P-158  The rules of the game
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Aim: Using Bernstein’s theory of pedagogic discourse to explore how student radiographers determine whether radiographic images are normal or abnormal.

Content: A study focusing on third year student radiographer’s image interpretation abilities using Bernstein’s educational theoretical framework as an, in-depth analytical method to illuminate the tacit rules that underpinned their interpretive decisions.

Relevance/impact: Many higher education institutions have incorporated image evaluation skills into their pre-registration courses, ensuring that their students have acquired and developed these skills before graduation. Bernstein’s framework can be utilised as a data analysis instrument providing educators with a deeper insight into the challenges that their students face when applying notions of normal or abnormal.

Outcomes: The students accurately produced notions of abnormality contingent with their learning environment across case 1 revealing their acquisition of the recognition and realisation rules. However, when presented with a more challenging image (case 2) weak realisation rules authorised some of the students (n=5) to deviate from legitimate meanings despite being empowered with the recognition rules.

Discussion: Bernstein’s theory highlights two types of tacit rules embedded in the student’s interpretations. Recognition rules, said to determine ‘what’ legitimate meanings (i.e. trauma characteristics) might be put together, and realisation rules, which determine ‘how’ these meanings are put together during normal vs. abnormal. The recognition and realisation rules are useful for identifying whether students have acquired ‘the rules of the game’ and understand what is required of them to carry out a competent interpretation of an X-ray image.

Computer assisted detection/diagnosis and image perception

P-159  An investigation into perceived image quality by the application of colour scales to chest radiographs
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Introduction: Despite the concept of colour radiography first being brought about in 1951 and the great advances that have been made in modern digital systems, with their ability to manipulate data post exposure, little research has been undertaken into the application of colour scales to medical radiographic images.

Methodology: Three sets of twenty four chest radiographs, one with an inverted greyscale applied, one with a fire scale and one with an inverted fire scale were compared against their greyscale equivalents by eight radiography students at the end of their final year of study and marked for specific image quality criteria using a five point Likert scale.

Results: Overall, the inversion of the greyscale was perceived to enhance the image quality the most, yielding an average score of greater than three for six out of seven of the image quality criteria, with a p-value of <0.05 being returned for four out of those six criteria. However some of the participants did favour the fire scale and inverted fire scale for specific image quality criteria.

Conclusion: The application of varying scales to chest radiographs can be used as a useful adjunct to traditional greyscale in the interpretation of chest radiographs.

P-160  Iterative reconstruction for CT pulmonary angiograms: A phantom study to investigate potential dose reduction
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Aims/objectives: To establish whether iterative reconstruction (IR) algorithms can be applied to CT pulmonary angiogram (CTPA) examinations enabling radiation dose to be reduced whilst maintaining image quality.

Content: A retrospective review of CTPA image quality was conducted to establish baseline quality. A phantom study was then conducted using an anthropomorphic chest phantom with a contrast enhanced artificial main pulmonary artery inserted.
The scan exposure factors were reduced incrementally by reducing the effective mA whilst keeping the kV constant. Images were reconstructed using a combination of filtered back projection (FBP) reconstruction and IR with the number of iterations ranging from 0-5 for each exposure. Imaging was conducted on a Siemens Definition 128 slice scanner.

Image quality was evaluated using subjective and objective measures to include a blind review by radiologists and signal- and contrast-to-noise ratio within the main pulmonary artery.

Relevance/impact: IR is becoming more widely available yet few studies have evaluated the application to CTPA examinations.

Outcomes: Initial analysis indicates that a significant dose reduction is possible whilst maintaining the baseline image quality in terms of both subjective and objective measures. Further analysis is ongoing and will include an estimation of the potential radiation dose reduction.

Discussion: The results of this study are promising and suggest a reduction in radiation dose is possible whilst maintaining image quality. Further work is necessary to investigate the application of these findings to a patient population.

P-161 CO2 angiography; why use it?
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Carbon dioxide (CO2) has been used as an alternative agent to iodinated contrast for angiography for more than half a century. It's popularity has grown slowly over the years, pioneered by Hawkins in the 1970s by the use of Digital Subtraction Angiography (DSA).

Due to the fact that CO2 is a natural product within the humans, it has proven useful in cases of patients who require imaging but have an allergic reaction to iodinated contrast. CO2 as a contrast medium has also been demonstrated to be very safe. It does not cause any significant renal toxicity, and is therefore the agent of choice for those with renal impairment and/or diabetes. Even large volumes injected intravascularly result in no changes in arterial pH, pCO2 and pO2. Studies have demonstrated that the CO2 is respired out of the lungs on first pass.

The use of CO2 is however limited to the use of arteries below the diaphragm, due to the risk of spinal, coronary and cerebral artery gas embolisms. It is also not used in those with cardiac septal defects- which would cause a right to left shunt, thereby risking cerebral gas embolisms.

The introduction of CO2 angiography into this institution will be described.

P-162 A method to investigate image blurring due to mammography machine compression paddle movement
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Background: Compression paddles can move during mammography exposures. Speculation suggests that this movement can cause image blurring. Our method and data demonstrate that paddle movement can cause image blurring.

Aim: Develop a method to determine whether paddle movement can cause image blurring.

Method: A Hologic Selenia Dimensions mammography machine calibrated to give compression force in Newtons (N) with 24 x 29 cm fixed and flexible paddles were used in this study. Previous phantom-based research has demonstrated that these paddle move (Hauge et al). Eleven metal ball-bearings with 1.50mm diameter were inserted onto the surface of a deformable breast phantom. The ball-bearings were placed at various points, from nipple to chest wall. The phantom was compressed using the foot pedal then hand wound to 80N and also 150N respectively to represent low and high compression forces used in clinical mammography. Under these conditions, 39 mammogram images were created by exposing the phantom/ball-bearings. Image blurring was determined by measuring the change in ball-bearing diameter (distortion) using computer software.

Results: Ball-bearing diameters increased, illustrating the effect of compression paddle motion on the images. The change in ball-bearing diameter is the highest around the nipple region for both fixed (1.688±0.013 at 80N, 1.694±0.005 at 150N) and flexible (1.714±0.003 at 80N, 1.661 ±0.005 at 150N) paddles.
**Conclusion:** The increase in ball-bearing diameter suggests that paddle movement can be identified on mammography images. Increase in diameter can be used as an indicator of movement severity.

**P-163 Development of personalised paediatric femora model using CT**

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**Objectives:** Children younger than three years old are most likely to experience inflicted injuries. Current diagnosis is heavily dependent on clinicians’ experience and lacks objective measurements. Individualised biomechanical models could be used to identify when the carers’ narrative of the accident is physically incompatible with observed fracture. The first step towards this ambitious goal is to verify the feasibility to generate accurate biomechanical models from medical imaging data of very young children.

**Methods:** Ten QCT scans were performed as part of post-mortem examination of children (0-3 years) using a GE Lightspeed 64-slice CT scanner. The scans were segmented to create finite element models of the right femora. The stiffness (Young’s modulus) of femur was estimated based on measured Hounsfield units using a well-established densitometric calibration protocol. Each model was subjected to a series of four-point bending simulations, representing various directions of impact perpendicular to the shaft.

**Results:** The cross-section of the femur at mid-shaft became elongated in the anteroposterior direction for older children. The mature cortical bone was present at a very early age. The load to fracture as predicted by the biomechanical model varied with age.

**Conclusions:** This preliminary study showed that the current approach was appropriate and capable of distinguishing effects of loading, mechanical properties and geometry. Both the length and diameter of the femur increase with age, while the stiffness becomes more differentiated. The model will be further developed to simulate loading scenarios during inflicted injury to help identify injury characteristics in suspected abuse.

**Current and emerging techniques**

**P-164 Diffusion weighting in abdominal imaging - a problem solving tool**

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Diffusion imaging is a valuable tool in diagnostic magnetic resonance imaging. It is an established and well recognised technique, however it is often under utilized in the investigation and diagnosis of abdominal pelvic disease.

The strength of diffusion imaging lies in its sensitivity and ability to detect inconspicuous lesions, but challenges occur in its interpretation due to susceptibility to artefact when acquiring different diffusion sequences. Diffusion imaging is often invaluable in the detection and characterisation of lesions, especially when evaluated in conjunction with standard abdominal MRI sequences. Occasionally it can prove the sole component of the study that determines clinical outcome.

We present a pictorial review to demonstrate the technical aspects of diffusion in abdominal imaging. Emphasis will be made on clinical cases such as cancer staging, which demonstrate its value in lesion detection and characterisation as well as the common pitfalls.

**P-165 Peninsula Trauma Centre: Our experience of imaging of pelvic fractures with emphasis on review of anatomy, classification systems and associated injuries**

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*Plymouth Hospitals NHS Trust*

**Introduction:** We come across a large amount of pelvic trauma as we are now the major trauma centres in the West Country and are called ‘Peninsula Trauma Centre’. We see a significant volume of trauma in Southwest of England associated with Motorcross, horse-riding and surfing.

**Objectives:** We perform a Pan-trauma CT, for all the patients, who qualify the trauma criteria. The radiologist plays a significantly important role in making an accurate and quick diagnosis. The anatomy of the pelvic ring is quite complex and it is important to understand the mechanisms of injury that lead to disruption of the ring.