1. Malignant otitis externa: an illustrated discussion of the aetiology, presentation, and treatment of MOE. 2. Imaging findings: this major section will be illustrated by radiological imaging from our case series. 3. Differential diagnoses: illustrated discussion of the major differential diagnoses including nasopharyngeal carcinoma,

squamous cell carcinoma of the external auditory canal, multiple myeloma and metastases. 4. Further investigations: illustrated discussion of the role of further imaging including NM studies and biopsy in diagnosis. **CONCLUSION:** After completing this exhibit we hope the viewer will have become aware of skull base osteomyelitis as a rare complication of MOE. Develop an understanding of the imaging appearances, differential diagnoses and role of further investigations and biopsy in the management of the condition.

### e1015

#### Flap reconstructions in head and neck cancer: a survival guide for the radiologist

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**KEY LEARNING OBJECTIVES:** Aims of this presentation are to: help the reporting radiologist identify and interpret anatomy and complications following neck flap reconstruction procedures for head and neck cancers; offer tips on detecting tumour recurrence in reconstructed neck; describe some of the imaging appearances of post-operative complications and following adjuvant treatments in patients with head and neck cancer. **DESCRIPTION:** Head and neck cancer is the sixth most common cancer worldwide. Large numbers of patients undergo surgical treatment, with curative or palliative intent and reconstructive techniques are utilising flap grafts more and more. Post-operative CT and MRI interpretation is more challenging in the reconstructed neck. A pictorial review of regional anatomy with imaging correlation using CT and MR images is presented. This will be related to a description of principle surgical techniques. Normal post-surgical imaging appearances of the neck flaps will be displayed with pictorial examples. It is crucial for post-operative imaging to differentiate the expected post-surgical changes from persistent or recurrent disease in the neck. Examples will be used to demonstrate these features. Furthermore, limitations of imaging techniques in detecting early recurrence are described next, especially following adjuvant treatments such as radiotherapy. **CONCLUSION:** As treatments become more complex for head and neck cancer, the radiologist must be aware of post-operative anatomy and pathology. This presentation will serve as survival guide for head and neck radiologists reporting such cases working in a multi-disciplinary setting.

### e1016

#### MRI-measured tumour volume predicts occult cervical lymph node metastasis and survival in oral cavity squamous cell carcinoma

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**PURPOSE:** The role of MRI in the staging and management of oral squamous cell carcinoma (OSCC) is vital but staging implications are ill-defined. This work studies the MRI-measured tumour volume (Tv) as a predictor of 2-year disease-related survival (DRS) and disease-free survival (DFS), as well as occult cervical lymph node metastasis, in oral cavity cancer. **MATERIALS/METHODS:** 177 patients presenting to the John Radcliffe Hospital with oral cavity squamous cell carcinoma, having staging MRI and undergoing surgical resection with curative intent between 1998 and 2008, were identified retrospectively. The Tv (cm<sup>3</sup>) was determined using manual segmentation. Duplicate measurements were done by a single observer using available T<sub>2</sub> weighted, T<sub>1</sub> weighted fast spin echo (FSE) and short-tau inversion recovery (STIR) studies in the coronal and axial planes. **RESULTS:** The probability of occult cervical lymph node metastasis increased with increasing Tv (logistic regression, HR = 1.14 per cm<sup>3</sup>, 95% CI 1.06–1.23, *p* = 0.001). Similarly, 2-year disease-related and disease-free survival were found to decrease with increasing Tv (Cox proportional hazards; DRS: HR = 1.05 per cm<sup>3</sup>, 95% CI 1.03–1.08, *p* < 0.001; DFS: HR = 1.05 per cm<sup>3</sup>, 95% CI 1.03–1.07, *p* < 0.001). **CONCLUSION:** MRI-derived tumour volume has the potential to

provide important pre-surgical information for planning the surgical management of the clinically N0 neck. Similarly, tumour volume can offer both patient and surgeon information about disease-related and disease-free survival, supplementing informed decision making.

**e1017**

**Multimodality and fusion imaging in thyroid cancer – a pictorial review**

Jayan, R.<sup>1</sup>, Prowse, S.<sup>1</sup>, Jayawardena, M.<sup>1</sup>, Nedumaran, A.<sup>1</sup>, Wiesmann, H.<sup>1</sup>, Hanlon, R.<sup>1</sup>, and Smith, L.<sup>2</sup>

<sup>1</sup>University Hospital Aintree, Liverpool, UK, <sup>2</sup>Royal Liverpool University Hospital, Liverpool, UK

**KEY LEARNING OBJECTIVES:** This review aims at demonstrating the role of multimodality and fusion imaging in the diagnosis and management of thyroid cancer. The roles of Ultrasound, CT, MRI, Tc-99m pertechnetate scanning and I-131 scanning in thyroid cancer are illustrated in a pictorial review. The role of recent advances such as I-131 SPECT-CT and FDG PET-CT is also discussed and illustrated. **DESCRIPTION:** Thyroid cancer is the most common endocrine malignancy. Its prognosis is usually excellent with optimal management. Ultrasound plays a key part in the initial diagnostic evaluation of a thyroid swelling and in assessment of patients with suspected recurrence in the neck. Some thyroid cancers are picked up as cold spots on Tc-99m pertechnetate imaging or as incidental findings of increased uptake on FDG PET-CT. MRI is vital in assessment of patients with extra thyroidal tumour extension to plan the surgical procedure. CT is useful for assessment of suspected lung or mediastinal metastases. I-131 scanning is used in guiding radio-iodine therapy after surgery and in detecting I-131 avid metastatic disease. I-131 SPECT-CT improves the localisation and helps accurate diagnosis of metastatic disease. PET-CT is useful in the subset of patients with poorly differentiated thyroid cancers in the setting of negative I-131 scans and raised thyroglobulin. **CONCLUSION:** The accurate diagnosis and management of thyroid cancer relies heavily on imaging. Multi-modality imaging is often necessary and recent advances such as SPECT-CT and PET-CT have improved management. This is illustrated in our review with suitable examples.

**Paediatrics poster**

**p1101**

**The role of chest radiography in children with H1N1 influenza (swine flu) – the Birmingham experience**

Banerjee, A. K., Jones, G., Hackett, S., Welch, S., and Smit, E. Birmingham Heartlands Hospital, Birmingham, UK

**PURPOSE:** The recent outbreak of H1N1 influenza (swine flu) has affected more children and young adults than previous documented flu outbreaks. A large outbreak of swine flu has been seen in children in Birmingham recently. In this study we have analysed the chest radiographic abnormalities seen in these patients. **MATERIALS/METHODS:** Children with virological confirmed diagnoses of swine flu from June 2009 were included in the study. All radiological imaging was reviewed by 2 consultant radiologists. **RESULTS:** Of 92 patients (mean age 8.7 years, range 3 months to 16 years) so far analysed 57 had no imaging performed. Of 35 cases who underwent chest radiography, 20 were normal and 15 abnormal. Abnormalities included perihilar haziness (8), pleural effusion (2), consolidation (6), alveolar shadowing (1). Examples will be presented and previous literature will be reviewed. **CONCLUSION:** The majority of children with swine flu do not require chest radiography and less than 16% of our cases developed chest complications visible on radiography.

**p1102**

**Multi-modality imaging review of bronchopulmonary sequestration**

Jacoby, J., Rao, S., and Griffiths, M. Southampton General Hospital, Southampton, UK

**KEY LEARNING OBJECTIVES:** After viewing the presentation the reader should: understand what constitutes sequestered

lung and the different types of sequestration; be aware of the complications and associations of lung sequestration; understand which imaging modalities are suitable for the assessment of lung sequestration; be aware of the common differential diagnoses of lung sequestration. **CONTENTS:** The e-poster aims to present a comprehensive review of pulmonary sequestration in an easily digestible format using high quality plain radiographs, cross-sectional imaging and angiography. The proposed structure of the presentation is: Introduction – including definition, aetiology and classification of sequestration; Intralobar sequestration – including description and imaging appearances; Extralobar sequestration – including description and imaging appearances; Management of sequestration – including a brief description of how imaging guides treatment; Differential diagnosis of sequestration. **CONCLUSION:** Although pulmonary sequestration is a relatively rare developmental anomaly, it is none the less important to be familiar with this condition and its common imaging appearances. Such knowledge informs the choice of the most appropriate imaging modality thereby aiding appropriate management.

**p1103**

**Imaging findings in neonatal seizures: a pictorial review of our experience**

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**KEY LEARNING OBJECTIVES:** 1. Review the aetiology of neonatal seizures. 2. Discuss the corresponding imaging appearances with cases encountered at our institutions. **DESCRIPTION:** Neonatal seizures are defined as paroxysmal alterations in neurological function. Seizures are the most common overt manifestation of neurological dysfunction in the newborn, affecting up to 0.5% of term and 20% of preterm infants. The causes are wide ranging and include pre/peri-natal adverse events, metabolic abnormalities, cerebro-vascular abnormalities, neurocutaneous disorders, developmental defects and epilepsy syndromes. Seizure aetiology is a strong predictor of long term outcome and imaging of the brain is essential in determining this. **CONCLUSION:** This educational exhibit reviews the imaging features of the common aetiologies of neonatal seizures.

**p1104**

**Imaging of primitive neuroectodermal tumour presentation: CNS and peripheral, common and rare**

Narang, G., Kilburn-Toppin, F., and Thyagarajan, M. University Hospital Bristol NHS Foundation Trust, Bristol, UK

Primitive neuroectodermal tumours (PNET) are rare, but highly aggressive tumours presenting in infants and young adults. CNS PNETs appear as large masses containing foci of haemorrhage and necrosis which reflect the aggressive nature of the tumour, with calcification seen rarely. The tumour's solid component is heterogeneous on CT and has intermediate signal on T<sub>2</sub> weighted MRI. CNS PNETs can invade meninges, dural sinuses and skull vault, with no respect for normal anatomic boundaries. Peripheral PNETs (PPNETs) are rare with an incidence of 1% amongst all types of sarcomas. PPNETs are commonly described in thoraco-pulmonary region and less commonly in soft tissues of the retroperitoneal paravertebral region, head and neck region, and intra-abdominal and intrapelvic soft tissue. Extrasosseous Ewing's sarcoma is an important differential diagnosis with similar radiological appearances at these sites, but carries a better prognosis than PPNET. Disease free survival for PNET depends on tumour appearance (small and solid vs large and cystic), age (better prognosis if presenting after age of 2 years), metastases and completeness of tumour resection. Imaging plays a key role. Our pictorial review aims to illustrate: 1. Some common imaging findings of CNS PNET. 2. Common and rare presentations of peripheral PNET. 3. Highlight the diagnostic difficulties of distinguishing from common differentials such as Ewing's sarcoma based on imaging findings alone.

p1105

**Complications of BCG vaccination**Thiruchunapalli, D.<sup>1</sup>, Jameson, E.<sup>2</sup>, and Hattingh, L.<sup>3</sup><sup>1</sup>Leeds Teaching Hospitals, Leeds, UK, <sup>2</sup>Royal Manchester Childrens Hospital, Manchester, UK, <sup>3</sup>Bradford Teaching Hospitals, Bradford, UK

**KEY LEARNING OBJECTIVES:** BCGosis is a difficult diagnosis to make due to its non-specific presentation. In all cases of BCGosis an underlying immunodeficiency state must be sought. A multi-speciality approach is essential in complex cases **DESCRIPTION:** Here we present a case of a 6-month-old Asian male, Q to the local paediatric department because of weight loss developmental regression, hypotonia, weight loss, irritability and hepatosplenomegaly. During the admission Q underwent radiological investigation as follows: abdominal ultrasound which showed enlarged liver and spleen with small hypoechoic areas throughout. X-ray of the left leg and arm which showed lytic lesion in bones. Skeletal survey showed numerous lytic lesions in the long bones and the skull. MRI of legs showed bone marrow changes but not suggestive of osteomyelitis. The above imaging findings posed initial diagnostic dilemma as the differential diagnosis was wide. However, this child underwent liver biopsy for those hypoechoic lesions which demonstrated acid fast bacilli. Given the systemic nature of the infection, history of BCG vaccination and evidence of infection at more than two sites a diagnosis of BCGosis (disseminated BCG infection) was made. The imaging findings complemented the pathological findings; the hypoechoic areas on the liver ultrasound keeping with focal granulomas and the multiple lytic lesions on plain film being due to mycobacterial infection affecting the bone marrow. **CONCLUSION:** This case illustrates the importance of a multi-speciality approach to complex problems. The constant need to question a diagnosis is an art that must be emphasised in medical training.

p1106

**What lies beneath? Imaging of verrucous haemangioma: a novel theory**

Hales, S. L., Roebuck, D. J., Syed, S. B., Harper, J. I., and Barnacle, A. M.

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**PURPOSE:** Verrucous haemangioma (VH) is an extremely rare, congenital vascular malformation, characterised by hyperkeratotic skin lesions. There have been numerous, sometimes conflicting, theories regarding the underlying cause. To the best of our knowledge, there is no published literature on the imaging of VH. We aim to describe our imaging findings, which led to a new theory of the underlying cause. **METHODS:** Children with a clinical diagnosis of VH were referred to interventional radiology, for consideration for treatment. Each child underwent ultrasound and MRI and 75% also had extremity venography. All imaging was reviewed by an interventional radiology consultant, with a specialist interest in vascular anomalies. **RESULTS:** There were four children in our group, aged 1.8–7.5 years. All children had a VH lesion on the right thigh. In 100% of cases, ultrasound and MRI demonstrated large calibre, anomalous venous channels within the right lower limb. The anomalous veins ran directly beneath the VH and small venous channels, connecting the large anomalous vessel to the VH, were demonstrated on high resolution ultrasound. Lower limb venography in 50% confirmed the presence of a patent deep venous system, but, in 25% (one patient), the deep venous system appeared rudimentary. **CONCLUSION:** Imaging of VH in our small paediatric cohort, suggests that there is an underlying venous abnormality, which has not previously been described. Not only can imaging be used to aid diagnosis, but this discovery raises important questions regarding the aetiology of VH and novel possibilities for its treatment.

**Paediatrics e-poster**

e1107

**Radiologists' understanding of RCR guidelines in the imaging of suspected non accidental injury**Walker, P. S.<sup>1</sup>, Mahady, K. F.<sup>1</sup>, Self, A. C.<sup>2</sup>, and Gains, C.<sup>1</sup><sup>1</sup>Mid Yorks NHS Trust, Dewsbury, UK, <sup>2</sup>Queen Victoria Hospital, East Grinstead, UK

**PURPOSE:** Non accidental injury is a serious and emotive issue; the reported incidence of which is increasing. Radiology objectively diagnoses and documents physical injury via a thorough radiological study. To facilitate this, intercollegiate RCR/RCPC guidelines, published March 2008 outline the basic imaging required, views and timing of study. The document was aimed at and distributed to all radiologists regardless of sub-specialty. This audit assesses radiologists' knowledge of imaging in suspected non accidental injury within the West Yorkshire region. **METHODS:** Consultant radiologists within West Yorkshire completed an electronic questionnaire on: indications for, imaging required, timing, modality and follow up in suspected non accidental injury. The answers to all questions are within the RCR/RCPC guidelines March 2008. **RESULTS:** Despite blanket distribution of the guidelines, general radiologists have a poor understanding of imaging in suspected abuse; average number of views thought to comprise a skeletal survey was 14 rather than the recommended 20. Although only 30% of responders report skeletal surveys, 64% are assessing their technical adequacy. Regarding timing, 27% believe skeletal surveys should be done out of hours. **CONCLUSION:** Radiologists reporting skeletal surveys have a good understanding of the guidelines. Unfortunately, protocolling and assessment of adequacy is often done by a radiologist with a poor understanding. On-call skeletal surveys may lead to incorrect views, missed pathology and repeat exposures. Imaging and reporting of suspected non accidental injury is time consuming, potentially litigious and has significant consequences; protocolling and reporting should only be conducted by radiologists with a special interest in paediatrics.

e1108

**Neuro-imaging in non-accidental injury**

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**PURPOSE:** RCR/RCPC Guidelines published in March 2008 state "neuro-imaging should be undertaken in any child under the age of one where there is evidence of physical abuse". Our aim was to review our practice of neuro-imaging in suspected non-accidental injury (NAI). **MATERIALS/METHODS:** The study was carried out at a paediatric tertiary referral centre. Radiology reports were reviewed on children who had been investigated for suspected NAI over a period of 1 year. **RESULTS:** Overall there were 75 skeletal surveys. 34 children were investigated locally and 23 of these were under the age of one. 18 of these children had a CT head scan. 2 of the remaining 5 who did not have a scan, were related to patients being investigated for suspected NAI and one had a reasonable mechanism of injury. Overall, 90% of the under 1 year olds had a CT head scan as part of their NAI imaging review. 33% of the scans were positive for abnormalities including skull fractures, hypoxic ischaemic injury and subdural or subarachnoid haemorrhage compared to 25% in children over the age of one. 41 of the 75 patients were investigated externally and images were imported for a second opinion; neuro-imaging was only transferred in 18 of the 29 children under the age of one (62%). **CONCLUSION:** All radiologists should be aware of these guidelines as there is a higher incidence of intra-cranial abnormalities in children less than a year old who are suspected of being subject to NAI and have normal neurological examination.

e1109

**Scurvy: a tale from Nelson's county**

Johnson, C. A. and Pickworth, F.

*Norwich Radiology Academy, Norwich, UK*

**KEY LEARNING OBJECTIVES:** To appreciate the radiological appearances of scurvy, and to recognise its more common clinical manifestations. **DESCRIPTION:** We describe a case of a 6-year-old girl who presented to her GP with right knee pain following a fall.

Initial radiographs showed no fracture. There was a past medical history of mild learning difficulties and "fussy eating". Examination revealed a small, lethargic child with swollen joints, and skin and gum petechiae. A correct diagnosis of scurvy was made after a review of the plain films and the child recovered fully with vitamin supplements and an improved diet. Scurvy is caused by deficiency in vitamin C. Clinical and radiological findings are related to the resulting defective collagen synthesis in bone, cartilage, skin and blood vessels. We describe the characteristic radiological findings of osteopenia, "pencil-thin" cortices, dense and lucent metaphyseal lines, and "Pelkan spurs". **CONCLUSION:** Scurvy is an important differential diagnosis in a child being investigated for possible non-accidental injury, malignancy, or infection. Clinicians should have a high index of suspicion in patients presenting with fatigue, anaemia, purpuric rashes, joint pain and a poor dietary history. The plain film radiological findings are characteristic.

### e1110

#### **Tubes, lines, wires and artefacts in paediatric radiology**

Zavareh, A. T. and Humphries, P.

*University College London Hospital, London, UK*

**KEY LEARNING OBJECTIVES:** To review the different types of tubes, wires and intravascular lines used in paediatric and neonatal patients, their purpose and correct position. To demonstrate their radiological features along with other artefacts such as monitoring lines, skin folds and metal works. To discuss the complications of those misplaced and relevant radiographic appearances. **DESCRIPTION:** The paediatric and neonatal intensive care requires using many supportive devices which should be positioned correctly. Hence, it is crucial for radiologists, particularly the paediatric radiology trainees to identify these artefacts and their correct position and also distinguish the similar devices using their course in the vessels or gastrointestinal tracts. The importance of the clinical and radiological knowledge of the complications arising from those misplaced is also of note. In this presentation we have a pictorial demonstration of the actual devices along with describing their purpose and correct position. Dedicated images and diagrams are also used to show the radiological features of each device. Further discussion with illustration will be on recognising those misplaced and their complications. In addition, other misleading artefacts such as monitoring lines and skin folds will be summarised. **CONCLUSION:** Through this pictorial presentation, the Radiology Trainees and Radiologists are able to review the commonly used supportive devices in paediatric and neonatal care and familiarise themselves with the radiological appearances of each device.

#### **Nuclear Medicine poster**

### p1201

#### **"Get it off your chest" – serendipitous cardiothoracic findings on PET/CT**

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*Southampton General Hospital, Southampton, UK*

**KEY LEARNING OBJECTIVES:** To demonstrate examples of unexpected FDG uptake in the cardiothoracic area on PET/CT imaging. These include interesting incidental findings, presentation of previously unrecognised pathology and unusual disease patterns. **DESCRIPTION:** PET/CT is an essential component in oncological imaging. It involves the accumulation of both CT and PET tomographic images, which provides large volumes of data. This wealth of data is advantageous but requires a robust approach to reporting. It is pertinent to identify potential causes of unusual FDG uptake in order to either recognise them as a false positive or to identify unexpected pathology. The value of high quality diagnostic CT in conjunction with PET cannot be overestimated, allowing reporters to further characterise any unusual uptake. In our experience we have come across a number of serendipitous findings in the thorax. These include: cardiac abnormalities such as old infarcts, lipomatous hypertrophy of the interatrial septum and right atrial enlargement; lung parenchymal abnormalities such as round atelectasis, radiotherapy induced fibrosis

and pulmonary hamartoma; rib anomalies such as fibrous dysplasia; chest wall abnormalities such as foreign bodies and breast lesions; thoracic spinal cord uptake as part of paraneoplastic syndrome; atypical lymph node uptake. **CONCLUSION:** As the amount of PET/CT undertaken invariably increases unexpected findings will become commonplace. The majority of these abnormalities are not clinically significant but it is important to identify unexpected pathology and false positives. A confident assessment of these findings undoubtedly facilitates accurate and clinically useful reporting.

### p1202

#### **Molecular imaging of amyloid: SAP (serum amyloid scintigraphy) for suspected cases of amyloidosis**

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*<sup>1</sup>University Hospitals of Leicester, Leicester, UK, <sup>2</sup>Queens Medical Centre, Nottingham, UK, <sup>3</sup>Royal Free Hospital, London, UK*

**BACKGROUND:** Amyloidosis refers to a spectrum of conditions due to abnormal deposition of amyloid in various tissues and organs. A protein is called "amyloid" when there is alteration to its structure and it becomes insoluble like beta pleated sheets. Technical considerations: One of the normal plasma protein is serum amyloid P component. A non invasive way of imaging amyloid deposits is SAP (radiolabelled serum amyloid P component scintigraphy). The radiological manifestations of the disease are varied and non-diagnostic. Advantages: The supplementation of scintigraphic techniques, biopsy and microscopic analysis help to diagnose and monitor the disease progression. The advantage of using imaging methods is to highlight different organ involvement, suitability for biopsy, treatment response, *i.e.* progression or regression of disease. This addresses the limitation posed by imaging guided biopsy which provide small samples and do not highlight the extent of the disease process. SAP medicine tracer for amyloid can help in this situation. Labelled serum amyloid P component imaging has improved the diagnostic standard and improvement management strategy for this fatal condition. **CONCLUSION:** The abstract highlight technical limitations of diagnosing amyloid at molecular level and advantage of integration of diagnostic and molecular imaging. We would like to draw the attention of the reader that National Amyloid Diagnostic Centre at the Royal Free Hospital, London is the National Referral Centre for Diagnostic Studies of Amyloidosis and suspected cases of amyloidosis can be referred if there are clinical concerns.

### p1203

#### **Increased sensitivity of diagnosing bone metastases with SPECT versus Tc99 bone scanning alone**

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*<sup>1</sup>Glasgow Royal Infirmary, Glasgow, UK, <sup>2</sup>Crosshouse Hospital, Kilmarnock, UK*

**PURPOSE:** To assess the impact of the installation of a SPECT scanner at Glasgow Royal Infirmary in early 2006 on the sensitivity of diagnosing metastatic bone disease in all patients referred for Tc99-MDP scintigraphy. **MATERIALS/METHODS:** In a retrospective audit of a 3 month period of 2005 all patients who underwent bone scanning ( $n=451$ ) were categorised into a diagnosis category of either benign, metastatic or indeterminate. All patients in a similar period in 2006 post scanner installation were similarly categorised ( $n=398$ ) and the indeterminate rate, time to final diagnosis and the number of follow up investigations required was compared. **RESULTS:** Although there was no impact on the average number of follow up investigations or the delay to definitive diagnosis (mets/no mets), there was a reduction in the proportion of indeterminate scans after initial imaging (6.0% vs 14.9%;  $n=24$  vs 67). **CONCLUSION:** SPECT in combination with Technetium bone scanning increases the sensitivity of diagnosing bone metastases, primarily by confirming the benign nature of previously indeterminate pathology.

### p1204

#### **Radionuclide lymphoscintigraphy: a pictorial review**

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**KEY LEARNING OBJECTIVES:** Whole body isotope lymphoscintigraphy (LS) is considered the first-line investigation in the diagnosis of peripheral lymphatic circulatory disorders. Compared to conventional contrast, CT or MRI lymphangiography, LS is essentially non-invasive, relatively easy to perform, reproducible and can guide management. The aim of this study is to highlight the common findings in LS studies. **DESCRIPTION:** LS is the first-line investigation for peripheral lymphoedema in our institute. A total of 35 MBq of rhenium-labelled nanocolloid is administered by bilateral injection into the webspace of the fingers or toes, depending on the region to be assessed. Static views at 10 min intervals are obtained for 60 min. Normal lymphatic drainage with visualisation of ilio-inguinal nodes should be achieved by 30 min. If these nodes are not visualised by 90 min, a whole body planar view is obtained at 5 h. Data for all LS studies was gathered using RADIS from October 1992 to November 2009. A total of 139 cases were identified of which 130 were lower limb studies and 9 upper limb studies. Lymphatic drainage was normal in 54 patients. Of the abnormal studies, 49 demonstrated dermal backflow, 78 significant delay of lymphatic drainage (>30 min), and 2 abnormally dilated lymphatic channels. These studies are often not performed in isolation and ultrasound Doppler is useful for detection of deep venous thrombosis. **CONCLUSION:** LS is the best imaging modality available for the assessment of lymphatic disorders. We present a pictorial overview of the common findings of primary and secondary lymphoedema.

## Nuclear Medicine e-poster

e1205

### **Biliary-type pain in patients with gallbladder stones, on otherwise normal ultrasound: what does cholescintigraphy reveal?**

Mohaghegh, P., Gibbins-Issaac, D., and Garvie, N.

*St. Bartholomew's and The Royal London Hospitals, London, UK*

**KEY LEARNING OBJECTIVES:** Recognise alternative diagnoses that cholescintigraphy may reveal in patients with biliary tract pain, who have gallbladder calculi or biliary sludge but no other abnormality at ultrasound. Appreciate the clinical implications of different abnormalities at cholescintigraphy. **DESCRIPTION:** Biliary-type pain in patients with gallbladder calculi at ultrasound, and no other abnormality, is often presumptively managed as cholecystitis. This exhibit examines this assumption through a pictorial review of Tc99m-HIDA cholescintigraphy results from a group of patients, and illustrates the range of abnormalities and alternative diagnoses. Over a 5-year period, 19 patients with biliary-type pain underwent ultrasound, demonstrating gallbladder stones or biliary sludge, but no ultrasonic evidence of cholecystitis. Cholescintigraphy was normal in 12 cases (63%) and abnormal in 7 patients (37%). Eight abnormalities were identified (one patient had two abnormalities): poor gallbladder contraction after fatty meal (biliary dyskinesia: 37.5%), non-visualised gallbladder (acute cholecystitis: 37.5%), poor gallbladder emptying (chronic cholecystitis: 12.5%) and gastric reflux (12.5%). Examples of these are illustrated, the pathophysiology outlined, and the clinical implications discussed. For example, a normal cholescintigraphy study may prevent unnecessary cholecystectomy in some patients, and an abnormal study may help expedite earlier surgical intervention in others. **CONCLUSION:** Cholescintigraphy is a valuable, yet often under-utilised investigation, in the early management of patients with biliary-type pain, who have gallbladder stones on an otherwise normal ultrasound study. A range of diagnoses can be established at cholescintigraphy that can significantly alter the clinical management of such patients. Therefore, earlier use of cholescintigraphy should be considered in such patients.

e1206

### **Bone scintigraphy image quality**

82

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**PURPOSE:** To assess adequacy of image count density. Visualising abnormal bone uptakes on bone scans can be challenging often involve changing contrast to enhance visibility of lesions. However, clinicians have access to the images on viewers which has no ability to adjust bone scan image contrast, as a result the images are pre-processed and saved in contrast setting which allows lesions to be visualised without the need for change in contrast settings, this is vital for the clinician to allow full appreciation of the radiologist report. Local. The departmental standard is aimed at more than 90% compliance. **MATERIALS/METHODS:** 119 consecutive scan evaluated by two assessors. Visibility of findings on the images matched against the original radiologist report. **RESULTS:** 92.4% of scans showed the abnormalities documented in the radiologist report. Results showed a 100% agreement between the two assessors. **CONCLUSION:** The quality of the bone scintigraphy images available for clinicians has met the expected standard. Auditing tools suggested for further improvement and regular monitoring.

e1207

### **Comparison of bone scintigraphy with FDG PET/CT in detecting bone metastases**

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**PURPOSE:** With increasing availability of 18-FDG PET/CT, its ability to detect bone metastases (BM) in comparison to the bone scan is of significance. This study aims to compare the sensitivity of these two investigations, related to primary tumour origin. **MATERIALS/METHODS:** The study group comprised 30 oncology patients (mean age 57) undergoing whole body bone scintigraphy and standard PET/CT (64 Channel GEMINI time of flight scanner). The group was subdivided according to primary tumour; breast ( $n=11$ ), lung ( $n=16$ ) and miscellaneous ( $n=3$ ). Patients undergoing chemotherapy were excluded. If positive, scans performed within a 3-month interval were accepted. Subsequent evaluation was performed by experienced radiologists and nuclear medicine physicians. FDG-avidity within BM was classified as low, moderate or intense, and CT lesions were described as lytic, sclerotic or mixed. **RESULTS:** 12/30 patients (40%) demonstrated BM of which 4 (33%) were of breast origin. 3 of these demonstrated lytic lesions with intense FDG avidity, 1 showed sclerotic lesions with low to moderate avidity. Of the 5 (42%) metastatic lung patients, 4 had lytic and 1 had sclerotic deposits. They also demonstrated intense and low to moderate FDG avidity, respectively. There was total conformity between both investigative modalities in the detection/exclusion of BM in all patients in this study. **CONCLUSION:** Compared to PET/CT, bone scintigraphy does not provide additional diagnostic information in detecting BM from breast or lung primaries, indicating that it may have little value as a supplementary investigation. The association between FDG-avidity and extent of bone destruction suggests that PET/CT provides a better guide to tumour aggression.

e1208

### **Repatriation of a cardiac nuclear medicine service from a tertiary centre to a DGH – can we maintain the same reporting standards?**

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**PURPOSE:** The transfer of diagnostic services from a tertiary referral centre to a DGH offers benefits to patients including ease of access. This should be achieved without a negative impact on reporting quality. We describe a method used to audit the standard of reporting following repatriation of a cardiac NM service. **MATERIALS/METHODS:** A fifth of all myocardial perfusion studies performed each month at a DGH were selected for double reporting over a 6-month period following repatriation. These were



reported independently by the local DGH NM radiologist and a visiting NM consultant from the tertiary centre where these studies were performed before repatriation. Inter-observer agreement was assessed by the visiting radiologist by comparing the two reports for each examination and scoring these as “strongly agree”, “agree”, “disagree”, and “strongly disagree”. The proportions of these scores were determined. **RESULTS:** 47 myocardial perfusion studies were double reported over a 6-month period. The proportion of studies scored as “strongly agree” was 64.8% and “agree” was 34.0%. The proportion reported as “strongly agree” increased over the 6 month period from 45.0% in the first 2 months to 76.5% in the last 2 months. **CONCLUSION:** The reporting quality of a repatriated service may be assessed by an experienced external reporter using this method. The inter-observer agreement was high for this cardiac NM service, and improvement was shown over the 6-month interval. In addition to assessment, the external reporter has the opportunity to provide advice and support in the early period following transfer of the service.

### e1209

#### **Physiological assessment of vesico-ureteric reflux with indirect radionuclide cystography**

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**OBJECTIVES:** 1. To outline the technique of acquisition of the indirect radionuclide cystography (IRC). 2. To discuss the benefits and limitations of the technique in the assessment of vesico-ureteric reflux (VUR). 3. To show a possible use of the IRC in the screening of children with bladder dysfunction. 4. To present examples of the value of paediatric IRC supported by correlative imaging. **DESCRIPTION:** IRC is the only completely physiological investigation that can assess bladder emptying. It gives information on the time and completeness of bladder emptying as well as on possible presence of VUR. The IRC makes use of readily available information at the end of the Tc-99m MAG3 dynamic renography when the tracer has been excreted into the bladder and the micturition phase can be studied with a dynamic imaging acquisition. The radiation burden given by a Tc-99m MAG3 dynamic renography is very low (between 0.5–0.7 mSv) and the IRC does not give additional radiation to the child. Limitations of this examination include its feasibility only in toilet trained children, its inability to assess VUR during bladder filling and poor anatomical detail. **CONCLUSION:** IRC is the only completely physiological imaging examination in the assessment of vesico-ureteric reflux in toilet-trained children, with a very low radiation burden. We outline the advantages and limitations of IRC illustrated by a range of cases from our own experience.

### e1210

#### **Lymphoscintigraphy in oncological staging and investigation of lymphoedema; applications and limitations**

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**LEARNING OBJECTIVES:** 1. Introduction to Lymphoscintigraphy – Technical considerations, science of lymph node mapping, various problems and pitfalls. Imaging alternatives including SPECT/CT and interrelationship with other imaging techniques. 2. Application in Breast carcinoma – Prognostic significance of sentinel node identification. Regional lymphadenectomy versus peri-operative localisation. 3. Application in Melanoma – Staging of nodal disease and identification of anomalous lymphatic drainage. 4. Other applications in Oncology – Endoscopic/radiology-assisted interstitial tumour injection. Gastro-intestinal, pelvic and genito-urinary tumours. 5. Investigation of Upper/Lower Limb Lymphoedema – Imaging of the lymphatic vessels. **DESCRIPTION:** Recent years have seen a resurgence of interest in Lymphoscintigraphy – technique first introduced in 1953 using radioactive Gold colloid – and its role in the staging and management of certain malignancies is now established. However, although radiologists are familiar with ultrasound, CT, MRI and PET-CT for identifying nodal disease, relatively few have a clear

perception of the applications and limitations of lymphoscintigraphy and the circumstances under which it should be advocated. The objective of this paper is to illustrate, using clinical case material, the present status of lymphoscintigraphy. A review of the science of lymph node mapping and current techniques utilised in lymphoscintigraphy is provided including potential applications for oncological staging in the future. **CONCLUSION:** After completing this exhibit we hope the viewer will have become aware of the clinical applications of lymphoscintigraphy. An improved understanding of the science of lymph node mapping and technical considerations will enable the radiologist to decide when lymphoscintigraphy is indicated.

### Oncological Imaging poster

#### p1301

#### **FDG PET CT and the oncology MDT: what the radiologist needs to know**

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**KEY LEARNING OBJECTIVES:** To be able to recognise and be familiar with the normal radiological appearances of 18-F FDG PET CT and relevance of incidental findings. **DESCRIPTION:** 18-F FDG PET CT is used routinely in the diagnostic work up of oncology patients in their staging, restaging, diagnosis and monitoring of treatment. As with other image modalities FDG PET CT can reveal expected and unexpected findings to include physiological uptake, unrelated pathology, image artefacts including misregistration which pose as dilemmas for the radiologists and clinicians involved. If these findings are misinterpreted, they could lead to delay in treatment with further unnecessary investigations. Therefore the radiologists involved in Oncology Multidisciplinary Meetings (MDT) need to be familiar with the normal appearances, incidental findings and their relevance in addition to the abnormalities related to patients underlying malignancy. **CONCLUSION:** This image guide aims to familiarise the radiologist with the common imaging patterns of whole body 18-F FDG PET CT and address the controversies raised in the oncology MDTs.

#### p1302

#### **2b or not 2b? Pictorial review and implications of the revised TNM classification of non-small cell lung cancer (NSCLC)**

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<sup>1</sup>*University Hospitals Bristol NHS Foundation Trust, Bristol, UK,* <sup>2</sup>*Great Western Hospitals NHS Foundation Trust, Swindon, UK*

**KEY LEARNING OBJECTIVES:** To illustrate with a series of cases the recent revisions made to the TNM staging of NSCLC. Using pictorial review and case notes from the lung multi-disciplinary meeting this exhibit will highlight changes to the classification and their implication on patient management. **DESCRIPTION:** The revised seventh edition of the TNM classification of NSCLC is the result of analysis of a database of over 68,000 patients. With a strong evidence-based foundation and improved scientific validity the classification will strengthen the utility of lung cancer staging. The TNM stage will more accurately reflect prognosis and affect treatment algorithms. The reviewed radiological staging of NSCLC based on CT appearances includes several major changes. The new classification includes additional cutoffs for tumour size such that T1 tumours remain <3 cm but if <2 cm are classified T1a and if <3 cm T1b. T2a now describes tumours <5 cm and T2b those <7 cm. Pleural effusions are reclassified as M1a together with contralateral pulmonary nodules. Ipsilateral pulmonary nodules are reclassified from M1 to T4 depending if in a separate lobe from the primary. Lymphangitis carcinoma will be staged as Ly. The exhibit includes CT examples of the major changes to the classification and their implication to the clinical staging (I–IV). The new system better delineates the early stages where previously there was overlap. There is improved distinction between clinical stage IIa and IIb. **CONCLUSION:** The reporting radiologist must be able to accurately implement the new TNM classification and understand the implications for patient prognosis and management.



p1303

**Imaging stage 3 metastatic melanoma**

Kolawole, R. O. and Colley, S.

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**KEY LEARNING OBJECTIVES:** To provide a concise review of the imaging modalities used in the staging of loco-regional disease spread in malignant melanoma. **DESCRIPTION:** Melanoma is one of the most widely metastasising tumours, and the incidence of metastatic melanoma is rising in the UK at a faster rate than any other malignancy. Radiology is an essential part of treatment planning, with detection of Stage 3 and 4 disease being important in effective patient management. High frequency ultrasound, fine needle aspiration and biopsy, CT, MRI, fused PET-CT and sentinel lymph node imaging are all important imaging modalities for identifying stage 3 disease. Accurate delineation of disease within the local drainage basin provides prognostic information, but also allows appropriate surgical management. **CONCLUSION:** We present a review of imaging modalities used in the staging of loco-regional disease spread in metastatic melanoma.

**Education & Training poster**

p1401

**"Please Sir, can I have some more?" Medical students' opinions of radiology teaching**

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**INTRODUCTION:** The GMC guidance states that junior doctors should be able to interpret the results of commonly performed investigations. In our experience, medical students and many junior doctors lack the knowledge and confidence to interpret chest and abdominal radiographs. As part of a larger project to develop an electronic learning resource for radiology we sought to determine whether students themselves wanted more formal radiology teaching. **METHODS:** 330 fourth year medical students at Newcastle University Medical School were offered access to a pilot radiology teaching resource and asked to complete four Likert style questions on their attitudes to radiology teaching in the medical school course. Free text answers were also collected. **RESULTS:** Of the 203 students starting the package, 166 (82%) completed these questions. 128 (77%) disagreed that radiology is taught in a structured way in the course. 157 (98%) would like more formal radiology teaching. Only 19 (28%) thought they had enough radiology knowledge to function as a junior doctor. **DISCUSSION:** Radiology is one of the faster developing areas of medicine and junior doctors must be equipped with the knowledge and skills to interpret commonly performed radiographic investigations. They must also be trained to make best use of the local radiology service. Undergraduate teaching in radiology in our experience can be limited, but these results show there is a perceived need amongst students for more formal teaching.

p1402

**Radiology competence: trust me, I'm a junior doctor!**

Taheri, A., Bowering, K., Mullet, R., Roche, O., Gough, V., Craghill, E., and Curtis, J.

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**PURPOSE:** Fresh out of medical school, newly appointed house-officers are expected to detect abnormalities and develop action plans when reviewing plain radiographs. During on-call duties, circumstances often dictate the need to act promptly without senior advice being readily available, e.g. in patients with compromising pneumothorax. This study was designed to assess radiological competence amongst foundation trainees and final year medical students. Competence was defined as detecting obvious "life or death" abnormalities with misinterpretation having a potential bearing on patient safety. **MATERIALS/METHODS:** A mix of 73 foundation trainees and final year medical students were shown radiographs depicting: tension pneumothorax, pneumoperitoneum, dilated small and large

bowel loops, incorrect NG tube placement. Correct recognition of the aforementioned diagnoses constituted a "competent" candidate. A large pleural effusion, large atelectasis, fracture of the neck of femur, consolidation and surgical emphysema. Correct recognition of these additional films was deemed as "satisfactory" basic radiology knowledge. The candidates were asked to pick the diagnosis from a list of 30 possible answers. **RESULTS:** 65% of second year and 45% of first year foundation trainees and 30% of final year medical students achieved core competency. However, 100% of candidates detected an abnormality and stated that they would seek senior advice. **CONCLUSION:** This study highlights significant room for improvement in the performance of undergraduates and foundation trainees in interpreting important diagnoses. Encouragingly, an abnormality was recognised in all cases. The lack of specificity about particular diagnoses has potential critical implications on the day-to-day running of the wards/initial management of acute admissions.

p1403

**Training radiologists of the future: are academy trainees as prepared for on-call?**

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*Leeds Teaching Hospitals NHS Trust, Leeds, UK*

**PURPOSE:** To compare the perceived quality of teaching and preparation of first year radiologists, particularly in the context of readiness for on-call. **MATERIALS/METHODS:** An online questionnaire was sent to 70 second year trainees to compare traditional and academy based training schemes. A seven-point questionnaire was used to assess the teaching of the RCR's Structured Training Curriculum and also assess satisfaction related on the amount of teaching received, preparation to commence on-call, and performance in the Part 1 FRCR examination. **RESULTS:** 42 second-year trainees (25 from five traditional schemes and 17 from the three academies) responded (response rate 60%). The academy trainees scored their physics and anatomy teaching highly and non-academy trainees scored clinical teaching higher: only physics tuition scored significantly differently. All self-assessment scores were high for reporting plain films, performing and reporting ultrasound and barium studies. All respondents also agreed that supervision was appropriate for their level of training. All traditional scheme respondents had some experience of on-call during their first year whereas the academy trainees did not. When asked to score whether their first year of radiology training had prepared them for on-call duties, the two groups of trainees scored themselves similarly with no significant difference. **CONCLUSION:** Academy and non-academy trainees have similar training experiences in their first year. Both groups felt confident that the teaching and clinical experience from the first year has enabled them to meet the targets set out for year 1 by the RCR training curriculum.

p1404

**Infection control: are we preparing our workforce?**Willis, S. J.<sup>1</sup>, Burnett, S.<sup>2</sup>, Crompton, S.<sup>2</sup>, Hiley, A.<sup>2</sup>, Lynch, S.<sup>2</sup>, and Heales, C. J.<sup>3</sup><sup>1</sup>University Campus Suffolk, Ipswich, UK, <sup>2</sup>University of Exeter, Exeter, UK, <sup>3</sup>Alliance Medical Limited, Warwick, UK

**PURPOSE:** Learning within the clinical setting is deemed pivotal to the development of tomorrow's practitioners. However, previous research has suggested that education within the clinical setting may have resulted in a reduced understanding of procedures relating to infection control. The aim of this study was to investigate the effect of clinical placement experience upon students' understanding of infection control procedures within a healthcare context. **METHODS:** First year undergraduate radiographers (2008–09 cohort) were invited to participate in the study ( $n=58$ ). Data were gathered using questionnaires at two time-points, prior to and immediately following a 4-month clinical placement. Response rates of 100% ( $n=59$ ) and 92% ( $n=54$ ), respectively, were achieved. **RESULTS:** Improvements were evidenced in the respondents' knowledge of infection control procedures across all aspects of infection control (hand hygiene,

protective clothing, correct use and disposal of sharps). For example, the number of students correctly identifying when and how to wash their hands improved by 150% and 109%, respectively. The percentage of correct responses decreased in relation to the duration of hand-rubbing with alcohol gel (students typically over-estimated the amount of time needed) and hand-hygiene when using sharps. However, it should be noted that the prime focus of the placement was on areas where sharps were not in routine use. **CONCLUSION:** The study's findings demonstrate the important role that placement learning has in consolidating students' understanding of infection control procedures in the clinical context. **ETHICS:** Ethical approval was granted by the School of Physics Ethics Committee prior to the commencement of data collection.

#### p1405

##### **Problem based learning – is competency a problem?**

Pickering, V. J. and Hussain, Z.

*University of Liverpool, Liverpool, UK*

**KEY LEARNING OBJECTIVES:** Problem-based learning (PBL) is a student-centred teaching and learning strategy in which students work in small groups organising and directing their own learning. PBL can be used to enhance content knowledge and foster the development of communication, problem-solving, and self-directed learning skills. The aim of this study was to investigate the relationship between student and tutor evaluation of PBL competency and academic attainment in an undergraduate radiography degree programme. **DESCRIPTION:** 36 undergraduate students were investigated over a 3 year period. Student and tutor evaluations of competency gained during PBL were undertaken. This led to the determination of an overall level of competency gained through profession specific scenarios. The relationship of student and tutor evaluation of competency with examination performance was examined. Statistically significant correlations were found between student and tutor ratings of competency in years 1 and 3 and correlations improved significantly through years 1, 2 and 3. No significant correlations were found between examination performance and student self evaluations, but significant correlations were found between examination performance and tutor evaluation of competency. **CONCLUSION:** A convergence of the student and tutor evaluations of competency occurred over time. Skills required for success in PBL develop slowly by the process itself. To provide support to students during PBL these skills should be developed with feedback being provided to the students to enable positive monitoring of development.

#### p1406

##### **Ultrasound-guided drain insertion – a wealth of information for the beginner**

Bhattacharya, B.

*Leeds and West Yorkshire Radiology Academy, Leeds, UK*

**KEY LEARNING OBJECTIVES:** 1. There is a wealth of useful online information available for practitioners who are learning how to perform ultrasound-guided interventional techniques such as ascitic and pleural drains. 2. A sound core knowledge base including issues surrounding consent, equipment, anatomy and techniques will be invaluable to the trainee. **DESCRIPTION:** The use of ultrasound for guidance of percutaneous drain insertion is rapidly expanding. The National Patient Safety Agency recently reviewed 12 deaths and 15 cases of severe harm associated with chest drain insertion, and attributed many of these to inadequate experience, incorrect site of insertion and inadequate imaging. The demand for ultrasound-guided drain insertions is therefore likely to further increase. We provide a comprehensive review of useful online resources which can be invaluable for the health care professional (whether that be radiologist, ultrasonographer or specialist nurse) beginning their training in interventional procedures. We highlight the best resources pertaining to consent, equipment such as types of drains and wires, anatomical considerations and general techniques. The resources are presented in pictorial format. **CONCLUSION:** Whilst one cannot replace practical experience, adequate knowledge of anatomy, available equipment

and techniques will provide an excellent basis for training, and will increase confidence for the beginner. A wealth of such information is readily available via carefully chosen online resources.

#### p1407

##### **Data collection: Excel vs Access (a guide for Radiologists)**

Patel, R. P., Wai, D. S. W., and Dheer, A. K.

*UHCW, Birmingham, UK*

**KEY LEARNING OBJECTIVES:** To understand the key differences between Microsoft Access and Excel in order to improve the efficiency of data collection and analysis. **DESCRIPTION:** Formal training in the use of spreadsheet and database software is not given at medical school, yet an understanding of data collection and analysis is essential in order to undertake audit and research. The majority of healthcare professionals have “picked up” the basics of Microsoft Excel in order to collect data but still manipulate the data manually. Excel and Access are extremely powerful applications and proficiency in their use can lead to drastic savings in time spent collecting and analysing data. We highlight the fundamental differences between Microsoft Excel and Access in order for individuals to maximise the functions incorporated in these applications. We also highlight a number of clever tools that these packages offer to analyse large quantities of data. Finally, we discuss the important factors that need to be taken into account at the design stage of any study in order to ensure data integrity and consistency. **CONCLUSION:** Any person undertaking audit or research will gain a better understanding of Microsoft Excel and Access and feel more confident deciding when and how to use them in everyday practice.

#### Education & Training e-poster

#### e1408

##### **Detecting the absent: a vigilance challenge**

Cameron, C. and Mucci, B.

*Southern General Hospital, Glasgow, UK*

**KEY LEARNING OBJECTIVES:** A continual challenge in radiology is detecting the absence of objects or structures. While most pathology presents as a change in anatomical structure or the appearance of pathological objects some conditions do not. Pathology presenting as missing structures such as congenital absence or pathological removal or destruction of normal anatomy is more difficult to detect in the radiographic image. We highlight the vigilance challenge of “detecting the absent”, and provide a set of images to demonstrate this and test observers. **DESCRIPTION:** As a vigilance training tool we assembled a series of images where normal structures are missing from the image. Some of the set is composed of congenitally absent conditions, or removed structures, others are destructive pathology. A further portion consists of digitally manipulated radiographs where photographic manipulation software has been used to remove anatomical structures. The series of images is presented to the observer as a test set with subsequent answers to provide vigilance training with immediate feedback. **CONCLUSION:** One of the most difficult observational tasks in diagnostic radiology is detecting absence of structures. This skill has clinical importance and needs taught by example which we provide in this set of images.

#### e1409

##### **Artefacts in magnetic resonance imaging (MRI): a pictorial review**

Qureshi, M., Sahu, A., Chaganti, S., and Mukonoweshuro, W.

*Plymouth Hospitals NHS Trust, Plymouth, UK*

**KEY LEARNING OBJECTIVES:** 1. Recognise a variety of common artefacts occurring in MRI. 2. Understand the origins of these artefacts. 3. Recognise steps which can be taken to reduce them. 4. Understand how image artefacts can also be exploited to aid diagnoses. **DESCRIPTION:** 1. Describe and illustrate image artefacts and classify them by their origin. 2. Discuss measures taken to reduce or eliminate them, reviewing the current literature. 3. Overview of magnetic resonance angiography, reviewing current literature. **CONCLUSION:** Although MR is an accurate way of

visualising anatomy and detecting pathology, it is not perfect. The MR image is prone to distortion in a number of ways, relating to image acquisition (hardware), image processing and magnetic susceptibility. It is important to recognise these artefacts to be able to limit image degradation and not misinterpret an image. The use of susceptibility artefact in assessing blood flow is now an established technique and an example of how artefacts can also be useful in clinical practice.

## Service Delivery poster

p1501

### A study to follow the introduction of an infection control protocol within a busy CT department

Sanderson, S. L. and Arnold, P. M.  
*University of Leeds, Leeds, UK*

**PURPOSE:** A previous microbiological study within the CT department of a teaching hospital had identified potential routes for cross infection of nosocomial infections due to the standard infection control policy being non-specific with regard to the type of variety of equipment used in this medical imaging modality. A new Departmental Infection Control Protocol was required that was specific and effective in levels of decontamination, but would not compromise department efficiency and patient throughput. **MATERIALS/METHODS:** A protocol was drafted in conjunction with the CT department and the hospital Infection Control team to specifically address areas of contamination identified by the earlier microbiology study. Questionnaires were formulated to gauge staff opinion on the protocol, and its viability in the clinical environment at the beginning of the study, and 1 month after the initial implementation of this new protocol. The researcher will observe the practicality of this policy on a weekly basis and engage with staff on the effects of its practical application on their work to identify any issues and barriers. **RESULTS:** This study is still a work in progress; we will be presenting the results of the initial microbiology study which identified potential areas for cross-infection in the gantry controls, head rests, table top and patient positioning straps as this has motivated staff to be closely involved in ensuring the success of the new protocol. **CONCLUSION:** It is envisaged that by implementing an effective infection control protocol coupled with educational aids, compliance can increase as well as staff morale and empowerment.

p1502

### The impact of imaging on demand in the assessment of suspected lung cancer

Musson, R. E. and Matthews, S.  
*Northern General Hospital, Sheffield, UK*

**PURPOSE:** From April 2008, patients were able to attend the radiology department direct from clinic to book investigations; many were performed that day. This "Imaging on Demand" service was introduced to reduce waiting times, particularly in cases of suspected malignancy. Our study aimed to evaluate the impact of the new service compared to previous audits. **METHODS:** 102 consecutive patients underwent staging CT scanning for suspected lung malignancy from June–August 2009. The referral to scan times were assessed. **RESULTS:** For outpatients (73/102 cases), the mean imaging time was 5.8 working days (range 0–31 days). 52/73 scans were performed within 5 days, 14/73 in 6–10 days and 7/73 in 11+days. For the 46/73 patients on a Trust Cancer Wait Pathway, the mean time to scan was 2.9 days (42/46 scanned within 5 days and 4/46 within 6–10 days). The majority of delayed scans were due to patient preference. Of 29 in-patients (one excluded for delay due to renal function), 24/28 were imaged the same or following day and 100% imaged within 2 working days. This audit was compared to a previous audit following introduction of pre-clinic CT imaging performed in January 2006 (31 patients). The mean time to scan then was 6.6 days. Only those with eventual diagnosis of cancer were included in this study. **CONCLUSION:** Following the introduction of "Imaging on Demand" the wait for CT in suspected lung cancer has reduced. This was most marked for patients on the Trust Cancer Wait Pathway.

p1503

### Use of questionnaire feedback to improve patient satisfaction in radiological breast assessment

Leaver, A., Yeung, A., and Lunt, L.  
*Queen Elizabeth Hospital, Gateshead, UK*

**PURPOSE:** To evaluate patient satisfaction regarding radiological breast assessment (first cycle), change practice to address areas with lower scores, and re-evaluate with the same questionnaire (second cycle). **MATERIALS/METHODS:** A patient satisfaction questionnaire was formulated following review of the available literature, asking patients to rate various statements from 1 (strongly disagree) to 5 (strongly agree). Copies were distributed by clinic nurses immediately following patients' breast assessment, including those discharged, awaiting biopsy or results. The clinician being assessed was unaware of which clinics were targeted. Individual clinicians received their results confidentially. Group average results were discussed at the consultant meeting. Strategies were agreed to address deficiencies and a further cycle of questionnaires was performed. **RESULTS:** There were 78 completed questionnaires in the first cycle, 119 in the second. Overall, patient satisfaction was high. First cycle scores were lowest on two statements: "felt able to ask questions" and "felt questions and concerns were taken seriously". Strategies targeted towards these areas included radiologists inviting questions at least twice during an assessment, taking time for extra explanation/consideration if needed. Second cycle results were improved across the whole survey, but most markedly in the targeted areas: "strongly agree" ticks increasing 10.79% to 94.12%, and 13.31% to 96.64%, respectively. **CONCLUSION:** Use of this questionnaire has facilitated audit and reflective practice at both individual and departmental level. Changes made on the basis of the questionnaire have improved levels of patient satisfaction and therefore patient care.

p1504

### Improving patient experience using Lean

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<sup>1</sup>*Royal Bolton Hospital NHS Foundation Trust, Bolton, UK,*  
<sup>2</sup>*University of Salford, Salford, UK*

**PURPOSE:** The aim of the study was to evaluate, comparatively, measures of patient journey time and satisfaction of both patients and staff before and after the use of lean methodologies to bring about change to a radiology pathway in a large DGH. **METHOD:** A mixed methods study was used to collect both qualitative and quantitative data both before and after the changes to the service. The quantitative data was collected on a standard proforma used to generate value stream maps of the whole patient journey. This was supplemented with data collected by patients as they recorded their journey, in particular the timings at specific times along that journey, and by data collected by staff about their interactions with patients. A questionnaire was designed for both staff and patients in order to collect the qualitative data to measure satisfaction with the service. **RESULTS:** Preliminary evaluation suggests that there has been a dramatic reduction in the patient journey and an increase in staff and patients satisfaction. **CONCLUSION:** The philosophy of lean, to reduce waste and increase respect for people, is met when developing a service using lean methodologies as demonstrated by a reduction in waiting times and an improvement in satisfaction of both staff and patients.

p1505

### Patient feedback regarding CT colonography service

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<sup>1</sup>*St Helens and Knowsley Hospitals NHS Trust, Prescot, UK,*  
<sup>2</sup>*North Cheshire Hospitals NHS Trust, Warrington, UK*

**PURPOSE:** To assess patients' experience of the conduct of CT colonography and the information leaflet provided. CT colonography is currently being done at this institution for patients unable to tolerate a colonoscopy or have a failed endoscopic examination. Patient feedback was obtained. **MATERIALS/METHODS:** 66 patients undergoing CT colonography were asked to complete a questionnaire

after the investigation was performed. They were asked to comment regarding the clarity and details in information leaflet posted to them about the procedure. They were asked regarding the pain or discomfort during colonography, their tolerance to the procedure and any suggestions for improving the service. **RESULTS:** 82% of patients found the information leaflet adequate. 15% of patients asked for more detail regarding food intake with the effect of laxative taken and the information leaflet was modified. 86% tolerated the procedure well and were willing to have a repeat procedure if required. 90% had a smooth recovery after the procedure. 68% of the patients found distension of the bowel by air as the most uncomfortable part of the procedure. 9 had difficulty lying on their front and back and 5 had difficulty holding their breath. 2 were intolerant to the bowel preparation. The staff was commended for providing care and support to patients. **CONCLUSION:** Following the satisfaction survey, the information leaflet was modified. We changed our practice from using air for bowel distension to the use of a carbon dioxide insufflator for reducing post procedure discomfort for patients.

### p1506

#### **Point of care ultrasound: a working partnership**

Bailey, E.

*Global Diagnostics Ltd, Norwich, UK*

**PURPOSE:** A key theme that runs across the NHS's healthcare strategy is making services more responsive to patient needs. As clinicians, we are encouraged to consider how services can be delivered in innovative ways to enhance convenience. Providing patient-centred services was one of the rationale for a collaboration between Leicester County and Rutland Community Health Service and Global Diagnostics in August 2009. This has resulted in the provision of high quality, clinically effective, Point of Care ultrasound services to the Leicester community. **METHODOLOGY:** Led by Global Diagnostics' Clinical Director, Advanced Practitioner Sonographers provide, within an integrated clinical governance framework, a general and MSK Ultrasound service across 6 Community Hospital sites. Peer consensus is available at all times from the local Radiologist via the Trust's CRISPACS. Additional subspecialist Radiological opinion is also available via Global's own web based RISPACS system, the "Global-Link", integrated via N3 with the Trust CRISPACS system. 10% of all examinations are audited, with results shared at bimonthly CPD meetings. **RESULTS:** The service enables referral to report turnaround times of less than 10 working days. Patient feedback is very positive, with the close to home service greatly appreciated, particularly by the older patient. GP feedback is equally supportive, with fast turnaround times enabling effective onward management of the patient. Unnecessary secondary care presentations are also avoided. **CONCLUSION:** The collaboration between the PCT and Global is providing high quality, efficient and effective, patient focused care – a working example of the NHS's vision for innovative and responsive health services.

### p1507

#### **Are you being interrupted during your reporting sessions?**

Butt, N. A.

*Glasgow Royal Infirmary, Glasgow, UK*

**PURPOSE:** Aim of this study is to identify interruptions during a reporting session and possible impact on radiologists' working patterns. A radiologist is frequently presented with clinical problems during a reporting session. These interruptions have received limited attention in the published literature and planning of departmental workflow. **MATERIALS/METHODS:** Interruptions during CT reporting sessions were monitored for 1 week. A total of 20 reporting session during a working week were included in the study. Reporting radiologists were asked to note all queries presented to them; to record nature of request and approximate duration of interruption. Additional note was made whether radiologist was interrupted while reporting a scan or in between scans. These interruptions were analysed and classified. **RESULTS:** A total of 438 interruptions were recorded. Maximum and minimum number of interruptions during a session was 35 and 17, respectively. Majority of queries came from

clinical teams for discussion about clinical request, reports and imaging plans. Second most common group was queries regarding scan planning/priority presented by radiographers. Others requests included advice to radiology trainees, secretarial staff, case discussion with other consultants, consultation to patients and telephone calls. **CONCLUSION:** Impact of interruptions during radiological reporting has been downplayed in the past but with increasing number of these in a rather demanding radiological environment and increasing workload on a radiologist, these should be taken into consideration for planning of departmental workflow. An analysis of these will allow to plan and adopt measures and consequent reduction in number of these interruptions.

### p1508

#### **How do we implement standards on critical, urgent and unexpected findings? A sample survey**

Rogers, P. J. N. and Suresh, P.

*Derriford Hospital, Plymouth, UK*

**KEY LEARNING OBJECTIVES:** 1. Awareness of policies by the Royal College of Radiology and the National Patient Safety Data regarding the communication of urgent, critical and unexpected significant findings. 2. Appreciation that the time frames in which to make communication with clinical colleagues for each category, and the medico-legal ramifications of error. 3. Understanding of the terms "critical", "urgent" and "significant unexpected" and the difficulties associated with the local interpretation of the current guidelines to give the best patient care. **DESCRIPTION:** Timely communication of reports is becoming an increasingly important medico-legal issue, with errors often resulting in significant mortality and morbidity. Between November 2003 and May 2006, the National Reporting and Learning Service received 22 reports where failure to follow up radiological imaging reports led to patient safety incidents, mostly involving fatalities or significant long-term harm. This educational presentation outlines the current standards and explores their implementation in different trusts across the region. Via an interactive discussion of clinical vignettes, audience members will be asked to describe various radiological findings as "critical", "urgent" or "significant unexpected" and then view matched responses from a sample survey of radiologists. **CONCLUSION:** As diagnostic imaging proliferates, and becomes a greater part emergency care pathways, what are the different approaches to managing patient's urgent, critical and significant unexpected findings? This presentation will educate the audience in the current guidelines and discuss how we can best meet the needs of tomorrow's patient.

### p1509

#### **Is a 24/7 immediate reporting service for trauma radiographs feasible?**

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Hospitals NHS Trust, Wakefield, UK, <sup>3</sup>Liverpool and

Broadgreen University Hospital, Liverpool, UK, <sup>4</sup>Pennine

Acute Hospitals Trust, Oldham, UK

**PURPOSE:** Radiographer reporting is now seen as an essential reporting service within many hospitals, particularly in relation to trauma. However, despite the introduction of immediate reporting of trauma radiographs being advocated by the Audit Commission and Professional bodies to reduce image interpretation errors within the emergency department and inform patient management, such a service is rarely routinely available. In order to establish the impact of a radiographer immediate reporting service on patient outcomes and service costs, a randomised controlled trial was undertaken. This presentation will focus on service delivery costs and feasibility. **MATERIALS/METHODS:** Between July and December 2009, patients attending 5 hospitals across the North of England with musculoskeletal injuries were recruited and randomly assigned to immediate or delayed reporting arms on X-ray registration. Patient recruitment took place between 8am and 2am and included weekday

and weekend periods. Assuming a 5% difference in ED recall rates between the 2 groups, a total sample of 1242 (90% power) was required. **RESULTS:** This is an ongoing study funded by the NIHR and initial findings will be presented describing patient attendance and recall statistics across the study arms. Preliminary findings related to service usage, costs, interpretation errors and the potential impact of an immediate reporting service will be explored. **CONCLUSION:** The immediate reporting of trauma radiographs is a natural extension to the current scope of radiographer reporting practice in the UK. However, the implementation of new roles and expansion of service provision must be justified and supported by research evidence and resourced appropriately.

#### p1510

##### **A simple, cheap tool to aid and facilitate the radiologist in gastric-band port access**

Timmis, J. B.

*Whittington Hospital NHS Trust, London, UK*

**PURPOSE:** With a rapidly increasing number of gastric-band placements being performed for obesity, there is an increasing demand for Radiologists to access gastric-band ports to adjust the degree of band restriction. This can be an awkward procedure, as the port is often difficult to palpate in obese patients, and is frequently tilted. I describe a novel approach for the accurate placement of the Huber needle into the gastric band port, using pulsed fluoroscopy and a simple, cheap, purpose designed targeting device. **MATERIALS/METHODS:** The ease with which gastric port access could be achieved using X-ray fluoroscopy and a targeting device was assessed in 487 consecutive patient examinations. **RESULTS:** In over 99% of cases (484/487), using the targeting device resulted in correct needle placement at the first, or occasionally, second attempt, with minimal X-ray exposure to both patient and radiologist. Nearly all tilted ports could easily be corrected and accessed with the application of gentle external pressure using the targeter. The only patients (3) whose ports could not be accessed, were those whose ports had completely inverted, and these patients were referred for surgical correction of the problem. **CONCLUSION:** Using a targeting device succeeds at the first or sometimes second attempt in virtually all cases. It minimises the procedural time, the X-ray dose and patient discomfort, and no local anaesthetic is required. Using the device requires only basic skills, and the technique is easily learned, especially by those who have already acquired hand-eye co-ordination skills in other interventional procedures.

#### p1511

##### **The journey to consultancy – the transition from advanced practice to consultant practice**

Field, L. J., Snaith, B., and McGuinness, A.

*The Mid Yorkshire NHS Trust, Dewsbury, UK*

Despite consultant radiographer roles being in existence for 8 years, the numbers of appointees remain small. Experience from within and out the radiographic profession has identified difficulties in recruiting suitable candidates, as well as issues related to the transferability of role and skills. The role of the consultant practitioner may vary considerably depending on the specific service need and the associated clinical requirements. **KEY LEARNING OBJECTIVES:** In line with workforce plans, one multicentre NHS Trust has developed trainee consultant posts to provide the development required to function at consultant level. Two radiographers with extensive advanced practice experience were appointed through a competitive interview process to trainee consultant roles for a period of 12 months. These training posts, termed trainee or associate consultants, have tended to identify individuals within a Trust who have the potential to reach consultant status and whose specific learning and developmental needs can be met by a locally devised programme. **CONCLUSION:** Expectations were established to provide a framework of development, particularly within the non-clinical elements of consultancy such as strategic development. This poster will outline the personal journeys of the trainees through the delivery of services and associated challenges.

The main aim is provide an understanding of the tasks involved in this transitional period and explore the potential of such roles.

#### p1512

##### **A changing workforce profile for radiography in NHS Scotland**

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**PURPOSE:** Role development is recognised as key to supporting the current and future demands in clinical radiology and achieving access targets such as the 18 week referral to treatment standards. To support the educational needs of radiography support workers to progress to assistant practitioner level, the then Scottish Executive Health Department commissioned the Scottish Qualifications Agency in 2005 to develop two Higher National Certificates (HNCs) in diagnostic imaging and radiotherapy. NHS Education for Scotland in collaboration with the Health Delivery Directorate subsequently funded 34 support workers to enable them to undertake the programmes. **METHODOLOGY:** The programmes were evaluated by means of monitoring reports completed by health boards, questionnaires completed by trainee assistant practitioners and mentors, interviews with radiology managers and educationalists. **RESULTS:** All participants successfully completed the HNCs which is regarded as exceptional for this type of programme. The evaluation has identified successes and challenges, information on the trainees' progress and personal development and their early impact on radiography practice and in radiography departments. The wider impact on mentors, radiography managers and educationalists was also identified. **CONCLUSION:** Evaluation data provides largely positive feedback as well as identifying some challenges which have arisen. It is clear the individual trainee assistant practitioners have invested a great deal in the programme. This has resulted in favourable outcomes for both themselves, in terms of personal development and increased confidence, and for the service such as better team-working and increased flexibility. In addition the programme is addressing a number of wider policy imperatives.

#### p1513

##### **Caring about the carers: experiences of higher education for radiography and radiotherapy students who are carers**

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**KEY LEARNING OBJECTIVES:** This is a quantitative and qualitative study of the experiences and attendance of radiography and radiotherapy students who are carers. Undergraduate radiography and radiotherapy programmes are attracting increasing numbers of mature students. It is therefore likely that the number of students with carer responsibilities is also increasing. The aim of this study is to report the experiences of carers and to work towards compliance with recent equality legislation. **DESCRIPTION:** All diagnostic radiography and radiotherapy students were invited to complete a short questionnaire. Students who identified themselves as carers were invited to participate in focus group sessions. From the findings of the focus groups absence was also investigated. 30 of the 217 students identified themselves as carers (19% radiography and 7.5% radiotherapy). 18 carers agreed to take part in focus groups. Carers reported, having fees paid by the NHS was an important choice factor for higher education. Carers' main concerns were: timetabling, finances, support after exam failures, understanding from academic staff and attendance issues. Examination of absence rates demonstrated carers had significantly less absence than non carers for radiography and no significant differences for radiotherapy. **CONCLUSION:** The NHS states it must be reflective of the community it serves. Thus those responsible for delivering health professional programmes have a duty to recruit and retain a diverse student population. Introduction of the Equality Bill means HEIs must consider the needs of those with protected characteristics.

A number of actions regarding the delivery and administration of the programmes have been identified.

### Service Delivery e-poster e1514

#### The role of the highlighted Senior Radiographer

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*Fairfield Hospital, Pennie Acute Hospitals NHS Trust, Bury, UK*

**KEY LEARNING OBJECTIVES:** To improve the quality of service delivery by the appointment of a Senior Radiographer with a central coordinating role to: 1. ensure maximum efficient use of screening rooms/MRI/CT/Ultrasound; 2. be a single point of contact within the X-ray department to deal with enquiries from patients, GPs and peripheral hospitals and all hospital staff. **DESCRIPTION:** The Highlighted Senior radiographer undertakes this role on a rota basis – working from a central office with a dedicated telephone line. The Highlighted senior oversees vetting of all inpatient imaging, eliminates duplicate requests and ensures all investigations are carried out in the appropriate order and in a timely fashion. The highlighted senior is available as first point of contact to answer queries from patients and GPs and to give guidance and support to junior doctors requesting inpatient imaging. **RESULTS:** Interruption to reporting by Consultant Radiologists is significantly reduced; delays are avoided and patient pathway is streamlined; junior doctors know exactly where to go to and are very appreciative of the support they receive; all screening and scanning facilities are used to maximal advantage providing an integrated service. **CONCLUSION:** There has been a very positive benefit for patients, service users and staff. The quality and efficiency of the department has been significantly improved: central coordinating role with a single point of contact; maximises efficiency Supports and helps GPs and junior staff; streamlines patient pathway.

### e1515

#### Your radiology department: why would anyone complain?

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*Norfolk & Norwich University Hospitals NHS Trust, Norwich, UK*

**PURPOSE:** Medical litigation is on the increase and the Radiology Department is not exempt. Identifying the causes of patient complaints enables implementation of changes to prevent or reduce their occurrence. **METHODS AND MATERIALS:** A retrospective analysis of patient complaints to a UK tertiary Radiology Department serving a population of 850,000 over a 23 month period was performed. The status and sex of the complainant, method of complaint and the number of days taken to respond were recorded. The nature of the alleged error (administrative error; failure of communication; appointment cancellation; examination environment; change of investigation by the radiologist; error of interpretation, etc.), the imaging modality and involvement of other specialities were noted. **RESULTS:** There were 91 complaints lodged by 96 complainants. 55 were made by the patient, 25 by a relative, 2 by their physician and 9 by their Member of Parliament. 64% of the complaints were authored by women. The median time taken to respond was 27.5 days (range: 0–56 days). 67% of complaints pertained to the Radiology Department alone, with other specialities implicated in 33%. The greatest number related to waiting times (35%), the majority for CT and MRI (69%) scans. Communication (21%) and radiological interpretation (14%) were other common causes of complaint. **CONCLUSIONS:** Whilst errors in radiological interpretation have been much studied, they constitute only a minor proportion of the complaints made. Complaints regarding waiting times and patient communication are more common but also more remediable. The pattern of complaints also informs the impact of resource limitations.

### e1516

#### We need to know who we are talking to!

Kumaraguru, J. and Regi, J.  
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**INTRODUCTION:** Interacting and advising our clinical colleagues is a major part of any Radiologists professional life. The manner in which we interact depends on their speciality, grade and seniority. Despite the emphasis in medical school on communication skills we have noticed a deterioration in the introductions of our clinical colleagues. We carried out an audit to objectively examine if this was real or just a group of aging Radiologists complaining! **Methods:** Two SpRs, one based in a large DGH and one based in the regional teaching hospital, recorded every clinical interaction over a 3 month period. Looking at whether clinicians introduced themselves face to face or over the phone. Gave their speciality or grade and whether they wore a visible ID or not. **RESULTS:** Only 38% introduced themselves. Women were better than men, the more senior clinicians were better than the more junior. 100% of GPs introduced themselves, only 20% of orthopods did. Twice as many introduced themselves in the teaching hospital. **DISCUSSION:** Does this mean that women are better doctors than men? Are GPs better communicators than orthopods? Are the standards are higher in teaching hospitals.

### e1517

#### Do hospitals comply with Department of Health (DOH) guidelines when transferring images between hospitals?

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**PURPOSE:** Data protection is a governmental priority. In May 2008, the NHS Chief Executive decreed that in all instances where images were being transferred between hospitals, the data should be encrypted. A second letter was sent in September 2008. **MATERIALS/METHODS:** We are a large tertiary referral hospital and therefore receive a large number of images each month. We performed a retrospective study, taking the months 1, 7, 11 after the initial governmental posting, and recorded how many different patients' images were uploaded onto our PACS system from an external source (*i.e.* CD), whether they were encrypted, and if the patient was an inpatient in a 2 week window either side of the uploading date (current DOH policy allows unencrypted transfer if the files are sent with the patient). **RESULTS:** 360 patients had images uploaded onto PACS via CDs in these 3 months. Only 14% of CDs complied with DOH guidelines regarding encryption, although 40% (45 CDs) complied in the final month of the analysis. 3 of 19 hospitals (June 2008), 1 of 32 hospitals (Dec 2008) and 3 of 18 hospitals (May 2009) sent encrypted CDs. **CONCLUSION:** Currently, there is a low level of compliance with regards to encrypting images for transfer between hospitals in our region. We have written to all the Trusts concerned and will re-monitor in due course.

### e1518

#### Assessment of ultrasound provision outside the imaging department

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**PURPOSE:** Ultrasound is increasingly used as a diagnostic tool and for guiding procedures. Ultrasound is a non-invasive technique which does not involve ionising radiation. Individuals practicing ultrasound should conform to national guidelines (RCR guidelines "Ultrasound training recommendations for medical and surgical specialities") as substandard ultrasound can affect quality of patient care and may directly impact upon radiology services. Equipment purchase should be according to demand and should be regularly maintained. Results of ultrasound examinations should always be documented. **MATERIALS AND METHODS:** Questionnaires were distributed to each department using ultrasound. Information was collected on each practitioner including grade, experience, training and qualifications. Information was collected on ultrasound equipment and documentation. **RESULTS:** There were 70 respondents, 2 were excluded as they did not use ultrasound. It was used primarily for vascular access, echocardiography and urology. 62% of users performed ultrasound < 5 times per week. More than 50% did not receive any training on departmental ultrasound machines. Of those that used ultrasound

more frequently, two-thirds did not hold any formal qualifications and only 50% of users had attended any formal courses. 81% were not regularly audited in their practice. Only one-third of machines were serviced in the last 12 months. The majority of machines were not connected to PACS. 80% of departments are recording results with images available for review in 50%. **CONCLUSION:** More formalised training, assessment and audit of practice of ultrasound practitioners is recommended with adequate resource planning. Images should be available for review ideally on a PACS system.

### e1519

#### **Creation of a dedicated "lumps and bumps" ultrasound service: implications for training**

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**PURPOSE:** At our institution, we have noted an increasing demand from primary care for ultrasound examination of clinically apparent swellings or "lumps and bumps" that present to the general practitioner. We aimed to create formal ultrasound sessions dedicated to these referrals, and surveyed the ultimate ultrasound diagnosis. The range of diagnoses arising from these pilot lists would then help plan training for sonographers to carry the service forward. **MATERIALS/METHODS:** Four formal "lumps and bumps" ultrasound lists were created during October and November 2009 through the grouping of referrals from primary care. Patients referred for formal musculoskeletal, head and neck or vascular imaging were excluded. 62 examinations were performed by two Radiologists. We surveyed the imaging diagnoses that followed. **RESULTS:** Of the 62 scans performed, there were 25 different diagnoses. Although the diagnoses included more common entities such as lymph nodes (9/62) and lipomas (9/62), the list of diagnoses was diverse with findings ranging from normal variants (cervical ribs or prominent xiphisternal cartilage) to definite pathology (hernias, gynaecomastia, superficial thrombophlebitis and plantar fibromatosis). **CONCLUSION:** The survey showed that the range of diagnoses encountered in a dedicated "lump and bump" ultrasound session is wide-ranging and diagnosis required considerable clinical and radiological experience. Although this does not preclude the introduction of skill mix to this field, the amount of training required to achieve competency should not be underestimated.

### e1520

#### **Small bowel enteroclysis – a patient satisfaction study**

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**PURPOSE:** The aim of this study is to produce a detailed information leaflet for patients undergoing small bowel enteroclysis. Besides the already known information we wanted to hear from the patients about how they experienced the procedure starting from the existing information letter we sent to the before, during and after care of the examination. **MATERIALS/METHODS:** This is a retrospective analysis of a patient centred questionnaire sent to all who under took SBE during 2008. The data was analysed to identify how to improve patient satisfaction by producing a new information leaflet. **RESULTS:** 22 patients completed the questionnaire. Of these 72.7% were happy with the procedure. 95.4% found the examination uncomfortable with the same number finding introduction of the naso-gastric tube the most difficult part. 77.2%, 90.0%, 100% found the explanation from the referring clinician adequate, the information from the staff informative and the radiologist supportive and encouraging, respectively. 31.8% were not happy with the information letter already sent to them with 3 patients not receiving one. Many additional positive comments were also noted on how to improve the service and patient information for the future. **CONCLUSION:** The study has highlighted what new areas to address to improve patient satisfaction and a new information leaflet is being produced from the findings.

### e1521

#### **Engaging with patients in research: lessons learned from a Scottish imaging department**

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**KEY LEARNING OBJECTIVES:** 1. Highlight the importance of engaging with patients in order to enhance the quality of service provision. 2. Describe innovative methods of data collection capable of ensuring that the patient's voice will be heard. **DESCRIPTION:** The NHS seeks to provide patient centred care. However, within imaging departments progress towards this has been slow and there has been a heavy reliance on patient satisfaction surveys. While these provide some useful data, they have their limitations. In particular, they tend to focus on topics identified by staff as important although these may not reflect the priorities of patients. In recent years the authors have been developing methods of data collection which enable the patient's voice to be heard more readily. During this presentation examples will be given from our previous studies which employed innovative methods. These include: 1. the recruitment of people with cancer away from hospital settings (e.g. from local voluntary agency support groups); 2. semi structured interviewing incorporating open ended questions; and 3. the use of a graffiti wall, cameras and video box with children. **CONCLUSION:** Innovative methods of data collection enable patients' views to be known, thus enabling service improvements to address patient concerns. Our studies have demonstrated that such approaches are feasible within a busy imaging department. Above all else our work indicates that patients are willing to participate in research employing procedures that are significantly more time consuming and demanding for them.

### e1522

#### **Is the information adequate? A comparison of referrals for lumbar spine MRI by physiotherapists**

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*King's College Hospital, London, UK*

**PURPOSE:** To compare the clinical data provided by physiotherapists and medical practitioners when requesting lumbar spine MRI. **BACKGROUND:** Physiotherapists have extended their roles over the past decade. At Kings College Hospital (KCH), physiotherapists working in the Musculoskeletal Assessment and Triage Service have been given the authority to request spinal MRI. RCR guidelines for completion of radiology request forms state that the reasons for the request should be clearly recorded to assist the radiologist in making an accurate diagnosis. **METHODS:** This retrospective study analysed data included on MRI request forms and reports completed between July 2008 and July 2009 at KCH. Data provided by physiotherapists and an equivalent number by hospital-based medical practitioners (Orthopaedics, Anaesthesiology, Emergency Department, Rheumatology) were compared. **RESULTS:** 122 physiotherapist and 120 medical practitioner referral request forms and MRI reports were reviewed. Positive pathology was demonstrated on MRI in 67% (80) of physiotherapist referrals compared with 56% (67) of medical practitioner referrals. Clinical symptoms were provided on 98% (120) and 96% (115) of physiotherapist and medical practitioner referral forms, respectively. A clinical differential diagnosis was provided on 87% (106) and 93% (112) of forms, respectively. Documentation of the side (left/right/bilateral) and the vertebral level that clinically correlated with patient symptoms were recorded in 95% (105/110) and 69% (84) of physiotherapist referral forms and 86% (74/86) and 60% (72) of medical practitioner referral forms, respectively. **CONCLUSION:** Physiotherapist requests for lumbar spine MRI provided more clinical details to assist in accurate radiological interpretation and did not increase the rate of negative MRI examinations compared with medical practitioners.



Advances in Technology poster

p1601

**A new technique for imaging Taylor Spatial and Ilizarov Frames**

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**KEY LEARNING OBJECTIVES:** Outline the role of imaging for patients with Ilizarov and Taylor Spatial frames. Highlight recurrent inadequate image quality. Introduce a new technique for imaging Taylor Spatial frames. **DESCRIPTION:** Ilizarov and Taylor Spatial frames are external fixators offering advanced orthopaedic options for correction of lower limb deformities. Used for the treatment of fracture mal-union and non-union, limb lengthening, and correction of congenital deformities, successful deformity correction relies upon a combination of antero-posterior and lateral radiographs and dedicated computer software to calculate frame adjustment. The proximal ring (the reference ring) must be orthogonal to the imaging plate for accurate measurements to be taken. Two published works have highlighted potential inappropriate therapeutic adjustments of Ilizarov and Taylor Spatial frames caused by incorrectly positioned radiographs. Possible solutions have been provided in the literature, however these suggested techniques are complex. This poster presents a simplified technique using a long-length imaging unit with the patient in an erect position. Long-length imaging units are characteristically used for imaging pre-operative limb lengthening and scoliosis but have proved successful for imaging Taylor Spatial frames post-operatively. This technique provides reproducible images that include all relevant anatomy and the entire frame. This is imperative to calculate post-application adjustments, assess the patient's progress and plan future management. **CONCLUSION:** Previous literature has addressed the issues of inadequate imaging for Taylor Spatial frames but their proposed techniques are complex. Our technique produces consistently correctly positioned radiographs and is potentially more comfortable, quicker to perform, and pleasant for the patient.

p1602

**Non malignant uptake in the musculoskeletal system on oncology FDG PET/CT imaging – avoiding aches, pains and trauma! A pictorial review**

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**KEY OBJECTIVES:** FDG PET/CT is now being widely used to assess patients with established and potential malignancy. This exhibit aims to discuss non malignant causes of FDG uptake in the musculoskeletal system and outline potential pitfalls. These are very important to consider so that appropriate decision processes can be made for patient management at multi-disciplinary meetings. **DESCRIPTION:** Several illustrative cases will be presented. Representative examples will be shown of FDG uptake due to: Physiological activity in ligaments and capsules of native "ball and socket" joints and in active muscles. Physiological activity around prostheses. Inflammation in bursae and around articular surfaces in degenerative and inflammatory arthritis. Fractures and other osseous and muscular trauma. Biopsy/surgical intervention. Infection. Other bone pathologies such as Paget's disease. Possible differentiating features of the configuration of these from malignancy will be discussed. **CONCLUSION:** Non malignant FDG uptake in the musculoskeletal system is frequently observed in PET/CT. By reviewing the large number of example images the viewer should gain an understanding of the common causes of non malignant FDG uptake and typical patterns in these categories. It is important to distinguish these non malignant causes from osseous or muscular metastases to avoid over staging by FDG PET/CT.

p1603

**Attenuation correction of myocardial perfusion scintigraphy has no clear benefits on report conclusion, reporter confidence or interobserver agreement when clinical information is known**

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**PURPOSE:** Benefits of attenuation correction (AC) of myocardial perfusion scintigraphy (MPS) have been demonstrated largely in data analysed blind to clinical information. This study assesses the effect of AC on report conclusion, reporter confidence and interobserver agreement in clinically-informed MPS. **MATERIALS/METHODS:** Adenosine stress and rest non-corrected (NC), X-ray computed tomography (CTAC) and gadolinium-153 line source (GdAC) attenuation-corrected perfusion images were acquired prospectively in 52 patients (60% male, 64±8.4 years) and reported by 2 experienced physicians in separate sessions. Overall report (normal, fixed, mixed, reversible) and reporter confidence (very low, low, moderate, high, very high) were assigned before and after provision of clinical information. Tracer uptake was scored semi-quantitatively using a 17-segment model. **RESULTS:** Both AC techniques increased summed uptake scores ( $p<0.001$ ), particularly inferiorly ( $p<0.0001$ ). Report conclusion was unaffected by the use of AC, both before and after provision of clinical information ( $p=0.73$  and  $0.35$ , respectively). When blind to clinical information, CTAC and GdAC increased reporter confidence compared to NC images alone ( $p=0.03$  and  $0.01$ , respectively). After provision of clinical information, reporter confidence was similar in all 3 groups ( $p=0.66$ ). Interobserver agreement for final clinical report was unaffected by the use of AC ( $\kappa=0.53$  (NC),  $0.52$  (CTAC),  $0.55$  (GdAC)). **CONCLUSION:** Both AC techniques correct attenuation artefact, particularly inferiorly. When blind to patient history, neither affects report conclusion but both increase reporter confidence. Once clinical information is known, report conclusion, reporter confidence and interobserver agreement are similar regardless of AC use, suggesting no clear benefits for AC when reporting MPS clinically.

p1604

**Cardiac multi-detector computed tomography: a comparison of radiation doses calculated from conversion factors and a computed based simulator**

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**PURPOSE:** The application of cardiac multi-detector computed tomography (MDCT) for the diagnosis of coronary artery disease is increasing worldwide. Previous publications calculate the effective dose (mSv) to the patient by means of a conversion factor based on the older ICRP (International Commission on Radiological Protection) tissue weights and helical chest CT scans. The aim of the study was to calculate the effective dose from cardiac MDCT using computational models incorporating the latest ICRP 103 tissue weights and compare these results with the conversion factors from previous studies. **MATERIALS/METHODS:** The radiation dose within the scanner was measured with a 100 mm pencil ionisation tube during a variety of different scanning algorithms; changes in kV and CT filters. This information, along with the mA and scanning area, was entered into the ImpACT calculator for each patient and an effective dose calculated. These doses were then compared with the doses calculated from the scan DLP and a conversion factor (0.014 and 0.019). **RESULTS:** The median effective dose calculated with the ImpACT calculator was 5.4 mSv (inter-quartile range 3.5–5.9). The dose from the conversion factors was 2.3 mSv (inter-quartile range 1.5–2.7) and 3.1 mSv (inter-quartile range 2.1–3.7) based on the 0.014 and 0.019 conversion factors respectively. **CONCLUSION:** The effective dose from cardiac MDCT is lower than levels previously published; however the use of a conversion factor applied to the DLP



from a prospectively gated scan significantly under-estimates the effective dose to the patient when compared to the dose calculated using a computer based anthropomorphic model.

### p1605

#### Is the grey-scale display of my reporting workstation OK? A quick daily check

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**PURPOSE:** Current IPEM/RCR recommendations for daily to weekly QA checks of Reporting Monitors are visual checks of a test pattern image such as SMPTE or TG18-QC (Samei, *et al.* "Assessment of Display Performance for Medical Imaging Systems", AAPM TG18). IPEM recommends that the "white on white" and "black on black" details be visible. A number of monitors meeting these requirements have been found to have very poor DICOM grey-scale compliance when checked by Physics (maximum deviation from DICOM standard of 60%, c.f. <10% deviation expected). Although the visual difference between well and poorly calibrated monitors may be very apparent when viewed together, it is less apparent when poorly calibrated monitors are viewed separately. **MATERIALS/METHODS:** A simple change in approach to viewing TG18-QC is proposed. The test pattern contains the letters "QUALITY CONTROL" superimposed over white, black and mid-grey backgrounds. The letters are displayed in diminishing contrast to background. For a monitor displaying 1024 grey-levels the "Q" is 56 grey steps different to background, whilst the final "L" is 4 grey steps different to background. The test pattern may be scored by recording the last visible letters on each of the three backgrounds. This offers a more sensitive check for white, black and mid-grey levels. **RESULTS:** By scoring the test pattern during commissioning after DICOM grey-scale compliance has been assured, a baseline for acceptable grey-scale performance may be established. Daily routine checks are very quick. **CONCLUSION:** This method offers a more sensitive check than the current IPEM method.

### Advances in Technology e-poster

#### e1606

#### CT – yet more cause for concern? Preparations for the third UK national CT dose survey

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**KEY LEARNING OBJECTIVES:** To highlight and justify the need for the third national CT dose survey in the UK. Following a pilot study we demonstrate the proposed survey format, data required and illustrate the data collection procedure. **DISCUSSION:** A combination of further developments in CT technology, a reduction in scan times and expansion of new clinical applications support the need to review current multidetector CT practice in the UK. The aims are to assess changes since the last survey in 2003, update existing examination specific national reference doses and provide guidance for some recently established examinations. As the use and application of CT continues to grow we need to revise national reference doses, since they act as the baseline for potential dose constraints in follow-up optimisation studies. The pilot study is being used to refine the survey format and data collection procedure, before the survey is expanded nationally on a voluntary basis. The national survey will require data from a mixture of sources including radiology information databases, CT scanners and Picture Archiving and Communications Systems. The pilot study is allowing us to test the field survey form presented, as well as ensure the time required and manual input for retrospective or prospective data acquisition are all optimised. **CONCLUSION:** National patient dose surveys have an important role in monitoring and advising on suitable reference doses for patients undergoing CT. Completion of the pilot survey allows us to collect further data nationally and ensure adequate patient protection in the future.

#### e1607

#### MR neuroimaging at 1.5T and 3T: what you need to know

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Center, Durham, NC, USA

**PURPOSE:** To review issues arising when transitioning from 1.5T to 3T for MR neuroimaging. **MATERIALS AND METHODS:** Suggested protocols for neuroimaging applications (*e.g.* whole brain, spine, neurovascular, acute stroke, IAC and cranial nerve, orbits, pituitary, and chronic epilepsy) were developed by a multi-institutional panel of expert neuroradiologists and experienced technologists. This exhibit presents specific suggestions for acquisition and display parameters and includes specific recommendations for essential protocol factor modifications when moving from 1.5T to 3T. **RESULTS:** The main advantage to 3T imaging is improved signal-to-noise ratios (SNR), which can translate into better spatial resolution and thus more precise anatomical delineation of brain lesions and surrounding structures, or alternatively, can be used to gain greater acquisition speed. However, many issues must be considered in adapting protocols to 3T scanning including higher specific absorption rate (SAR), and increased chemical shift and susceptibility.  $T_1$  relaxation times are increased at 3T, which positively impacts contrast enhanced scanning and MRA but also results in decreased spin echo grey-white matter contrast encouraging a shift to other techniques. High relativity contrast agents provide benefits but encourage other modifications in parameters for imaging and contrast delivery and dilution. **CONCLUSION:** MRI of the CNS at 3T is associated with the potential for significant clinical benefit. However, an understanding of the impact of the physics of higher-field imaging is critical to leveraging the maximum gain from this technique. This exhibit discusses neuroimaging protocols designed to explore the critical issues for the neuroradiologist transition from 1.5T to 3T imaging.

#### e1608

#### Pharmacokinetics and safety of gadobenate dimeglumine in patients from 2 to 5 years of age

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**PURPOSE:** To assess the pharmacokinetics (PK) and safety of gadobenate dimeglumine in 2- to 5-year-old subjects. **MATERIALS/ METHODS:** 15 subjects scheduled to undergo contrast-enhanced MRI were enrolled and received 0.1 mmol kg<sup>-1</sup> bw gadobenate dimeglumine. Blood was drawn at 1 h pre-dose, and at 5 min, 10 min pre-MRI, and at 30 min, 1 h, 2 h, and 6 h post-MRI. Urine was collected from contrast administration to 24 h. Collected samples were analysed for gadolinium (Gd) using ICP-AES. Adverse events (AEs) were monitored through 72 h postdose. Vital signs and ECGs were acquired pre-dose and then at 1 h, 2 h, and 24 h postdose. PK parameters were calculated from the blood Gd concentration-time data using compartmental and noncompartmental techniques. **RESULTS:** Peak Gd concentration (range: 50.6–91.1 µg ml<sup>-1</sup>) was observed immediately after contrast injection. After reaching peak concentrations, Gd blood levels dropped rapidly during the next 30–60 min, followed by a slower rate of decline. At 6 h after gadobenate dimeglumine administration, all subjects' residual Gd in blood was close to 1.0 µg ml<sup>-1</sup>, indicating that Gd was successfully cleared from the blood. The mean estimated elimination or terminal half-life was 1.2 h. Four adverse events were reported for 2 (13.3%) subjects. No clinically meaningful pre- to postdose differences were observed in vital signs, ECG parameters, or laboratory tests. **CONCLUSION:** Gadobenate dimeglumine was well tolerated, with no differences in PK parameters observed between paediatric subjects aged 2–5 years

and reported data in adults. Adjustment of gadobenate dimeglumine dosage does not appear to be necessary for paediatric subjects.

### e1609

#### Biochemical imaging of the cartilage (Syngo MapIt)

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**KEY LEARNING OBJECTIVES:** Introducing syngo MapIt (Biochemical Imaging) of cartilage on the Siemens MR Systems. Discussing the applications and advantages of the technique to clinicians, operators and patients. **DESCRIPTION:** This is a relatively new technique where the MR scanner can produce  $T_2$ ,  $T_2^*$  and  $T_1$  maps automatically without any additional time consuming post processing. Demonstrating biochemical changes in the cartilage.  $T_2$  mapping: a multiple SE sequence which can have up to 32 echoes. Clinically  $T_2$  maps can be used in detecting early signs of OA, it can provide information on structural changes of collagen and water content of the cartilage.  $T_2^*$  mapping: A  $T_2^*$  gradient echo sequence with up to 12 echoes.  $T_2^*$  takes into account field changes in the voxel and therefore it can be used to look at microstructures within the voxel. This can be useful in patients that have had micro fracture therapy in showing areas of repair.  $T_1$  mapping: Use a 2 angled Vibe, soiled Gradient echoes.  $T_1$  looks at the difference in concentration of Gadolinium in the cartilage pre and post contrast and is used to measure proteoglycan content of the cartilage. **CONCLUSIONS:** Biochemical imaging is proving to be a powerful tool in looking at the microstructure of cartilage. It has the potential to improve both the accuracy of diagnosis and also the planning and monitoring of treatment.

### e1610

#### Foetal magnetic resonance imaging: a new developing technique for the developing patient

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**INTRODUCTION:** Foetal MRI was first described in the 1980s. However, due to foetal motion, there was a need for maternal/foetal sedation to obtain good quality images. With the advent of ultra-fast MRI imaging technique recently, we can now obtain optimum MRI images almost independent of maternal/foetal motion. **OBJECTIVE:** To evaluate the effectiveness of new MRI sequences in depicting foetal anatomy/placental abnormalities at our MRI Suite, Department of Diagnostic Imaging, KK Women's and Children's Hospital, Singapore. **METHODOLOGY:** After obtaining their consents, 63 pregnant patients with gestational ages from 18 weeks to 39 weeks were scanned to look for foetal abnormalities or placental abnormalities. Fast MRI sequences, *i.e.* 2D, 3D FIESTA  $T_2^*$  and 2D SSFSE  $T_2$ , 2D SSFSE IR  $T_1$  and were used. Comparison was made with the findings from antenatal ultrasound. **RESULTS:** All the sequences employed, particularly the 2D and 3D FIESTA (Fast Imaging Employing S'eady state Acquisition)  $T_2^*$  were able to clearly depict foetal anatomy/placental abnormalities. In some cases, MRI demonstrated abnormalities better than ultrasound. **CONCLUSION:** Ultrasound has been the only imaging modality to depict foetal and placental abnormalities. The recent improvement in ultra-fast MRI imaging technique has enabled us to image foetus without motion artefacts. With its relatively high accuracy (50%) in diagnosis, foetal MRI is a valuable and complementary tool to routine ultrasound.

### Audit poster

#### p1701

#### Value of the lateral chest radiograph in diagnosis of lung cancer

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**PURPOSE:** Miss rates for lung cancer on CXRs vary from 10–50%. Minimising this number is important, therefore we investigated the utility of the lateral CXR in diagnosis of lung cancer. **MATERIALS/METHODS:** Initial retrospective audit of 45 consecutive cases of

lung cancer, in which at least one CXR had been performed in the preceding 12 months, was conducted. Lateral CXR was then added to the routine CXR protocol for all patients >40 years old, who had not had a previous lateral film in 3 months and who were able to stand. Subsequent reaudit of 41 consecutive cases of lung cancer was performed. Films and reports were reviewed. Audit standards included: 1. lesion should be identified in >75% of cases on a previous CXR if one was performed in the preceding 12 months. 2. if the lesion was reported, further investigation/management should be recommended in >95%. **RESULTS:** In the initial audit a lesion had been correctly identified on a previous CXR in 35/45 examinations (78%). Further investigation/management was recommended in 30/35 (85%). Following addition of lateral CXRs, where 89% of eligible cases had a lateral CXR, the lesion was correctly identified in 36/48 examinations (75%). Further investigation was recommended in 31/31 (100%) in which CT had not already been arranged. There was no significant difference in the sizes of missed lesions (mean size 3.6 cm initially, 3.0 cm reaudit). **CONCLUSION:** Addition of lateral CXR has not reduced the miss rate of lung cancers. While standards are met, alternatives to reduce missed lung cancers are required.

#### p1702

#### Current discrepancy rates in radiology

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**PURPOSE:** To show current discrepancy rates in radiology in the UK. **METHODS:** The reporting from a major UK radiology reporting service is continually audited. The reporting is done by directly employed and part-time radiologists whose primary appointment is within the NHS. Since 2007 almost 10,000 UK reports have been audited with a mixed caseload of MR, CT and plain film images from primary and secondary care. The reports are independently audited by colleagues with the relevant sub-specialty interest and expertise working in respected NHS centres. The audit system is conducted according to strict protocols (and has also been independently audited on three occasions). All discrepancies are feedback to reporters and clinically relevant discrepancies are discussed as they arose between the auditor and reporter. A five category system is used ranging from Category 5 (no discrepancy identified) to Category 1 (serious discrepancy with unequivocal potential for major morbidity). Categorisation of discrepancies is agreed between reporters and auditors, with arbitration if an immediate agreement is not reached. **RESULTS:** Total audited reports (to date)=7646. Category 1=0 (0.00%), Category 2=7 (0.09%), Category 3=304 (3.98%), Category 4=1261 (16.49%), Category 5=6074 (79.44%). **CONCLUSION:** The total rate of clinically relevant discrepancies was 4.2%. In about one per thousand reports there was a discrepancy that has a noteworthy bearing in practice (Category 2 or 1). Important clinical discrepancies were uncommon in this large contemporary series and lower than some past audit reports suggest.

#### p1703

#### Plain film reporting – a dying art for Radiologists?

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**PURPOSE:** Plain film reporting is a skill learnt over many years. In the advent of modern cross sectional imaging is this skill being lost? This audit aimed to assess sensitivity, specificity and accuracy of Radiology trainee reporting against a required standard control group. **MATERIALS/METHODS:** 100 A&E plain films, were viewed in a 1 min per film assessment. Of the 100 films, 3% were normal variants, 22% were normal and 75% were abnormal. Some films had radiographic trauma outside the primary area of interest or more than one pathology. Full marks were awarded for identifying the film as normal, normal variant or abnormal, and if the description of the normal variant or abnormality was correct. Participants of the audit were ST1, ST2, ST3 and post-FRCR Radiology trainees. Reporting Radiographers and Consultant Radiologists formed the required standard control

group. RESULTS: Sensitivity for ST1, ST2, ST3 and post-FRCR trainees reporting was 58.9%, 70%, 76.1% and 73.9%, respectively. The specificity for ST1, ST2, ST3 and post-FRCR trainees reporting was 64.7%, 79.5%, 81.4% and 70.5%, respectively. The accuracy for ST1, ST2, ST3 and post-FRCR trainees reporting was 60.3%, 72.4%, 77.4% and 73%, respectively. The sensitivity, specificity and accuracy of the required standard control group was 90%, 95.5% and 91.4%, respectively. CONCLUSION: Plain film interpretation is a core skill required by Radiologists. This audit illustrated that the required standard of reporting plain films isn't achieved even in trainees post-FRCR. Improving plain film reporting skills could be achieved by increasing plain film report numbers during training.

#### p1704

##### **Audit of the usage of intravenous contrast during CT pneumocolonography in South Tyneside General Hospital**

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PURPOSE: CT pneumocolonography has surpassed the barium enema as the non invasive investigation of choice for suspected colonic malignancy. There is still much debate regarding the appropriate use of IV contrast in CTC. Owing to the fiscal, practical and safety issues associated with this, STDH has developed a protocol for the use of IV contrast in CTC. This audit assesses adherence to this protocol before and after staff education. METHODS: Data was collected retrospectively for all patients undergoing CTC in October 2008 (cycle 1) and April 2009 (cycle 2). According to the protocol, indications for the use of IV contrast are: iron deficiency anaemia; history of known malignancy; primary colonic malignancy detected at endoscopy, which was an incomplete examination. The audit standard used is 100% compliance with this protocol. The intervention between the 2 cycles was informal staff education. RESULTS: The proportions of patients receiving contrast when it was indicated increased between the 2 cycles (47% and 100%) and decreased for those who received contrast inappropriately (20% and 16%). Thus the proportion of scans that were correctly dealt with in regards to contrast use increased from 70% to 88% ( $p < 0.05$ ). An increased service utilisation between the 2 cycles was noted (77 compared to 50 scans). Significant pathology was detected in 12/50 scans in cycle 1 and 7/77 in cycle 2 and of this 36% was extra-colonic in nature. CONCLUSIONS: Improved adherence to the departmental protocol can easily be achieved through informal education of involved staff.

#### Audit e-poster

#### e1705

##### **Audit of the requesting of abdominal plain films by the casualty department in a single hospital**

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PURPOSE: The abdominal X-ray (AXR) has been superseded by other imaging techniques for several indications and updated guidelines have reflected this. The AXR is frequently requested in casualty by junior, non-specialist staff. We sought to determine if the AXR was appropriately requested according to national guidelines: The Royal College of Radiologists: Making the best use of clinical radiology services (MBUR), 6th edition. MATERIALS/METHODS: 100 consecutive patients who had undergone an AXR in casualty were retrospectively identified from the hospital Radiology Information System. Demographic data, indication, adherence to guidelines and further investigations were recorded. RESULTS: 77 of 100 (77%) examinations did not meet the MBUR guidelines, based on the clinical information given. In 17/23 (74%) compliant requests the AXR was the definitive test. Common inappropriate indications included suspected perforation, renal colic, abdominal pain, abdominal trauma and constipation. The majority of patients who underwent a further, definitive radiological investigation had an inappropriate AXR first

(47/57, 82%). In only 3/13 (23%) AXR requests for renal colic was a CT urogram subsequently performed. CONCLUSION: A culture appears to exist amongst junior casualty staff that an AXR is necessary regardless of more appropriate alternative investigations. This may be due to several factors including poor awareness of guidelines, easy access to plain X-ray imaging and a belief that surgical specialists will expect them. We plan to present our findings to the casualty department, remind the clinicians that the referral guidelines are available via the Trust intranet site and re-audit in 6 months time.

#### e1706

##### **Are radiology reports always read and acted on?**

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PURPOSE: The aim of this audit is to assess whether radiology reports are documented and acted on, and to highlight those areas that do not meet the required standards and recommend how these can be improved. MATERIALS/METHODS: This is a retrospective audit looking into 100 patient notes, taking five cases from 20 different clinical areas. Patient demographics, type of radiological procedure and evidence of clear documentation of acknowledgement of the radiology report and subsequent management plan in the patients' notes was collected. The cases were divided into those with significant or non-significant pathology based on the radiology reports. In accordance with good medical practice and IR(ME)R regulations a 100% compliance is expected. RESULTS: Clinical areas were divided into acute care areas which included medical and surgical assessment areas, A&E, wards and outpatients. Overall, radiology reports were documented in 82% of the cases with 92% having a management plan. Amongst the 3 clinical areas, wards fared the worst with only 73% having reports documented and 88% having a management plan. Acute care areas fared the best with 95% in both categories but none reached the 100% target. CONCLUSION: This audit has shown that radiology reports may not be regularly read and/or acted upon. This is particularly the case when the report has a non significant pathology and for ward patients. We will present recommendations to mitigate this problem.

#### Digital Imaging & Health Informatics poster

#### p1801

##### **Double reporting: it can work?**

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PURPOSE: Double reporting is routinely used for screening mammograms and contrast enemas, but can it work for all imaging? DoH considers double reporting cost effective for error trapping when balanced against litigation costs, while affording a uniform approach to reporting and increasing consistency despite lacking good evidence or sufficient NHS resources for it. METHODS: One Independent Sector contractor was funded for 100% double reporting of all ultrasound, non-contrast CT, MRI, echocardiography and plain radiography for 6 months in 2007 (before premature contractual closure) using UK-based Radiologists via Teleradiology links. All reports were scored 1-5: Reports scoring 1-3 were reviewed for validation, or submitted directly to one of the regular discrepancy meetings held in accordance with RCR standards. Validated reports were fed back to QA Radiologists or reporting Radiologists for education, or submitted to Discrepancy meetings if feedback was deemed inaccurate. Final rulings occurred at Discrepancy meetings, any changes communicated to referring clinicians as required. RESULTS: 1807 MRI, 148 CT, 163 Radiographs, 317 echo's and 732 ultrasound scans were done in all with scores of 4 or 5 (*i.e.* no amendment to reports) achieved in >75% exams. Across all modalities reports scoring "1" or "2" accounted for <10% (<1% for ultrasound and echo). CONCLUSION: The conception and implementation of properly funded double reporting is sound when underpinned with IT support, gives reproducible results but some valuable lessons were learned along the way.

**p1802**

**PACS vs without PACS: effectiveness of fast track recall of missed X-rays**

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**OBJECTIVE:** Current software designs in PACS do not allow clinicians to access/edit information, once the X-rays have been processed. We aim to study the effectiveness of fast track recall of missed X-rays (without PACS) using white labels in A&E set up. **METHOD:** A local standard of 100% White Labelling of the X-rays done in Accident and Emergency department was set. The casualty officers were asked to write down their own diagnosis on the white label, clearly stating whether there is a fracture or the radiograph is normal. Retrospectively, 1-week sample of casualty X-rays were reviewed. The radiographs were sent to the Radiology department to note down the discrepancy between the casualty officer and the Radiologist. The Radiologists were advised to write down fast track recall if they pick up any abnormality that was missed by the casualty officer. **RESULTS:** A total of 285 films were retrieved. Majority of the films were reported with in 3 days. 3 mismatches were found. These were 5th metatarso-phalangeal joint dislocation, wedge fracture of T12 and one radiograph showing fracture of the superior and inferior pubic rami. This patient was recalled. The other two patients received appropriate treatment when they were in Accident and Emergency Department. **CONCLUSION:** PACS need to bridge the time gap between the A&E clinicians and Radiologists after X-ray processing and before formal reporting. PACS should have tools, where the clinicians in Accident and Emergency can type their own interpretation prior to the availability of formal report.

**p1803**

**MRI reporting time delay: A two tier reporting system at a University Hospital**

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**BACKGROUND:** Radiological investigations play an important role in the clinical decision making process. Therefore to maximise care it is ideal to report investigations as soon as possible. **OBJECTIVE:** We measured the time taken for MRI head scans to be reported when performed on a named Consultant lists and compared this to the reporting time for those scanned on Initiative lists. The aim was to assess if a two tier reporting system was in existence. **METHOD:** The data was gathered retrospectively from reporting records for MRI head scans performed in November 2008. The time delay was calculated by comparing the date scanned with the date for a verified report to be issued. MRI scans were then divided into those that were performed on a consultant list and those that were performed on an initiative lists. **RESULTS:** 722 MRI head scans were reported during the audited month. Scans reported on initiative lists were either reported locally or were outsourced. Those scans performed on a dedicated consultant list took on average 0.59 days to be reported. The average time for general neuroradiology reporting pool scans to be reported locally was 14.79 days. Scans outsourced took on average 26 days to be reported. **DISCUSSION:** Our data suggests there is a significant delay in the time taken for scans to be reported when scanned on initiative lists and added to a general neuroradiology reporting pool. This is clearly a two tier system, and strategies for dealing with this will be discussed.

**p1804**

**Virtual radiology training using clinical (Social) networking technology**

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**PURPOSE:** To demonstrate the potential for clinical (social) networking technology as a means of delivering on-line radiology image interpretation training for medical students **MATERIALS/METHODS:** A Web 2.0-based social networking system, coupled to

a web-based DICOM communications and viewing imaging platform (PACSMail) was used to enable the creation, transfer and remote viewing/reporting of "virtual" case files. An expert report was sent to participants once their own report was complete. A pilot study was carried out to assess the ease of use and educational potential the system. The assessment was carried out by a group of medical registrars who reported their findings through an online feedback questionnaire. **RESULTS:** Students were able to self-register and set up their online training accounts with no IT assistance. Other than access to documentation, no training in use of the system or viewer was required. All participants that found the process of registration and set up of their account was either Very Easy or Easy. All found the use of the system for viewing images was either Easy or Manageable. Most participants recorded the potential for the system as an educational medium as either Excellent or Good. **CONCLUSION:** These findings suggest that this approach could provide an easily accessible means of providing remote training on radiological image manipulation and interpretation. The study also suggests that the system may also have other potential applications, notably as a means of supporting cross-disciplinary, multi-site medical practices.

**p1805**

**Is IMPAX better than the old PAC system?**

Khan, A.<sup>1,2</sup>, Patil, S.<sup>1</sup>, Jenkins, S.<sup>1</sup>, and McKnight, L.<sup>1</sup>

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**PURPOSE:** PACS was introduced in our hospital in September 2007, with the arrival of IMPAX in late 2008, there were questions being raised as to "which is better"? **METHOD:** A week long questionnaire survey was carried out among different grades of doctors. 65 responses were obtained with 33 being junior doctors, 28 being middle grades and 4 consultants of all these only 53 were regularly using PACS. **RESULTS:** 53% of the doctors thought the old PACS was better, and only 2% thought the IMPAX was good. 45% were not aware of the differences. It was then looked as to how the teaching sessions on IMPAX were advertised; the answer was in several different methods: Intranet, In-person at O/P clinic, emails to heads of department, Posters. Despite of this only 29 had attended any kind of teaching sessions. When asked for the reasons for "No training" nearly half of the people surveyed were unaware of any training sessions being held. 6% gave the reason of account log in and password difficulty. 20% said "they had no time" **CONCLUSION:** Regardless of IMPAX being faster, with increased efficiency and its ability to be accessed offsite, it was still thought that there was not much awareness among people. This could be developed by introducing training sessions as part of induction package and departmental teachings. The accessibility issues should be resolved, most important of all "the old PACS should be stopped" so as to understand and access the IMPAX more frequently.

**p1806**

**Diffusion of medical imaging informatics in resource constrained settings**

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**PURPOSE:** Although Medical Imaging Informatics (MII) systems such as PACS are widely commercially available, their use to date has been localised to large urban settings MII has yet to diffuse into resource constrained settings, such as community and rural hospitals, despite their potential impact. This work establishes quantitatively examines the cost and clinical impact of MII in two large urban hospitals to form a model to predict the impact of implementing MII in small community and rural hospitals. **MATERIALS/METHODS:** Retrospective clinical and cost data from two large academic medical centres in Northeastern USA that implemented PACS after each other were used in a case-control comparison to quantitatively determine the impact of MII. Using representative data from smaller institutions, a

model community and rural hospital model was established to predict the impact of MII in these settings. RESULTS: Improved productivity in urban settings in terms of monthly RVU and RVU/FTE increased by  $29\% \pm 4\%$  and  $63\% \pm 5\%$  in the work and technical components, respectively. Payback period for capital investment was 48.8 months. Using this data for predictive models in resource constrained settings indicates that lack of capital and cost barriers remain as obstacles to MII diffusion. CONCLUSION: MII has a significant impact on both operational costs and clinical productivity. However, the even conservative estimates of observed impact in urban settings projected into rural and community settings show that cost and capital barriers still remain.

## Digital Imaging & Health Informatics e-poster e1807

### A simple computer coding system improves the rate of recording and auditing of reporting discrepancies

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KEY LEARNING OBJECTIVES: 1. To trial a simple coding system using the Addendum facility on the HSS Computerised Radiology Information System (CRIS), to simplify the recording of reporting discrepancies. 2. To study reporting discrepancies according to type of discrepancy, clinical significance, investigation, and reporter. DESCRIPTION: A simple coding system, reflecting the severity of a discrepancy, was introduced on the HSS CRIS Addendum facility when reviewing reports. The code can be quickly added, and allows CRIS to recall all recorded discrepancies, with subsequent classification by reporter, investigation, and potential clinical severity. Minor and significant discrepancies, which had the potential to cause harm, were audited over a 4 month period using medical notes to assess patient outcome. CONCLUSIONS: 1. The number of discrepancies recorded more than doubled from the previous paper based system. 2. The reliability of recording and subsequent recalling of discrepancies was greatly improved. 3. The frequency of discrepancy review meetings increased from 4 in 12 months to 5 in 6 months, and radiologist attendance from 45% to 80% – with an increased feeling of ownership. 4. Discrepancies occurred most commonly among CT scans; however these scans were more commonly reviewed than other investigations, particularly in multidisciplinary team meetings. 5. Audit of reporter versus potential clinical severity found no trend. 6. Few discrepancies lead to patient harm. 7. The coding used in the addendums correlated well with the potential clinical significance of the discrepancy identified in the medical notes.

## e1808

### Advances in post processing technology for quantifiable 3D dynamic evaluation in MRI

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KEY LEARNING OBJECTIVES: An understanding of: syngo Tissue 4D functionalities. The applications and uses of syngo Tissue 4D. How syngo Tissue 4D works. DESCRIPTION: syngo Tissue 4D is an application card for visualising and post processing Dynamic Contrast-Enhanced Magnetic Resonance Imaging (DCE-MRI) studies. Quantitative mapping of the transfer constant  $K_{trans}$  and the leakage space  $V_e$  is performed by pharmacokinetic modelling to determine tissue permeability, perfusion and cell density whilst using the  $T_1$  values of the tissue for the conversion of signal intensities into contrast concentration values. The main purpose of the application card is to facilitate the Radiologist in tumour diagnostics, recurrent tumour evaluation and also therapy monitoring. It provides a standardised and quantifiable method of analysis that enables comparability of results in follow up examinations and in multi-centre and multi-vendor studies. It currently has FDA approval for use in the prostate, liver and brain. The card provides colour display of parametric maps describing the contrast media kinetics such as: Transfer constant ( $K_{trans}$ ); Reflux

constant (Kep); Extra vascular extra cellular volume fraction ( $V_e$ ); Plasma volume fraction ( $V_p$ ); Initial Area-Under-Curve (iAUC) for the first 60 s. The pharmacokinetic calculation on a pixel-by-pixel basis uses a two-compartment model, with the calculation based on the Tofts model. CONCLUSIONS: The use of syngo Tissue 4D brings many clinical advantages to the analysis of tumour diagnosis and monitoring. This software has many advantages, but primarily offers a means of acquiring quantifiable and standardised information, with an improved workflow for oncology reporting.

## e1809

### Teleradiology and its implications in future decision making about remote interventions: are we heading for tele-robotic-radiology

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PURPOSE: Literature review of articles on: Teleradiology Telerobotics Telemedicine Robotic surgery and Intervention. To demonstrate that with recent advances we are heading for an era where interventions could be performed offsite. METHOD AND MATERIALS: We have reviewed literature available related to Teleradiology, Robotics and intervention and enlist interventions which in future could be performed by a trained operator. These include remote ultrasound biopsies drainage procedures vascular interventions tumour ablations surgery. RESULTS: All modalities including fluoroscopy, ultrasound, CT and MRI can be utilised for remote interventions. We are soon entering an era where skilled Radiologist will be able to provide their services all over the world. CONCLUSION: Teleradiology has its own merits and demerits however utilisation of Teleradiology, Telerobotics and Robotic surgery would be a useful aid in deciding and planning future interventions. Awareness and inclusion of advanced modalities in Radiology curriculum is advised. CLINICAL RELEVANCE/APPLICATION: Awareness and inclusion of advanced teleradiology and telerobotics modalities in Radiology curriculum for Trainees is advised.

## Student Radiography poster

### p1901

#### Optimising cervical spine imaging with digital radiography for the trauma patient

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PURPOSE: The principal advantage of digital radiography is optimisation of image contrast through look-up-tables. However, debate still surrounds the use of grids for imaging of the antero-posterior cervical spine (AP c-spine). The aim of this study was to compare images of the AP c-spine, with and without grids (stationary and bucky) processed using linear-look-up-tables (L-LUT) and c-spine-look-up-tables (C-LUT). METHODS: A tissue-equivalent anthropomorphic-phantom was used to obtain images at 115 cm source-to-image-receptor distance. Collimation was kept constant throughout. A Siemens Multix-Top X-ray tube and a Konica Regius-150 computed-radiography system was used. 73 kVp was used with 18 mAs for both the stationary grid and the bucky, and 6.3 mAs for no grid. 10 images and 20 dose measurements were obtained for each parameter (improving statistical validity). Entrance-dose measurements were undertaken using a Barracuda dosimeter (RTI). Image-quality was assessed by two separate, blinded, readers using a 21-point grading system, (14=diagnostic quality). RESULTS: Images acquired using the C-LUT were assessed as having a higher image quality (16.46, SD=1.82) when compared with the L-LUT images (14.92, SD=0.86). Images taken using the C-LUT without a grid scored 17.3, SD=1.74 compared with 14.4, SD=2.58 for the stationary grid and 17.75, SD=1.65 for the bucky. The difference in dose between non-grid and grid/bucky exposures (307.17  $\mu$ Gy (SD=0.30) and 878.65  $\mu$ Gy (SD=0.62), respectively), were statistically significant ( $p < 0.0001$ ,  $t$ -test). CONCLUSION: This study's findings suggest that the use of

digital radiography when imaging c-spine patients may eliminate the need for a stationary grid without a perceivable impact upon image quality, with the further advantage of a reduced patient dose.

## Multisystem Disorders e-poster e2001

### **Familial paragangliomas: all in the genes. What the radiologist needs to know**

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**KEY LEARNING OBJECTIVES:** To highlight the use of appropriate imaging techniques in the diagnosis and follow-up of hereditary paragangliomas based upon the presenting genotypic variant.  
**DESCRIPTION:** Paragangliomas are unusual chromaffin positive neuroendocrine tumours. They are predominately located in the head and neck, but are not confined here. Although 90% are benign and non-secretory, early detection is vital to reduce morbidity from local mass effects; furthermore patients with malignant tumours

must undergo careful surveillance for metastatic deposits. Up to 35% of paragangliomas are inherited in an autosomal dominant fashion. Genetic inheritance alone predisposes to younger age of onset and is associated with overlap endocrine syndromes. Mutations in the genes encoding succinate dehydrogenase (SDH) are most commonly implicated. The three subtypes SDHB, SDHC and SDHD result in distinct clinical syndromes – although overlap may occur. SDHB is implicated in abdominal paragangliomas with high malignant potential. However, SDHC and SDHD are more commonly associated with benign head and neck paragangliomas. Studies have outlined the most sensitive and specific modalities for diagnosis and staging according to the mutation, and these will be discussed. It is therefore important to be aware of the presenting genotype to allow optimal and more focused radiological investigation and interpretation.  
**CONCLUSION:** Together with genetic screening of relatives and biochemical investigation, radiological evaluation is paramount in the early detection and follow-up of familial paragangliomas. This poster aims to highlight the recently recognised genotypes and illustrate appropriate radiological and scintigraphic imaging strategies of the evolving field of hereditary paragangliomas.

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