



B1 What do we need to understand - what are the additional considerations we need to have when providing radiotherapy for LGBT+ individuals?

B1.1 Evaluating the perceptions of the transgender and non-binary communities on pelvic radiotherapy information booklets

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Background: Acute and late toxicity arising from pelvic radiotherapy can cause a significant impact on psychosocial functioning and quality of life (Esparza, 2018). Having written information regarding these symptoms in the form of booklets is helpful to patients in making informed decisions about their management and as a reference for support throughout radiotherapy treatment. The UK transgender and non-binary communities are growing steadily (GIREs 2011), yet their needs differ from those of the general population and it is unclear if the information booklets produced for patients undergoing pelvic radiotherapy provide relevant support to this demographic.

Method: An online survey was distributed via social media to evaluate the perceptions of these communities of four commonly distributed pelvic radiotherapy information booklets. Likert questions addressed overall appropriateness and relevance of the booklets while open questions sought qualitative responses regarding these answers.

Results: In total, 18 full responses were provided. Respondents found the information to be relevant but that language and assumptions made regarding their social and sexual dynamics were incorrect and, in some cases, distressing. Some respondents pointed out that the language used may be confusing for non-binary people who identify as neither men nor women, and for those individuals who may have undergone part of a medical transition, who are not represented. Some stated plainly that the wording or guidance included would make them feel uncomfortable.

Conclusions: Further research is required to establish what is needed to provide an inclusive and empowering booklet for transgender and non-binary individuals undergoing pelvic radiotherapy.

1. Esparza AO, Tomás MÁ, Pina-Roche F. Experiences of women and men living with urinary incontinence: A phenomenological study. *Appl Nurs Res* 2018;40:68-75

2. Gender Identity Research and Education Society. The Number of Gender Variant People in the UK - Update 2011

B7 GI and GU short paper presentations

B7.1 Renal oncocytoma: Can we diagnose them on pre-op CT?

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Purpose: To retrospectively review the pre-operative imaging of a case series of pathologically confirmed renal oncocytomas to determine if the radiological findings are predictive for accurate diagnosis.

Methods and materials: Patients were identified from a local pathology database that also had pre-operative imaging available. From 2006-2017, a total of 164 scans from 117 patients were reviewed. The scans were assessed for characteristic imaging features based on a critical review of literature.

Results: There were 77 male and 40 female patients, with a mean age of 68 years old (with a range of 36 to 82). 3 patients had bilateral masses. 2 patients had concurrent renal cell carcinomas. 23 patients had recorded symptoms including pain and haematuria. Mass sizes ranged from 15 to 150mm in diameter. 98 (82%) were exophytic. All the masses showed contrast enhancement. 87 (73%) had heterogeneous enhancement. Only 11 (9%) of lesions had a stellate scar. 4 (3%) had a cystic component. 30 patients had follow-up imaging, of which 14 (47%) showed significant interval growth. None of the patients had lymphadenopathy, renal vein invasion, or metastases.

Conclusion: Oncocytomas can have variable CT appearance and often mimic a renal cell carcinoma but some authors say they can be predicted accurately. In our case series, few had the 'typical findings'. Only a minority were small masses in young patients. Few had a typical homogeneous appearance with a central stellate scar. Therefore, oncocytomas cannot be accurately diagnosed on pre-op CT, and histological diagnosis is still required.

B7.2 It is time to think inside the (collimation) box; A quality improvement project to reduce over-scanning in CT KUB

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Background: The Royal College of Radiology (RCR) recommends CTKUB as the first line investigation for renal colic. Radiology departments need to optimise CTKUB scans to reduce unnecessary scan length. The RCR recommends that excess scan length above the upper pole of the highest kidney should not exceed 10% of the total scan length. Currently there is no literature assessing if this is being achieved.

Aim: The aim of this quality improvement project is to determine what proportion of CTKUBs performed at a district general hospital (DGH) are meeting this standard and to explore improvement options as necessary.



Method: A retrospective study was performed of 100 consecutive patients who attended a DGH Emergency Department with renal colic from 1-30 October 2018 and subsequently had a CTKUB. The number of slices above the upper pole of the highest kidney, relative to total scan length was recorded. Radiographers at the DGH believed that over-scanning could be reduced by viewing CTKUB image acquisition in real time and manually stopping the scan when the top of the highest kidney was seen. This was implemented and the departments CTKUBs were re-audited using 50 consecutive patients from 15-28 November.

Results: Scan length above the highest kidney exceeded the standard on 81 of 100 CTKUBs (81%). Over-scanning was reduced to 7 of 50 patients (3.5%) after implementation of the intervention.

Conclusion: The DGH in this study was over-scanning 81% of patients having a CTKUB. Radiographers manually stopping the CTKUB reduced the number of patients over-scanned to 3.5%.

Turney, B.W., Reynard, J.M., Noble, J.G. and Keoghane, S.R. (2012) Trends in urological stone disease, *British Journal of Urology International*, 109(7): 1082-7

B7.3 MR Enterography: A comparison between Moviprep and Mannitol and Locust bean gum

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Background: MR enterography is a widely utilised imaging method for the assessment of small bowel. The success of the study predicated upon adequate distension of small bowel. There is at present no general consensus on best oral distension agent for MR enterography. This study seeks to compare bowel distension and patient satisfaction between two oral preparation agents - Moviprep and Mannitol with locust bean gum (Mannitol-LBG).

Method: Prospective recruitment of 60 patients undergoing MR enterography. Of these patients, 30 had Moviprep and 30 had Mannitol-LBG bowel preparation. Patients were given an optional questionnaire on acceptability of the preparation. Bowel distension was measured across three small bowel points (jejunum, mid ileum and distal ileum) on all study scans. Overall assessment of bowel distension (adequate vs inadequate) was also performed. Statistical analysis performed on SPSS.

Results: There was a significant difference ($p=0.005$) in mean bowel diameter with Mannitol-LBG (17.8mm) compared with Moviprep (15.5mm). In particular, significantly ($p=0.001$) better jejunal distension was observed with Mannitol-LBG (20.1mm vs Moviprep 15.8mm). Patient satisfaction with drinking the preparation was higher with Mannitol-LBG (76%) than with Moviprep (68%) but this was not statistically significant ($p=0.85$). Patient compliance was better with Mannitol-LBG, with 60% of patients finishing the preparation, in comparison to Moviprep (53%, $p=0.79$). A higher percentage of studies with Mannitol-LBG (87%) were deemed as adequate, in comparison with studies with Moviprep (73%), but this was not statistically significant ($p=0.33$).

Conclusion: In comparison with Moviprep, Mannitol - LBG preparation yields higher average bowel distension, and is associated with higher patient satisfaction and compliance.

B7.4 The efficacy of CT, MRI and FDG-PET/CT for target volume delineation in radiotherapy treatment planning of colorectal Cancer: a systematic review

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Background: The roles of preoperative chemoradiotherapy and advanced conformal radiotherapy techniques in rectal cancer treatment are well recognised. However, the benefits of these strategies may be lost or detrimental without accurate tumour volume delineation using appropriate imaging techniques. This systematic review investigated the efficacy of CT, MR and FDG-PET/CT imaging and the effects of their use on the interobserver variation in target volume delineation in radiotherapy planning of rectal cancers.

Methods: PubMed, EMBASE, Cochrane library, CINAHL, Web of Science and Scopus databases and other sources were systematically queried using keywords and relevant synonyms. Eligible full-text studies were assessed for methodological quality using the QUADAS-2 tool and data were extracted.

Results: Of 1448 originally identified studies, eight studies ($n=261$), all cross-sectional studies met the inclusion criteria. Findings show that MRI significantly delineate larger tumour volumes than FDG-PET/CT while DW-MRI identified smaller GTVs compared to T2W-MRI. CT-GTVs were found to be larger compared to FDG-PET/CT. FDG-PET/CT further identified new lesions and tumour volumes extending outside the routinely used clinical standard CT tumour volumes in about 15-17% and 29-83% of patients respectively. Between observers, delineated volumes were similar and consistent between MRI sequences whereas, interobserver agreement was significantly improved with FDG-PET/CT than CT.

Conclusion: FDG-PET/CT and DW-MRI appears to delineate smaller rectal tumour volumes and shown improved interobserver variability. With FDG-PET/CT, approximately one in six patients had a change in treatment plan. Multimodality imaging shows ample potential for future rectal cancer radiotherapy planning.

1. Gwynne, S., Mukherjee, S., Webster, R., Spezi, E., Staffurth, J., Coles, B. & Adams, R. (2012). Imaging for target volume delineation in rectal cancer radiotherapy - a systematic review. *Clin Oncol*, 24(1), 52-63

2. Joye, I., Macq, G., Vaes, E., Roels, S., Lambrecht, M., Pelgrims, A., Haustermans, K. (2016). Do refined consensus guidelines improve the uniformity of clinical target volume delineation for rectal cancer? Results of a national review project. *Radiotherapy & Oncology*, 120(2), 202-206

3. Liberati, A., Altman, D. G., Tetzlaff, J., Mulrow, C., Gøtzsche, P. C., Ioannidis, J. P. A., Moher, D. (2009). The PRISMA statement for reporting systematic reviews and meta-analyses of studies that evaluate healthcare interventions: explanation and elaboration. *BMJ*, 339:b2700



4. MacManus, M., Nestle, U., Rosenzweig, K. E., Carrio, I., Messa, C., Belohlavek, O., Jeremic, B. (2009). Use of PET and PET/CT for radiation therapy planning: IAEA expert report 2006-2007. *Radiotherapy & Oncology*, 91(1), 85-94

5. Rahbari, N. N., Elbers, H., Askoxyllakis, V., Motschall, E., Bork, U., Büchler, M. W., Koch, M. (2013). Neoadjuvant radiotherapy for rectal cancer: meta-analysis of randomized controlled trials. *Ann Surgl Oncol*, 20(13), 4169-4182

B7.5 An evaluation of a newly introduced 68 Gallium PSMA PET-CT service

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Paul Strickland Scanner Centre

Background: According to the Evidence-based indications for the use of PET-CT in UK (2016), when ⁶⁸Gallium prostate specific membrane antigen (PSMA) is used for the assessment of prostate malignancy it has superior diagnostic accuracy compared to ¹⁸F-Choline. Ten months ago, in response to demand from local oncologists we decided to offer ⁶⁸Gallium PSMA as an additional service to our ¹⁸F-Choline scans. ⁶⁸Gallium has a half-life of 68 minutes and is produced in generator the nearest being 21 miles from our Centre. Several factors were considered when setting up the new service, regulatory compliance, training of ARSAC licence holder, production, supply and transport of tracer, radiographer/technologist competence, quality assurance, radiation dose, audit, scanning protocols and calibrator testing. The ⁶⁸Gallium PSMA service was setup for a Saturday to facilitate the quickest journey times from production to scanning centre. When all phantom work, training and QA was completed and regulatory consents were in place the service could commence. An audit was undertaken to evaluate the new service, with the following outcomes being measured:

- Dose administered to patient
- Number of cancellations due to tracer not being available
- Referral criteria
- Clinical findings

Purpose: To inform of the complexity of setting up a new non 18F-FDG service in PET/CT.

Summary: A discussion of how a new service can be setup along with the factors to be considered. The results of an audit to evaluate the new service will also be discussed.

The, R. C. O. R., Royal, C. O. P. O. L., Royal, C. O. P., Royal College of Physicians of Edinburgh, & Administration Of Radioactive Substances Advisory Committee. (2016). Evidence-based indications for the use of PET-CT in the United Kingdom 2016. *Clinical radiology*, 71(7), e171

B7.6 Post and pre-biopsy MPMRI for prostate cancer - audit and re-audit of a pathway

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Background: Multi-parametric magnetic resonance imaging (mpMRI) for investigation of prostate cancer is rapid developing with the focus moving from post-random biopsy to pre-random biopsy MR to target the initial biopsy. MpMRI has is shown to improve diagnostic accuracy and avoid unnecessary surgery. We have changed from using MPMRI for assessing targetable prostate lesions in the post random biopsy setting to the pre-biopsy mpMRI for new patients using PIRADS-V2. We present data from a closed-loop audit comparing pre and post-biopsy mpMRI outcomes with pathology samples.

Method: We collected data from 135 MpMRI's (61 tissue samples) patients on an 'active surveillance' management pathway, post-random-biopsy in 2017 over a 6-month period. We then implemented a change with patients performing mpMRI prior to sampling. We then re-audited with 138 (78 tissue samples) pre-biopsy mpMRI's performed in 2018.

Results: Accuracy of the pathway for PIRADS v2 5 lesions for detecting any prostate cancer gleason 3+3 or greater increased from 76.9% post-biopsy (2017) to 95% (2018) for pre-biopsy mpMR, however detection of clinically significant cancer (defined as greater than gleason 3+4 or greater than 4+3) results to 75% and 50% respectively. PIRADS 3 lesions demonstrated a reduction in any cancer score from 16% to 5.8%.

Discussion: The amount of mpMRIs performed in our centre has increased following the move to pre-biopsy. Cancer detection rates for high-probability lesions are high and fewer PIRADS-V2 3-scoring lesions are biopsy-positive. No comparable data for PIRADS 1/2 was available due to the limited number of tissue samples.

C7 Physics: Dose justification and optimisation short paper presentations

C7.1 Diagnostic imaging IRMER improvement notice to CQC outstanding

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The diagnostic imaging department had a serious incident involving a paediatric imaging examination in 2015 and was subsequently issued with an ionising radiation (medical exposure) regulations (IRMER) improvement notice. This notice related specifically to staff training records, the paediatric imaging competency assessment of Radiographers and the optimisation of ionising radiation exposures following the introduction of new digital radiography (DR) equipment. The service implemented a quality-based project approach in order to address the improvement actions required and to commence working towards Imaging Service Accreditation Standards (ISAS) certification. In September 2018 the county wide imaging service was assessed



by the ISAS team and underwent the first independent diagnostic imaging CQC inspection. ISAS accreditation was achieved and the Diagnostic Imaging service has recently been rated as outstanding by the CQC.

C7.2 A retrospective review of justification of computed tomography examinations in Northern Ireland

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Public Health England

Background: Justification is one of the key principles of radiation protection. The most appropriate use of CT relies on many factors which must be considered each and every time a scan is justified. The Regulation and Quality Improvement Authority (RQIA), commissioned this study to assess the justification rate of CT examinations in a single 24 hour period across NHS Trusts in Northern Ireland.

Method: The study retrospectively reviewed the clinical information within 450 referrals for diagnostic CT scans against published referral guidelines to assess justification. Each referral was independently assessed by two consultant radiologists and where opinions differed, arbitration was carried out. The reviewers were also asked to indicate if an alternative modality would have been more appropriate in any referrals that they deemed unjustified. Results were analysed for variations in justification rate by patient gender, patient age, geographical location and anatomical region scanned.

Results: This study found that 94% of the CT referrals reviewed were justified. The number of justified scans varied with regard to the anatomical region being scanned, with the abdomen and pelvis being the only region that demonstrated any statistical significance in the number of unjustified examinations. The highest suggested alternative modality was MRI at 33% of the unjustified referrals.

Conclusion: The study compared favourably to a similar study carried out in Sweden from 2009 where the justification rate was 80%. This review shows that conventional systems utilising up-to-date referral criteria and robust justification processes can ensure that inappropriate examinations are rare.

C7.3 Dose optimisation in facial bone OM projection with variation in AEC chamber selection and centring point: A phantom study utilising DR

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Background: The recommended automatic exposure control (AEC) chamber selection for digital radiography (DR) examinations of the facial bones is not supported by confirmatory literature. The aim of this study was to provide evidence to support radiographic practice.

Method: Using DR equipment, a phantom was positioned to achieve an occipitomeatal (OM) radiographic projection. 7 AEC chamber combinations were utilised, with an SID of 100cm, and a 1cm grid of 9 incremental centring points (3x3) in lateral and craniocaudally planes, resulting in 63 images. Recording milliamps per second (mAs), peak-kilovoltage (kV_p) and dose-area product (DAP) facilitated effective dose (ED) calculations via PCXMC (mSv). Images were blindly evaluated by two experienced radiographers against four image quality criteria (3-point scale).

Results: ED for the recommended central AEC chamber setting was significantly higher than for the other 6 settings ($p < 0.001$); however, this was the only setting for which all images were evaluated as 'fully acceptable'. Whilst the left-central and right-central AEC chamber combinations were able to produce 'probably acceptable' images at a lower dose than the central chamber, this only occurred at specific centring points. All other AEC chamber combinations and associated centring points produced 'unacceptable' images, with similar image quality scores, and no statistically significant difference between calculated EDs.

Conclusion: The current recommended central AEC chamber is the optimal radiographic technique, producing consistently acceptable images, whilst allowing for a certain degree of centring variability. It is recommended future textbooks should reference this study in order to evidence best practice in the OM projection.

C7.4 Slice reduction in CT/KUB for renal colic

Jonathan Adlam

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Purpose: As the gold standard for suspected urolithiasis^[1], CT/KUB is an increasingly important source of radiation. One dose reduction strategy without direct guidelines at our institution was active reduction of the number of slices imaged from above the upper pole of the higher kidney.

Methods and materials: 50 sequential CT/KUB examinations were reviewed for excess slices which the RCR suggests should never exceed 10% of total slices^[2]. Three audit cycles were carried out with two interventions employed. Firstly, a new guideline specified that all scans should begin just above the upper kidney if visible on the CT scout views. Otherwise, the scan should begin at the upper border of T12. Following this, radiographers who continued to have excess slices were contacted individually to ensure the new guideline had reached all CT radiographers.

Results: Each intervention reduced the proportion of CT/KUB examinations with more than 10% excess slices from 46% to 20%, and then 10%. The average excess slices were reduced from 10.62% to 6.68% ($p < 0.0001$) and then to 4.51% ($p < 0.05$). Practice



changed to represent the new guideline with 58% of examinations starting at T12 compared to 16% initially. DLP was not significantly different between cycles, which is attributed to variation in body size and therefore insufficient power with the numbers audited.

Conclusion: Implementation of a new local guideline to actively restrict the upper limit of CTKUB examinations resulted in changes to local CT practice with associated reduction in excess slices.

1. Tsiotras, A. (2018) British Association of Urological Surgeons standards for management of acute ureteric colic. *J. Clin. Urology* 11(1) 58-61
2. Twemlow, M., Munjal, I. (2018) Audit to optimise CT KUB imaging in investigation of renal colic. [Online] Available from: <https://www.rcr.ac.uk/audit/audit-optimise-ct-kub-imaging-investigation-renal-colic> [Accessed 1st December 2018]

C7.5 Dual energy CT for assessing myeloma in MRI-incompatible patients: Preliminary phantom study and clinical implementation

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Purpose: Whole body MRI is the first line test for suspected myeloma. However, this may not be tolerated in a subset of patients. We aimed to develop a DECT protocol as an alternative for disease assessment for myeloma.

Methods and materials: An anthropomorphic torso phantom (Kyoto) was scanned (Somatom Force, Siemens) with a non-contrast DECT protocol (90kV/150kV) at a range of dose levels (ref mAs, x0.25, x0.5 and x2), and compared with a single energy non-contrast chest-abdomen-pelvis (SECAP) protocol (110kV). Noise and CNR were measured within the phantom (liver, bone and soft-tissue background). Image quality (IQ) of DECT image data sets (90kV, Sn150kV and weighted-average) and SECAP was assessed (5-point Likert scale). CTDIvol and DLP were compared for the DECT and SECAP protocols and effective dose (mSv) was calculated using DLP and a conversion factor ($k=0.021 \text{ mSv.mGy}^{-1}\text{cm}^{-1}$). Clinical scans were scored qualitatively by an experienced radiologist.

Results: The DECT protocol at default dose provided weighted-average images with noise (15.0-16.2 and CNR (4.2-23.7) comparable or improved to those for the SECAP protocol (noise 17.2-21.4; CNR 3.9-21.7). The IQ assessment of 'bone' and 'bone/soft tissue' contrast showed a preference for the DECT images over those with the SECAP protocol. The dose for the DECT protocol at the default reference mAs (DLP 456 mGy.cm; ED 9.1mSv) was 25% higher than that for the SEAP protocol (366 mGy.cm; ED 7.3 mSv). All clinical scans were of excellent diagnostic quality. Conclusions DECT provided comparable or superior IQ at an acceptable dose increase for clinical evaluation.

1. Myeloma: diagnosis and management, NICE guideline [NG35], February 2016
2. Petritsch B, Kosmala A, Weng AM, Krauss B, Heidemeier A, Wagner R, Heintel TM, Gassenmaier, Tobias, Bley TA (2017) Vertebral Compression Fractures: Third-Generation Dual-Energy CT for Detection of 'bone' Marrow Edema at Visual and Quantitative Analyses. *Radiology* 284 (1)
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4. Shrimpton PC, Jansen JT, Harrison JD, Updated estimates of typical effective doses for common CT examinations in the UK following the 2011 national review. *British Journal of Radiology* 2016; 89 (1057)
5. Phantom model PBU-50 user manual, Kyoto Kagaku, Japan

C7.6 Ionising radiation in research - the lead clinical radiation expert

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The Health Research Authority (HRA) carries out regulatory review on healthcare research^[1]. It requires that the entire burden of radiation exposure to a participant in research be articulated appropriately in the IRAS application form^[2], including consideration to exposures that would be additional to routine care through participation in research. This is to inform the review of the application for HRA and REC approval prior to the commencement of the research, a legislative requirement^[3]. Under their definition, a research exposure is one required by the trial protocol, which may or may not be additional to routine care.

The IRAS form requires input from a Lead Medical Physics Expert, who makes a statement on the trial radiation procedures, their estimated dose and radiation risk. This is reviewed by a Lead Clinical Radiation Expert, who judges which exposures might be additional to standard care at any site in the research, and whether the trial radiation exposures are justified in the context. There is a reported lack of training available for those fulfilling Lead CRE roles in research, as this is considered to be described in the literature^[2, 4] and largely similar to the IRMER justification process required at a local level for every radiation exposure^[3]. This talk describes the legislative and policy requirements for the Lead CRE, as well as the context and content for the Lead CRE review. Feedback from surveyed Lead CREs will be discussed, including approaches to streamline the Lead MPE/Lead CRE review process.

1. <https://www.hra.nhs.uk/about-us/>
2. <https://www.myresearchproject.org.uk/>
3. http://www.legislation.gov.uk/uksi/2017/1322/pdfs/ukxi_20171322_en.pdf
4. <https://www.hra.nhs.uk/planning-and-improving-research/policies-standards-legislation/ionising-radiation/>



E3 Paediatrics and chest short paper presentations

E3.1 Audit on paediatric appendicectomies - the role of ultrasound and paediatric appendicitis score (PAS) in the diagnosis of appendicitis

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Background: Clinical diagnosis of appendicitis in the paediatric population can be challenging. Ultrasound imaging (USS) is used as a first-line evaluation tool due to its favourable radiation safety profile compared to CT (Doria et al., 2006). We aimed to evaluate the role of Paediatric Appendicitis Score (PAS), a validated clinical scoring tool (Samuel, 2002, Goldman et al., 2008), and USS in diagnosing appendicitis in paediatric patients.

Method: We conducted retrospective analysis of patients aged <18 who underwent appendicectomy between April and September 2018. Patients were clinically stratified into PAS low (1-3), intermediate (4-7) and high risk (7-10) for appendicitis. Diagnostic performances of USS and PAS score in detecting appendicitis were evaluated with ROC analyses using histopathology as gold-standard.

Results: 53 patients underwent appendicectomy of which 60% had pre-operative USS (n=32). Negative appendicectomy rates for PAS high, intermediate and low risk were: 3%, 39% and 66% respectively. 52% of PAS high-risk patients had pre-operative USS compared to 67% of intermediate and 83% of low risk patients. Sensitivity and specificity of USS was 50%. AUC for USS and PAS were 0.50 and 0.81, respectively (p=0.011). Mean time from admission to operation in patients with pre-operative USS was 24 hours compared to 14 hours in those without USS (p<0.001).

Conclusion: PAS was a better predictor of appendicitis compared to USS findings. USS is highly operator dependent and has a role in diagnosing appendicitis in the low/intermediate risk patients. In high-risk patients, the benefits of USS must be balanced against the potential delays it can cause to treatment.

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2. GOLDMAN, R. D., CARTER, S., STEPHENS, D., ANTOON, R., MOUNSTEPHEN, W. & LANGER, J. C. 2008. Prospective validation of the pediatric appendicitis score. *J Pediatr*, 153, 278-82
3. SAMUEL, M. 2002. Pediatric appendicitis score. *J Pediatr Surg*, 37, 877-81

E3.2 Generalised systemic lymphangiomatosis - an imaging case study

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Background: A 7yo boy presented to our DGH A&E in November 2018, limping with a painful left leg and no traumatic history. X-ray demonstrated a pathological fracture through a 28mm ill-defined lucency in the distal fibula shaft, with similar lesions in the proximal fibular and tibial diaphyses. No relevant history was provided and prior imaging constituted 3 CXRs from 2015 demonstrating an ante-natal diagnosed, presumed lung sequestration and a later right pleural effusion. RIS system letters revealed a diagnosis of generalised systemic lymphangiomatosis under tertiary centre care.

Purpose: This rare systemic condition is infrequently encountered outside tertiary centres and we present an interesting imaging case study to illustrate features of this disease for educational purposes.

Summary: We will utilise studies from ante and neonatal periods and early childhood including plain film, US and cross sectional imaging to depict the clinical journey of this child and illustrate the systemic involvement. This condition is a generalised lymphatic anomaly which may involve the cutaneous and superficial soft tissues, thoracic and abdominal viscera and bones. Our patient has experienced recurrent chylous pleural effusions and a pathological fracture through an osseous lesion and is known to have visceral involvement. We will use this case in conjunction with relevant literature to discuss clinical presentation, imaging features and dilemmas in diagnosis, clinical and therapeutic management of these patients; including the biochemical, hormonal and immunological imbalances associated with the drainage of recurrent chylous effusions and the effect of drugs used to try and treat the condition.

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2. Raman, S.P (2009) Imaging of Thoracic Lymphatic Diseases. *American Journal of Roentgenology*. 193 (6), 1504-1513
3. Steiner, G. M. & Farman, J. & Lawson, J.P. (1969) Lymphangiomatosis of Bone. *Radiology*. 93 (5)

E3.3 Wilms' tumour: An overview and a multi-modality diagnosis pictorial review

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Background: Wilms' Tumour (Nephroblastoma), is the most common Paediatric renal cancer^[5]. Its origin though unknown has been considered embryonic as it manifests from the development of immature kidney cells and generic with alterations of genes that aid in genitourinary development^[4,11]. Wilms tumour's peak incidence is 1-3 years with 5% and 1% having a birth defect and a family history respectively, it is more common in blacks than whites and Asians and equal in both gender^[3,8]. Symptoms may include: palpable abdominal mass, haematuria, abdominal pain which all warrants referral within 48 hours to oncology specialists^[9]. Ultrasound is usually the initial assessment modality, followed by Computed Tomography of chest and abdomen to



stage the tumour, to assess IVC, renal veins and metastatic spread^[2,6]. Magnetic resonance imaging, been more superior at imaging Wilms' tumour is often also used to staging and diagnosis^[7]. Although having a lower sensitivity chest X-ray may be used optionally to assess chest metastases^[8]. Wilms' Tumour has five stages which determine, the protocol/guidelines used to develop treatment plans which may include surgery, chemotherapy and radiotherapy^[1].

Purpose: To increase the awareness of Wilms' tumour while highlighting the collaborative role of Imaging in its diagnosis. Advantages and disadvantages of the modality used to image WT will be presented which can assist Practitioners in making informed decisions.

Content: The aetiology, risk factors and symptoms of WT will be presented, however, focus will be on the diagnosis using a multi-modality picture review. A clinical pathway for Wilms' Tumour cases will be outlined.

1. How are Wilms Tumor diagnosed. American Cancer Society <http://www.cancer.org>
2. BALDISEROTTO, M., 2014. Wilms' tumor: is computed tomography specific to detect lymph nodes metastasis?. *Radiologia Brasilia*. [47 (1)]
3. CANCER RESEARCH UK. 2017. Children's Cancer. Cancer Research UK
4. COOPES M.J & PRITCHARD-JONES. K., 2000. Principles of Wilms' tumor biology. *Urology Clinic North America*
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E3.4 Does the compressed lung in cases of antenatal diaphragmatic hernia behave different to that in cystic pulmonary malformations?

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Background: In fetal lung conditions such as congenital diaphragmatic hernia (CDH) and cystic pulmonary airway malformation (CPAM), normal lung tissue is compressed. The reduced fetal lung volume and altered lung maturation lead to neonatal morbidity and mortality. Changes in lung signal intensity (SI) on magnetic resonance imaging (MRI) may reflect altered lung development.

Aim: To evaluate patterns in lung SI and volume in CDH and CPAM cases on T2-weighted images fetal MRI.

Methods: A retrospective study of 26 CPAM, 51 CDH and 21 control patients. The average lung SI was calculated using a region of interest tool for contralateral, ipsilateral and cystic lungs. SI ratio of the contralateral:ipsilateral lung was calculated. Regression analysis and analysis of covariance were performed. Lung volumes were also measured. Results SI ratio significantly increased over gestation in CDH, but no change was seen in the controls or CPAM. No significant differences were found between contralateral lungs in controls, CPAM and CDH. Despite compression, the ipsilateral lung in CPAM followed the same pattern as controls. In CDH, ipsilateral SI significantly decreased with gestation, suggesting lung hypoplasia. Inter- and intra-observer agreement was excellent. The results were not dependent on the volume of the lungs.

Conclusion: Fetal lung compression affects lung development differently, depending on the pathology. Lung compression results in a hypoplastic ipsilateral lung in CDH, however in CPAM the ipsilateral lung develops normally. Contralateral lungs develop normally in both CDH and CPAM. Fetal MRI signal intensity may help predict postnatal outcome.

E3.5 Optimisation of SABR lung CBCT verification

Louise Turtle; Andrew Willett; Colin Lee; Christopher Fitzpatrick; Robert Biggar

Clatterbridge Cancer Centre

Background: At our clinic SABR lung patients receive pre-treatment 4D CBCT and post-treatment 3D CBCT using Varian TrueBeam 'thorax' mode (125kV, 15mA, full trajectory, 46cm FoV). To improve on-set efficiency and optimise imaging dose 'spotlight' CBCT exposures (200 trajectory, 25cm FOV) were investigated. Spotlight was tested on post-treatment imaging to determine if clinically suitable for verification.

Method: Two thorax spotlight modes (A, B) were optimised using a CIRS lung phantom. Exposure parameters were reduced to 100kV and 10mA or 15mA for modes A and B, respectively. 5 patients were selected for clinical testing. 'Thorax' mode was replaced by 'spotlight' A or B, on subsequent fractions. Images were scored offline by 4 RTTs and 1 physicist blinded to which exposures had been used. A 5 point scoring system was utilised, where a score ≤ 3 was deemed clinically suitable.

Results: Spotlight A and B achieved an average scoring of 2.4 and 2.5 respectively, deeming both suitable for clinical use. With minimal scoring difference, the lower dose Spotlight A was preferred. CBCT delivery time was reduced from 60 to 33 seconds. CTDI_w was optimised from 3.94 to 0.78 mGy, with an associated lifetime cancer risk of 1:8,000 reduced to 1:42,000.



Conclusion: The use of spotlight mode for verification of lung SABR has been demonstrated. Imaging dose has been optimised as low as reasonably practicable whilst fulfilling the clinical requirement for verification. Delivery time has been reduced, improving patient experience and clinic throughput. The new mode will be introduced as the clinical standard.

E3.6 Lungs of stone - a review of pulmonary calcification and other causes of high attenuation lesions in the lungs

Varsha Halai; Lucia Chen; Andreea Leandru; Adam Wallis

Portsmouth Hospitals NHS Trust

Background: Pulmonary calcification is commonly encountered, often being visible even on plain radiographs. CT enables more accurate localisation and characterisation of calcification which has a wide differential diagnosis. The radiologist has to know when calcification is due to a benign cause and when it can signify more important malignant or metabolic disease.

Purpose: This presentation will allow the radiologist to recognise the various causes of calcific and high attenuation lesions in the lungs, differentiate benign from more important malignant and metabolic conditions and potential pitfalls in diagnosis to facilitate accurate ongoing management.

Summary: Using cases from our thoracic centre, various benign causes of calcification including hamartoma, sarcoidosis, amyloidosis and infective granulomatosis, and malignant causes of calcification including calcified metastases, carcinoid and sarcoma metastases will be presented, with pathologic correlation. We will also illustrate metabolic conditions including metastatic calcinosis, and various non calcific causes of high attenuation including vertebroplasty cement emboli, aspiration of contrast, pneumoconiosis, drug toxicity and talcosis. Solitary and multifocal processes will be included. Key features distinguishing the benign from more important malignant and metabolic conditions will be highlighted as well as potential pitfalls and how to avoid them.

E5 History short paper presentations

E5.1 The Marie Curie Hospital, Hampstead, 1929-1967

Francis Duck

University of Bath

The Marie Curie Hospital was a pioneering specialist cancer hospital for women, staffed by women. After WWI, a 400-case investigation of radium treatment of uterine cancer was carried out, co-ordinating the treatments at three London hospitals together the New Sussex Hospital in Brighton. One outcome was the creation of the Marie Curie Hospital at 2 Fitzjohn's Avenue, Hampstead in 1929, allowing all skills and radium sources to be brought together in one place.

The hospital had access to one gramme of radium, worth about £12,000, lent by several public bodies and private individuals. Leading doctors included Helen Chambers, Louise Martindale and Lady Barrett. The hospital emphasised team-work, involving surgeons, physicians, pathologists and, notably, physicists. 300mg of the radium was in a form suitable for the treatment of breast and rectal cancer.

In 1932, high-voltage radiotherapy was installed, extending radiation treatment to include fibroids and menorrhagia. Diagnostic X-rays were added in 1936. Radiation protection and dosimetry remained largely under the lead of Professor Sidney Russ from the Middlesex Hospital, who oversaw the recovery of the radium when the hospital was destroyed by enemy action in 1944. After the war, new premises were established nearby, the hospital eventually moving to become part of Mount Vernon Hospital in 1967. By then over 11,000 cases had been treated, including 3008 for cancer of the cervix and 2,259 for breast cancer. The Marie Curie Hospital is an important landmark in the development of gynaecological cancer treatment in Britain.

E5.2 Some common eponymous signs in gastrointestinal radiology - who were the eponymists?

Arpan K Banerjee

University Hospitals Birmingham NHS Foundation Trust

Background: Eponyms often much maligned still today remain an essential descriptor and part of medical practice worldwide and are often the source of interesting historical vignettes and a homage to the discoveries of the pioneers. In a previous presentation I covered the eponymous signs and eponymists in chest radiology. Continuing on this theme in this presentation I aim to discuss the lives and common eponymous signs and terms and famous eponymists as applicable to gastrointestinal radiology.

Method/results: In this talk some of the eponymous signs in Gastrointestinal Radiology will be described along with brief biographical sketches of the eponymists and reference to the original descriptions. Some examples include the American radiologist Leo Rigler and his double wall sign on the plain abdominal film, Schatzki and his ring, Barrett and his oesophagus, Boerhaave and his syndrome, Carman and his meniscus sign. Modern and historical examples of the signs will be presented and the original descriptions reviewed along with a brief biographical vignette of the eponymists.

Conclusion: Eponyms are here to stay and a knowledge of the common ones along with the history of the discoveries and reference to the original writings will continue to be a helpful and interesting way of learning about medicine's vast herit.



E5.3 Tuberculosis and radiotherapy: A historical perspective

Adrian Thomas

Canterbury Christ Church University

Tuberculosis has been a major source of morbidity both historically and in the present day. Whilst modern treatments rely on pharmacological interventions, in the past radiation treatments were utilised. Whilst these are largely forgotten, in their day were both popular and efficacious. This paper reviews their use and significance, and places contemporary treatments in a historical context. In 1904 a symposium took place at the 5th Annual Meeting of the American Röntgen Ray Society on the use of the Röntgen rays in the treatment of tuberculosis (TB) at various sites^[1]. Comparisons were made between the radiological and surgical treatments and all areas of the body were covered.

Robert Koch had recently discovered the pathogen that causes TB in 1882, and in the year following the meeting the BCG vaccine was developed. In the early 20th century knowledge of TB increased with the development of new treatments. Of particular interest at those involving various radiations including heliotherapy, the Finsen light, and X-rays. That TB responds to radiation is interesting. The impact of an infection on the body are complex, and depends on factors such as poverty, nutrition, mental and spiritual state and immunity. The response of the body is central, and radiation will modify the immunologic and cellular response to a foreign noxious influence.

This will be discussed and mechanisms proposed. Modern clinical practice relies on pharmaceutical interventions, however the traditional therapies should be remembered, and may once again become useful.

1. Transactions of the American Röntgen Ray Society, Fifth Annual Meeting, St Louis, Mo., September 9-13, 1904. (1905) Philadelphia: A H Sickler Company

E5.4 Godfrey Hounsfield - The centenary of his birth

Elizabeth Beckmann

Lanmark

Godfrey Newbold Hounsfield was born on the 28th August 1919 in Sutton on Trent near Newark. He is well known as the inventor of the CT scanner - an invention which transformed medicine in the 2nd half of the 20th Century. Who was he and what sort of person was he? This paper will explore this question looking at his roots, his interests, his academic successes and failures and the influences which lead him to create the CT scanner.

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F6 Radiotherapy: Treatment, planning and verification short paper presentations

F6.1 UK Stereotactic Ablative Body Radiotherapy (SABR) consortium survey 2018: Developments in UK provision and practice over the past 6 years

Gail Distefano¹; Satya Garikipati²; Matthew Hatton²; Helen Grimes³

¹Royal Surrey County Hospital; ²Weston Park Hospital, Sheffield, UK; ³University College London Hospitals

Background: A survey was designed updating data from the 2012 UK SABR Consortium survey^[1]. It aimed to aid standardisation and, by highlighting issues within the NHS, improve access to SABR services and trials across the UK.

Method: An online questionnaire was sent to 65 UK radiotherapy institutions covering current service provision and techniques collecting data on immobilisation, motion management, scanning protocols, target/OAR delineation, planning, image-guidance, QA and future plans.

Results: 50 centres responded, key developments since 2012:

- a) Provision - number of centres having an active SABR program increased (15 to 38); 30 centres deliver SABR to non-lung sites, 27 centres offering the range of sites required for treating oligometastatic disease. A lack of NHS contracts is a barrier, with geographical inequity noted.
- b) Practice - the development of Linac delivered SABR to non-lung sites; increasing use of abdominal compression (15 vs 2 centres); 90% use VMAT delivery; increase in planning time (table 1) reflecting increased complexity of cases; introduction of flattening-filter free beams and 4DCBCT; a wide range of approaches exists in accounting for tumour motion, target ITV delineation and treatment image verification; > 90% still perform patient specific QA.



Conclusion: This survey documents increasing SABR provision in the UK, but the program needs to continue to expand to ensure that patients with early stage lung cancer and oligometastatic disease have access. Implementation of novel technology is noted, however, guidance to address variability in target delineation, image guidance and possible reduction in patient specific QA is warranted.

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F6.2 Treatment planning study of single vs multi isocentre stereotactic radiosurgery for treatment of brain metastases *Yogesh Jagannath Hatage¹; Colin Jennings²*

¹Royal Preston Hospital; ²Rosemere Cancer Centre

Background: It is time consuming to plan and treat multi-lesion Stereotactic Radiosurgery (SRS) plans with multiple treatment isocentre's. The planning and delivery time can be significantly reduced if the treatment is planned using single isocentre and verified through the use of a Hexapod 6 degrees of freedom couch. The aim of this work is to compare both treatment methods dosimetrically and assess the efficiency of the treatment delivery.

Methods: This study included 6 patients, each with 2 to 4 SRS lesions. Static beam plans were generated using Pinnacle planning system. For multiple isocentre, each isocentre was placed at the centre of Planning Target Volume (PTV) and for single isocentre it was placed at centre of combined PTVs. Paddick conformity index (PCI), gradient index (GI), tumour coverage, normal brain receiving 12Gy (V12), delivery time and number of Cone Beam Computed Tomography (CBCT) required were evaluated.

Results: Dosimetric improvement was achieved for single isocentre treatments with percentage variation for PCI of 0.1%+4.7%, GI 3.8%+9.6%, tumour coverage of -0.5%+0.9% and V12 of 6%+13.6%. A simulation of the treatments showed a treatment time reduction of up to 44.6%+8.4% for the single isocentre technique, considering only one CBCT/lesion.

Conclusions: The main advantages for single isocentre are time saving and reduction in CBCT imaging exposure without compromising plan quality. As approximately 50% of patients require a post move scan, a single isocentre technique has a significant patient benefit.

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2. SAMEER K. NATH (2010) SINGLE-ISOCENTER FRAMELESS INTENSITY-MODULATED STEREOTACTIC RADIOSURGERY FOR SIMULTANEOUS TREATMENT OF MULTIPLE BRAIN METASTASES: CLINICAL EXPERIENCE. *Int. J. Radiation Oncology Biol. Phys., Vol. 78, No. 1, pp. 91-97, 2010*

F6.3 HDR brachytherapy skin applicator fabrication for clinical cases: Hand-formed vs digitally designed and 3D printed *Shauna Nic A Baird; Rhydian Caines; Lee Chris*

Clatterbridge Cancer Centre

Background: Previous studies have demonstrated feasibility of 3D-printed brachytherapy skin applicators^[1-3], but none have systematically compared this process to traditional hand-formed methods. This study compared five clinical hand-formed applicators, used previously for treatment, to digitally designed 3D-printed applicators retrospectively created for the same cases.

Methods: The hand-formed applicators comprised a thermoplastic shell, wax stand-off and catheters for source transfer, constructed to meet skin-catheter and catheter-catheter distance specifications. A process was developed to design applicators digitally in a TPS contouring module (Eclipse v13.6, Varian Medical Systems, CA). Applicators were printed using the Axiom20 3D-printer (Airwolf3D,CA). Applicators were CT-scanned and >3,800 geometric measurements made in the TPS. Skin-catheter and catheter-catheter distances were inspected and the proportion of measurements within 1 mm tolerance determined. Treatment planning and delivery was performed for all applicators according to local protocol. TLDs were used to verify dosimetry.

Results:

Skin-catheter distances: The proportion of geometrical measurements within 1mm of specification was 0.56 [95%CI: 0.53-0.59] for hand-formed applicators and 0.69 [95% CI: 0.67--0.72] for 3D-printed ($p < 0.01$, Fig.1)

Catheter-catheter distances: The proportion of geometrical measurements within 1mm of specification was 0.58 [95%CI: 0.55-0.61] for hand-formed applicators and 0.82 [95% CI: 0.80--0.85] for the 3D-printed ($p < 0.01$, Fig.2)

Dosimetry: TLD measurements for all applicators agreed within $\pm 5\%$ of expected doses.

Conclusion: The 3D-printed applicators were more geometrically accurate compared to hand-formed. All applicators gave satisfactory dosimetric performance. 3D-printing is faster and less labour intensive. The applicators are durable, lightweight, low cost, visually appealing and re-printable.

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2. Jones, E.L. et al. (2017). Introduction of novel 3D-printed superficial applicators for high-dose-rate skin brachytherapy. *Brachytherapy*, 16(2), pp. 409-414

3. Zhao, Y. et al. (2017). Clinical applications of 3-dimensional printing in radiation therapy. In *Medical Dosimetry*, 42(2), pp. 150-155

F6.4 Complexity metrics to predict DQA performance for challenging RayStation VMAT plans

Alex Taylor; Anna Trezza; Jonathan Sutton; Jonathan Littler; Elizabeth Harron

Nottingham University Hospitals Trust



Background: Delivery quality assurance (DQA) is a routine part of treatment plan checking to assess a plan's deliverability, but is time consuming and labour intensive. Departments often perform DQA for all Volumetric Modulated Arc Therapy (VMAT) plans even though only certain complex plans are undeliverable. Metrics have been previously developed to measure plan complexity; these are average leaf travel (LT), modulation complexity score (MCS) and LTMCS which is a combination of both LT and MCS. This work assesses whether complexity metrics can predict which VMAT plans will pass DQA.

Method: 24 VMAT beam arcs were used for analysis, based on 12 complex dual-arc plans (6 bilateral head and neck (H+N), 6 prostate and nodes planned in RayStation V6). The complexity metrics LT, MCS and LTMCS were determined for each arc using an in-house python script, and a gamma analysis pass rate was determined from DQA measurements using a Delta4 phantom.

Results: Early results demonstrate that the MCS is the most useful metric for predicting DQA pass rates for these VMAT plans. An MCS score > 0.21 gave 90 % sensitivity and 100 % specificity for identifying H+N plans which would pass a stringent 95 % gamma pass rate in DQA (local 2%/2 mm criteria). The results exhibited site-specific dependencies on the minimum MCS score, with a difference noticeable between prostate and H+N groups.

Conclusions: Applying complexity metrics to assess challenging VMAT plans in RayStation showed good accuracy in predicting which plans would likely pass DQA, potentially reducing practical measurement time.

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F6.5 Implementation of PerFRACTION™ to reduce phantom based patient specific quality assurance (PSQA)

Yun Miao; Vasu Ganesan; Dom Withers; Ghirmay Kidane; Liz Crees; Ahmed Iftahaker

Barking, Havering and Redbridge University Hospitals NHS Trust

Background: ArcCHECK®(Sun Nuclear, Melbourne) phantom has been used to verify the treatment delivery accuracy for individually-generated VMAT and IMRT patient treatment plans in our clinic. Recently, our clinic has implemented the PerFRACTION™(Sun Nuclear, Melbourne) software module as a PSQA tool to replace phantom-based PSQA which is time-consuming for physics staff. A local benchmark pass rate has been determined for the PerFRACTION™ software to ensure the accuracy of delivery for VMAT and IMRT plans.

Method: Thirty-one 6MV VMAT and IMRT plans, including H&N, brain, prostate, breast and lung, were retrospectively analysed. The plans were generated in Eclipse (v15.6) using AAA algorithm and delivered using a Varian Edge linear accelerator equipped with HDMLC and aSi 1200 portal imager. The gamma results obtained from PerFRACTION™ were compared with the ArcCHECK® results. A Bland-Altman test was performed to analyse the agreement between the two methods, and a local tolerance was determined for PerFRACTION™.

Results: All plans passed a tolerance of 97% when the gamma criteria of 2%/2mm was applied in PerFRACTION™. The Bland-Altman test between PerFRACTION™ and ArcCHECK® showed a bias of -0.5 with 2%/2mm criteria.

Conclusion: The PerFRACTION™ method for pre-treatment of PSQA is efficient and capable of producing results similar to the results obtained using ArcCHECK®. A tolerance of $\gamma(2\%/2\text{mm}) \geq 97\%$ and is defined for the PSQA passing rate. Work is in progress to implement the PerFRACTION™ software for 10MV plans.

1. Bresciana, S et al (2018) Comparison of two different EPID-based solutions performing pretreatment quality assurance: 2D portal dosimetry versus 3D forward projection method. *Physica Medica*. 52 65-71

F6.6 Using EPID results to compare the accuracy of set up between traditional tattoo set up and Surface Guided Radiotherapy (SGRT) set up - a move to markerless radiotherapy

Ben Allen; Mark Ramtohol

Queen Elizabeth Hospital

Background: Tattoos are not always ideal as they aren't where we want to treat and skin is mobile (Stanley et al 2017). A comparison of the accuracy between a tattoo set up and an SGRT set up using AlignRT for breast patients was conducted.

Method: The EPID results of the following patient set ups were assessed to compare accuracy of each set up: 96 breast patients with tattoos and in Free Breath (FB). 95 SGRT DIBH patients. 26 SGRT FB breast patients. Corrective shifts are applied to any treatment with $\geq 0.5\text{cm}$ deviation from planned position.

Results: Corrective shifts were needed in: 28% of patients with tattoo set up, 4.2% of patients with SGRT DIBH set up. 7.7% of patients with SGRT FB set up. Comparing the first fraction shifts for each cohort suggests there is higher accuracy of setups in all directions when comparing the standard deviations of DIBH (Sup-Inf: 1.8mm, Left-Right: 1.7mm, Ant-Post: 1.8mm) to free breath (Sup-Inf: 3.1mm, Left-Right: 3.4mm, Ant-Post: 2.4mm). Testing the distributions using the Kolmogorov-Smirnov test confirms ($P < 0.001$) that this is true for the Ant-Post direction and magnitude of the shift. Initial data for the SGRT FB patients suggest that the accuracy is better than the use of tattoos (Sup-Inf: 2.4mm, Left-Right: 2.6mm, Ant-Post: 1.6mm).

Conclusion: The results suggest SGRT produces a more accurate set up over a tattoo set up and will be adopted as the new standard for breast radiotherapy set up.

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H7 Head and neck short paper presentations

H7.1 Imaging on time, when 'time is brain': A case study and image series outlining rapid and safe mechanical thrombectomy in hyperacute stroke

Ganeshan Ramsamy; Kurdow Nader; Don Sims

University Hospitals Birmingham NHS Trust

Background: The goal of hyperacute ischaemic stroke management is rapid arterial recanalisation as safely as possible. Mechanical thrombectomy has revolutionised stroke management across the UK. It has been shown to be a highly successful and cost-effective procedure for large artery occlusive stroke^[1]. For neuro-radiologists and stroke physicians to achieve prompt revascularisation during thrombectomy, immediate imaging is recommended, either via CT angiography or MR imaging/angiography^[2].

Aims:

- To illustrate and explain key radiological findings for an acute stroke patient who underwent thrombectomy and made a full neurological recovery.
- To increase knowledge and awareness about the benefits possible with early intervention and appropriate imaging from the time of onset of stroke.
- To outline the considerable impact interventional neuro-radiology services can have on patient outcomes and the overall cost of stroke management.

Content: This paper will present the case of a 51-year-old male with sudden onset right-sided hemiparesis, facial droop and dysarthria. An intraluminal thrombus in M2 segment of the left middle cerebral artery was noted on CT. The timing from onset of symptoms to arterial puncture was less than 90 minutes - considerably quicker than median times reported in recent positive trials^[3]. A detailed, chronological image series of plain CT, CT angiography and thrombectomy will be presented and salient features explained in order to understand the excellent outcome achieved. The benefits of imaging and thrombectomy services available in this case will be discussed. Recommendations and future radiological considerations will be made for physicians and radiologists involved in managing acute stroke.

1. Evans MRB, White P, Cowley P, et al. (2017) Revolution in acute ischaemic stroke care: a practical guide to mechanical thrombectomy *Pract Neurol.* 17:252-265
2. White PM, Bhalla A, Dinsmore J, et al. (2015) Standards for providing safe acute ischaemic stroke thrombectomy services. *Clin Radiol.* The Royal College of Radiologists. 72, e1-175 - e9
3. Saver JL, Goyal M, van der Lugt A, et al. (2016) Time to treatment with endovascular thrombectomy and outcomes from ischemic stroke: a meta-analysis. *JAMA.* 316, 1279-88

H7.2 Trigeminal neuralgia: The patient experience of magnetic resonance imaging (MRI) of the brain

Sophie Gallagher; Julie de Witt

University of Derby

Background: Novel study to explore the experience of group of patients with Trigeminal Neuralgia (TN) and their experience of having an MRI brain scan. This gives a new perspective when considering patient centred services, not only to patients with this rare condition, but perhaps when scanning anyone with a pain condition, or indeed for MRI brain scanning in general.

Method: Qualitative method utilised an online survey (Limesurvey) with free text responses and some limited demographic data. Ethical approval was obtained. Survey was advertised on closed social media group and on National charity website (Trigeminal Neuralgia Association UK). 96 responses were received, with 50 free text responses to the open questions. These were analysed using thematic analysis (2 researchers, 2 Assistants involved for quality checking).

Results: Five themes emerged, with a number of sub-themes within each. These are that there are some good stories, there are some not so good experiences, that care and communication makes a difference that TN pain is more than just a headache and finally involving patients in their scan is important. In describing the experience of having an MRI brain scan it was striking that narratives key impact in terms of experience seemed to be the perceived care and 'kindness' of the staff.

Conclusions: It is important to work with a patient and their pain triggers. This is beneficial as this is likely to result in a timely scan with minimal blur artefacts if the patient's pain is minimised. And that care and compassion matters.

H7.3 Assessing dynamic change in salivary gland function using MRI during chemoradiation for head and neck cancer (HNC)

David Noble¹; Fulvio Zaccagna²; Amy Bates³; Tilak Das⁴; Vicky Lupson⁵; Karen Welsh⁵; Gill Barnet⁶; Rashmi Jadon⁶; Richard Benson⁶; Neil Burnet⁷; Raj Jena¹; Ferdia Gallagher²

¹Cambridge University, Department of Oncology; ²Cambridge University, Department of Radiology; ³Cambridge Clinical Trials Unit, Cambridge University Hospitals NHS Foundation Trust; ⁴Department of Radiology, Addenbrooke's Hospital, Cambridge University Hospitals NHS Foundation Trust.; ⁵Wolfson Brain Imaging Centre, Cambridge Biomedical Campus.; ⁶Oncology Centre, Addenbrooke's Hospital, Cambridge University Hospitals NHS Foundation Trust.; ⁷University of Manchester, Manchester Academic Health Science Centre and The Christie NHS Foundation Trust



Introduction: Parotid gland (PG) and submandibular gland (SMG) volumes decrease following radiotherapy for HNC, whilst apparent diffusion coefficient (ADC) on diffusion weighted imaging (DWI) increases. This study evaluated the relationship between toxicity and MRI changes during treatment to determine the role of imaging in guiding adaptive radiotherapy.

Methods: Seven patients (6 men, 1 woman, 55.1±1.2 years) recruited to the CRUK VoxTox-MinotOAR study were assessed. All received 65Gy/30 fractions (IG-IMRT) with weekly cisplatin for oro/hypopharyngeal SCC. Images (3T Siemens Skyra-fit) were acquired immediately prior to fractions 1, 6, 16 and 26. Volume changes were defined on T2; ADC on DWI (b-values: 0,700). Acute and late CTCAEv4.03 xerostomia and salivary duct inflammation (SDI) were recorded.

Results: Mean baseline volumes and ADC values were 27.1±2.2cm³ (PG), 9.1±0.5cm³ (SMG) and 1.72±0.05x10⁻³mm²/s (PG), 1.81±0.05x10⁻³mm²/s (SMG) respectively. Proportional volume reductions at fractions 6, 16 and 26 were: PG 9.3±1.9%, 23.0±3.0%, 26.2±2.8% and SMG 11.2±1.7%, 25.5±2.5%, 30.9±2.1% respectively (Figure 1A-B). Proportional ADC increases were: PG 5.5±5.1%, 13.8±4.9%, 23.1±4.5% and SMG 0.6±4.9%, 7.2±4.7%, 17.5±4.2% (Figure 1C-D). Falling SMG ADC at fraction 6 was correlated with worse acute SDI (R²=0.60, p=0.002, Figure 2). Patients with Grade 2+ SDI at 6 months had a fall in ADC compared to those with Grades 0-1 (-4.0% vs. +5.9%, p=0.03).

Conclusions: Salivary glands decrease in volume early in treatment, whilst increases in ADC changes occur later. Falling SMG ADC on DWI by fraction 6 predicts more severe acute and late SDI and could be used as an imaging biomarker to guide adaptive radiotherapy.

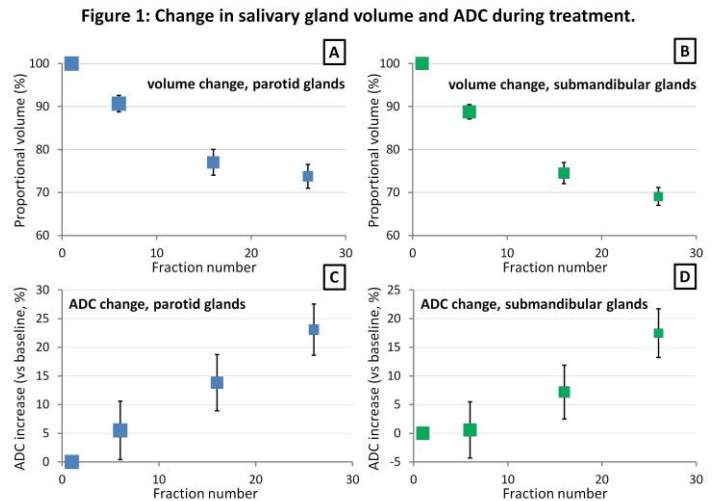
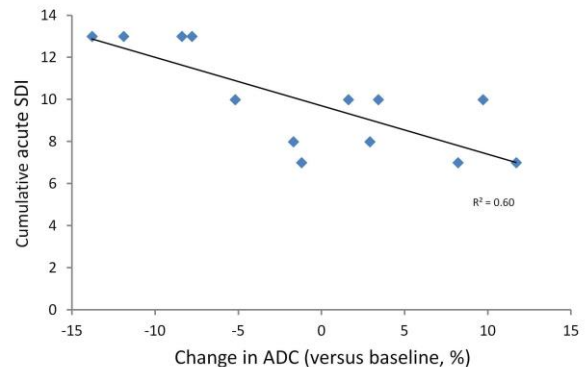


Figure 2: Cumulative acute toxicity (salivary duct inflammation) versus proportional change in ADC by fraction 6



H7.4 Head and neck cancer using MRI in radiotherapy planning: A pictorial review

John Paul Sahibbil

GenesisCare UK

Background: MRI has become an integral part in head and neck radiotherapy planning workflow. The decision to this recent development is based on superior soft tissue-contrast compared to CT scan. MRI has a number of advantages over CT scan as it has shown to improve the delineation accuracy in intracranial lesions, and perineural spreads, nasopharyngeal lesions, pterygopalatine fossa infiltrations, tumours in the liver, and better visualisation of cancerous regions within the prostate gland. Over the past years, MRI has been used to outline the tumour volume and organs at risks and has provided support to various processes involved in radiotherapy treatment planning and delivery.

Purpose of the poster: To present routine imaging protocols used in head and neck radiotherapy planning. It illustrates the imaging set-up using a flat tabletop overlay, the use of a thermoplastic mask with the phased-array coil. This review identifies technical challenges in image resolution and scans time. This presentation would be helpful to imaging professionals involved in radiotherapy planning. The aim of the review is to educate the reader on various MRI appearances and ways to improve patient throughput.

Summary: Important parameters related to anatomical information are outlined including imaging set-up and imaging pitfall like geometric distortion. Over the past months, it has improved and implemented MR-based planning successfully into clinical practice with in-house educational training being implemented for all radiographers and physicists connected to MRI. In line with this, we can suggest an optimal imaging protocol based on the most used MR sequences.

1. Bahig, H., Boudam, K., Landry, D., Fillion, E., Ballivy, O., Roberge, D., Côté, J.C. and Nguyen-Tan, P.F., MRI in Head and Neck Radiotherapy Planning
2. Balter, J., Yue, C. and Wang, H., 2013. Optimizing MRI for radiation oncology: initial investigations. MAGNETOM Flash, 45
3. Schmidt, M.A. and Payne, G.S., 2015. Radiotherapy planning using MRI. Physics in Medicine & Biology, 60(22), p.R323



H7.5 No radiologist required - a sustainable approach to implementing a one stop neck lump clinic

Nicola Davidson

Worcestershire Acute NHS Trust

Improving outcomes for patients diagnosed with cancer is high on the NHS agenda. When NICE recommended that ultrasound guided biopsies be used in the assessment of patients presenting with a neck lump in 2016, demand soon exceeded the capacity. With a national shortage of Radiologists and the increasing demand for their time to be spent reporting and performing more complex procedures, it was decided to extend the role of a sonographer to support this service. After a period of training and consolidation, dedicated sonographer led sessions for Fine Needle Aspiration (FNA) were introduced. Whilst radiology was able to improve its own 2 week wait performance, the Trust was still not meeting 62 day targets of referral to treatment in patients diagnosed with head and neck cancers.

The process of referral to initial diagnosis often required the patient to make multiple attendances. Inadequate FNA samples could add weeks to an already slow process and a more streamlined approach was required. To improve the pathway the multidisciplinary team decided to trial a 'one stop neck lump clinic'. Our service was established to be led by a sonographer and biomedical scientist. This combined approach has almost eliminated inadequate samples thus improving patient experience and reducing the time between referral to diagnosis.

By sharing our experiences, patient feedback, and by presenting the outcomes of the clinic, we hope to encourage others that this is a sustainable model which has seen an improved service for patients and positive role development for staff.

1. Ganguly, A, Giles, TE et al. (2010). The benefits of an on-site cytology with ultrasound guided fine needle aspiration in a one-stop neck lump clinic. *Ann R Coll Surg Engl.* 92(8):660-884

2. NICE. (2016) Cancer of the Upper aerodigestive tract: assessment and management in people over the age of 16. NICE guideline (NG36)

H7.6 PET-CT surveillance post (chemo)-radiotherapy (CRT) in advanced head and neck squamous cell cancer - beyond the PET-Neck protocol

Claire Paterson¹; Suyun Zhou¹; Robert Rulach¹; Fraser Hendry²; Allan James¹; David Stobo²; Mary Frances Dempsey²; Derek Grose¹; Stefano Schipani¹; Carolyn Lamb¹; Mohammed Rizwanullah¹; Christina Wilson¹

¹Beatson West of Scotland Cancer Centre; ²West of Scotland PET CT Centre

Background: The PET-NECK study demonstrated PET-CT scan 12 weeks post-radiotherapy for HNSCC was non-inferior to planned neck dissection (ND). High negative predictive value means patients who are disease-free are reliably identified and spared ND. Poor positive predictive value means optimal management for equivocal responders (EQR) remains unclear. The aim of this analysis was to evaluate outcomes using PET-CT surveillance with particular focus on those achieving an EQR nodal response.

Methods: All patients with node positive HNSCC treated with CRT between January 2013 and September 2016 were identified. PET-CT responses were classified as complete (CR), incomplete (ICR) or EQR. Patient demographics and outcomes were obtained from electronic records.

Results: 187 patients were identified. 82.3% had oropharyngeal cancer, 80.5% of those were HPV-positive. 80.7% had N2 disease. Median follow-up was 30 months. Median time from end of radiotherapy to PET-CT scan was 90 days. 59.4% had CR, 23.0% EQR and 17.6% ICR nodal response. Only 10 NDs (23.2%) were carried out for the EQR group with 50% pathological involvement. 2-year recurrence rate was 12.8%, 11.8% and 37.5% for CR, EQR and ICR groups respectively. 2-year survival was 91.9%, 87.5% and 50.0% respectively. No statistically significant differences in recurrence and survival rates were found between CR and EQR at 1-year and 2-years.

Conclusion: This study showed that patients with equivocal response on 12 week PET-CT have similar clinical outcomes compared to the complete response group, despite the omission of ND. This confirms the safety of an active surveillance strategy rather than immediate ND.

I7 Humanise and personalise short paper presentations

I7.1 The construction of care in CT

Rachael Forton¹; Maryann Hardy²; Anita Sargeant²

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Background: Patient centred care and the 'patient voice' are core components of UK healthcare policy and practice guidance. This study explored how care is perceived and experienced within the high technology environment of CT.

Methods: A Grounded Theory (GT) methodology using semi structured interviews was used to obtain primary data from CT radiographers and patients. Recruitment and data collection were performed at a 1200 bed teaching hospital over a 6-month period.

Results: The patient radiographer relationship and the radiographer's role in providing care within CT are complex and multifaceted. Both patients and radiographer's perceive CT imaging to be an integral part of the overall patient care and treatment pathway. As such, the act of being imaged is perceived as a care process and while image acquisition is recognised as a task orientated and technical process, the human element of providing care is cognitive, dynamic and responsive to individual need. Importantly, patient confidence in the care received was influenced by the radiographer's ability to build a trusting relationship and display technical competence and this in turn facilitated active compliance resulting in a technically accurate



examination. Despite previous literature suggesting that the technical environment created a barrier to patient care, patients within this study confirmed that radiographers provide care commensurate to the nursing ideals represented by the 6C's (Care; Compassion; Competence; Communication; Courage; Commitment).

Conclusion: A new model of care encompassing both technical components and patient-centeredness has been constructed based on care perceptions within high technology imaging environments.

17.2 Exploring the humanistic work of clinical imaging: Emotional labour and gifts of caring

[Tracy O'Regan](#)¹; [Leslie Robinson](#)²; [Ann Newton-Hughes](#)²; [Ruth Strudwick](#)³

¹The Society and College of Radiographers; ²University of Salford; ³University of Suffolk

Background: Discussion of emotional labour is becoming part of healthcare service discourse^[1]. Patient and carer distress, suffering, anxiety and anger are all common sources of emotional labour for healthcare professionals^[2]. People using imaging services are often in a vulnerable state^[3]. However, recognition of how the design of imaging services contributes to vulnerability of patients and the labour of staff is lacking. Paradoxically, there is also a lack of recognition of the satisfaction that can be derived from the silent care provided in clinical imaging^[3].

Method: A methodology of visual ethnography included radiographer, assistant practitioner and student collage production. Collage encouraged the use of metaphor to communicate knowledge and experience^[4] while facilitating processes of emotion^[5]. Axial coding was used to develop overarching themes that made sense of findings.

Results: Sections of collage images and conversational quotes will illustrate the results. The emphasis for this presentation will be emotional labour in relation to and representing the humanistic work of imaging. The concepts of emotional labour, exhaustion and gifts of caring^[6; 7] will be introduced.

Conclusion: Much emotional labour literature focuses on burnout and stressors among healthcare professionals. The relational work of emotional labour has traditionally been undervalued^[1]. Autonomous use of emotions, when individuals offer emotional gifts and derive satisfaction from caring, represent a humanistic element of imaging work that can benefit the experiences of patients and staff.

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- MUNN, Z. & JORDAN, Z. (2011) The patient experience of high technology medical imaging: A systematic review of the qualitative evidence. *Radiography*, 17, 323-331
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17.3 Examining the relationship between emotional intelligence and leadership attributes of Australian Chief Radiographers

[Sarah Lewis](#)¹; [Dania Abu Awwad](#)¹; [Stuart MacKay](#)²; [John Robinson](#)¹

¹The University of Sydney; ²The University of Liverpool

Introduction: Emotional intelligence (EI) is a person's ability to control their emotions and be empathetic, and influences how a person interacts with others. EI has been linked to strong job performance parameters such as leadership and is an important attribute for health leaders including chief/superintendent radiographers^[1]. This study explores the relationship between EI scores and leadership attributes of chief radiographers in Australia.

Methods: A cross-sectional survey design was used. A convenience sample of potential participants (n=70) were contacted and given unique codes to access the National Health Service Leadership Self-Assessment Tool (LSAT)^[2] and the Trait EI Questionnaire Short-Form (TEIQue-SF). The TEIQue-SF yields a global EI score and four factor scores for Sociability, Emotionality, Well-Being, and Self-Control^[3]. A total of 18 chief radiographers from a variety of Australian medical imaging departments participated in both questionnaires. Spearman's rank-order correlation and Kruskal-Wallis H-test were used for analysis.

Results: Chief radiographers from larger hospitals (>500 beds, n=6) had lower Sociability EI scores than those in hospitals with <200 and 200-500 beds (p=0.057, n=12). Chief radiographers with less than 10 years' experience in their role (n=6) had higher scores for the LSAT 'Developing Capability' dimensions than those with 10-20 years and >20 years of experience (p=0.043, n=10). Increasing years of experience was associated with a reduction across the LSAT and EI factors, particularly 'Sharing the Vision' (rho=-0.507, p=0.032) and 'Developing Capability' (rho=-0.583, p=0.011).

Conclusions: The study demonstrates negative relationships between years of experience, increased department size, EI and leadership of chief radiographers in Australia. The findings could be used as a starting point to plan strategies to support senior leaders of the profession to aid leadership, workforce retention and job performance across the working lifespan of radiographers.

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- NHS Leadership Academy. Healthcare leadership model the nine dimensions of leadership behaviour [Internet]. Leeds: NHS Leadership Academy, 2013 [cited 2018 Jul 1]
- Petrides KV. *Technical Manual for the Trait Emotional Intelligence Questionnaires (TEIQue)*. London Psychometric Laboratory, London, 2009



17.4 Think calm, stay calm and keep calm: A cognitive behavioural approach to anxiety related reaction in MRI

John Paul Sahibbil

GenesisCare UK

Background: MRI examinations are often associated with anxiety related reaction in many patients. This causes discomfort during the scan causing movements, panic attacks, or non-completion and termination of the scan. Published studies and the development of treatment were previously largely behavioural, and the focus has turned to the role of cognition. The last decade has seen a dramatic increase in the use of cognitive behavioural techniques for an effective form of psychological therapy for emotional disorder.

Method: Healthcare staff were trained using a face-to-face workshop. The degree of understanding and techniques for management of anxiety were assessed using simulation exercises, questionnaires and integrated cognitive stages - think calm, stay calm and keep calm.

Results: Reports shows a significant decrease in patients' refusal and scan termination due to anxiety after the training session. The correlation of reports was assessed for three months that are likely to reflect the technique using the cognitive-behavioural approach.

Conclusion: Our initial report identified a deficit in knowledge and awareness of healthcare staff in managing anxiety related reaction in MRI with significant improvement following a face-to-face workshop. Clearly, in the case of MRI scans, anxiety management should be incorporated in a structured program, rather than using basic strategies, which could increase the patients' level of anxiety and raise their vulnerability to extreme reactions. Although cognitive behavioural techniques show focus in improving anxiety, it is worth remembering that this tactic will not be useful in every situation and should ensure that this is applied appropriately in clinical practice.

1. Fletcher, J. 2014. Anxiety Panicking About Panic. A powerful, self help guide for people suffering from anxiety or panic disorder. London; Createspace Independent Publishing

2. Hudson, D. 2017. 8Cs education. [leaflet] (Experiences of Care Week – Supporting MRI Scanxiety) High Wycombe; InHealth Ltd (unpublished)

3. Munn, Z., Moola, S., Lisy, K., Riitano, D. and Murphy, F., 2015. Claustrophobia in magnetic resonance imaging: A systematic review and meta-analysis : Radiography.[e-]. 21 (2) pp.e59-e63

4. Silove, D. and Manicavasagar, V., 2009. Overcoming Panic and Agoraphobia. A self-help guide using cognitive behavioural techniques. 2nd ed. London:Robinson

5.Thorpe, S., Salkovskis, P.M. and Dittner, A., 2008. Claustrophobia in MRI: the role of cognitions: Magnetic Resonance Imaging.[e-]. 26 (8) pp.1081-1088

6. Thu, H., Stutzman, S.E., Supnet, C. and Olson, D.M., 2015. Factors Associated With Increased Anxiety in the MRI Waiting Room : Journal of Radiology Nursing.[e-]. 34 (3) pp.170-174

17.5 Clinical and lay attitudes towards sharing images with patients: A quantitative analysis

*William Cox*¹; *Penelope Cavenagh*²; *Fernando Bello*³

¹University of Portsmouth; ²University of Suffolk; ³Imperial College London

Introduction: Advancing technologies offer novel opportunities to share diagnostic radiological images with patients^[1,2]. This sharing may occur within the clinical environment under the supervision of a clinician, or may involve remote, unsupervised access^[2]. However, the benefits and risks of such practices have not been widely explored^[3].

Methods: A questionnaire was developed to measure respondent attitudes towards benefits and risks of image sharing utilising Likert scale type responses and a free text option. The questionnaire was distributed to clinical imaging experts and lay persons. Data were analysed using inferential statistics.

Results:

121 clinical and 282 lay responses were received:

- 94% (n=266) of lay participants surveyed wanted to see their imaging
- 79% (n=95) of clinicians thought sharing images with patient was a 'good idea'

Statistically significant findings included:

- Patients mean ranked higher on the scale asking whether sharing images with people was a good idea than clinicians did
- Patients ranked impact on the following factors as higher than clinicians did:
 - Knowledge and understanding
 - Communication
 - Engagement
- Patients ranked lower than clinicians regarding impact on the following:
 - Potential for negative emotional impact
 - Likelihood to confuse
 - Data security
 - Likelihood to affect their expectations.

Conclusion: Respondents confirmed that sharing images with patients may provide benefits, but there are risks inherent to this process. There is a need, therefore, for further work seeking clarification of how identified benefits and risks can be effectively managed.

1. Imperial College Healthcare NHS Trust. How it works.

2. Sectra. Share and collaborate.



3. Cox, WAS, Cavenagh, P. & Bello, F. (2017) The diagnostic radiological image - identifying the benefits from the literature - Poster Presentation. UKRC/O Congress, 12 - 14 June 2017. Manchester Central Convention Complex. IRAS Project ID 187752 NHS REC Ref 17/LO/0864

J6 Late breaking short paper presentations

J6.1 Pelvic radiography; the erect position and its impact on clinical measures

Kevin Flintham¹; Beverly Snaith²; Andrew England³; Kholoud Alzyoud³; Peter Hogg³

¹The Mid Yorkshire Hospitals NHS Trust; ²The Mid Yorkshire Hospitals NHS Trust, University of Bradford; ³University of Salford

Background: There is increasing evidence demonstrating the importance of spinopelvic alignment on image appearances when undertaking pelvic radiography (Fuchs-Winkelmann et al, 2008, Jackson et al, 2016). Previous research from the SEPRAIDD project (ISRCTN) has demonstrated that patient's body morphologies change with anteroposterior thickness increasing with patients imaged in the erect position. This study has considered the implications for clinical measures used within pelvis radiography and assessed for any significant changes between supine and erect positions.

Method: Ethical approval was gained for patients referred for pelvic radiographs to undergo measurements of body habitus in both erect and supine positions and to have radiographs obtained in both positions. Clinical measurements were performed on all radiographs, including sacrococcygeal-symphysis distance, Sharp's angle, Tonnis angle, Wiberg's centre-edge angle, acetabular quotient, femoral head extrusion index, Kellgren-Lawrence grading and the presence or absence of crossover sign, posterior wall sign, ischial spine prominence and cam and pincer deformities.

Results: 60 participants were recruited. Variations in abdominal thickness were observed between erect and supine positions with a change in anterior pelvic tilt demonstrated, assessed by sacrococcygeal-symphysis distance measurements. However, there was no correlation between the patient's BMI or the measured sacrococcygeal-symphysis distance and the other clinical measures.

Conclusion: Radiographic technique for the pelvis can be adapted to be performed in the erect position. This may result in a change in pelvic tilt but the assessed clinical measures remain unaffected from this change in technique, giving confidence for the continued use of these measurements if radiographic acquisition techniques change.

Fuchs-Winkelmann, S., Peterlein, C. D., Tibesku, C. O., & Weinstein, S. L. (2008). Comparison of pelvic radiographs in weightbearing and supine positions. *Clinical Orthopaedics and Related Research*, 466(4), 809–812.

ISRCTN registry. Supine and erect pelvis radiographs: a pilot study.

Jackson, T. J., Estess, A. A., & Adamson, G. J. (2016). Supine and Standing AP Pelvis Radiographs in the Evaluation of Pincer Femoroacetabular Impingement. *Clinical Orthopaedics and Related Research*, 474(7), 1692–1696. <https://doi.org/10.1007/s11999-016-4766-7>

J6.2 Experiences of delivering an MR-only prostate radiotherapy pathway: The view from the treatment floor

Rachel Brooks; Hazel McCallum; Jonathan Wyatt; Karen Pilling; John Frew; Rachel Pearson

Newcastle upon Tyne Hospitals

Background: MR-only planning has dosimetric^[1] and clinical benefits including smaller GTVs, potentially reducing side effects, greater geometrical accuracy and one less patient visit. At our centre we have delivered an MR-only radiotherapy pathway for 6 patients using MRI for target delineation and generation of synthetic CT to enable dose calculation. As the first department in the UK to use online soft tissue matching to an MRI reference image set, radiographer training and clinical implementation is presented.

Method: A group of 5 senior radiographers with extensive prostate soft tissue matching experience implemented the treatment technique. The staff had MRI outlining training with a Consultant Clinical Oncologist (CCO) to improve their recognition of prostate structures on an MRI scan and then did practice and benchmarking cases.

Results: Clinical implementation on the treatment units was straight-forward. The improved quality of the reference data and the definitive structure sets based on one reference data set contributed to efficient clinical decision making and timely treatment delivery. This enabled MR-only patients to be treated in the same allocated appointment time as standard prostate patients meaning intra-fraction motion and treatment machine capacity are comparable.

Conclusion: Moving from CT-planning to MR-only pathway was a substantial change in practice and training and support from CCOs was critical in ensuring patient safety when the change was first implemented. However, the high image quality of MR enabled radiographers to quickly develop expertise in MR-CBCT matching. In fact, the improved reference data set highlighted the opportunity to improve CBCT image quality.

1. Wyatt, J.J., Dowling, J.A., Kelly, C.G., McKenna, J., Johnstone, E., Speight, R., Henry, A., Greer, P.B. and McCallum, H.M., 2017. Investigating the generalisation of an atlas-based synthetic-CT algorithm to another centre and MR scanner for prostate MR-only radiotherapy. *Physics in Medicine & Biology*, 62(24), p.N548

J6.3 MR-guided isotoxic dose escalation of muscle-invasive bladder cancer using diffusion-weighted MRI

Jane Rogers¹; Victoria Sherwood¹; Sarah Wayte¹; Jon Duffy²; Spyros Manolopoulos²

¹University Hospitals Coventry and Warwickshire NHS Trust; ²University of Warwick

Background: Outcomes for muscle-invasive bladder cancer (MIBC) have changed little over recent decades, with long term survival remaining around 50 % (CRUK, 2018). Standard treatment involves resection of the tumour followed by uniform radiotherapy to the whole bladder, as residual tumour is not readily visible on computed tomography (CT). This work



investigated the use of diffusion-weighted MRI (DW-MRI) to enable dose-escalation, aiming to quantify local control improvements via MRI-based changes in technique.

Method: Geometrical distortion in DW-MRI was investigated via a bladder-mimicking phantom, to quantify effects on fiducial markers between DW-MRI, T2-weighted MRI, and CT. Open source software was tested for correction of magnetic susceptibility-related distortion in DW-MRI.

Patient CTs were used to mimic registration of DW-MRI to CT via 18 simulated bladder tumours, with planning target volume margins incorporating findings from the phantom investigations. Dose-escalated plans were compared against standard plans, using established organ at risk dose-constraints. Poisson-based TCP models were fitted to MIBC trials data and used to predict TCP.

Results: Fiducial locations on distortion-corrected DW-MRI agreed with CT within a maximum of 1.8 mm (mean 1.3 mm). Maximum dose-escalations to simulated tumours of 70 - 78 Gy were possible corresponding to TCP increases of 9.0 - 19.2 % and were highly dependent on tumour location.

Conclusion: The use of DW-MRI for planning and pre-treatment imaging of MIBC patients could isotoxically increase local control of MIBC. A personalised approach in which prescription is dependent on tumour location is indicated.

1. CRUK, 2018. Bladder cancer survival statistics. [Online] Available at: www.cancerresearchuk.org/health-professional/cancer-statistics/statistics-by-cancer-type/bladder-cancer/survival#heading=Two

J6.4 Incidentally detected renal cancers - characteristics and route to diagnosis

Tom Welsh; Amoolya Mannava; Alison Bradley; Giles Maskell

Royal Cornwall Hospitals NHS Trust

Background: Renal cancer is increasingly diagnosed as an incidental finding on imaging performed for another purpose.

Method: Imaging and histology records of 308 consecutive patients with a confirmed diagnosis of renal cancer were reviewed.

Results: 114 patients (37%) were symptomatic (pain, mass, haematuria or systemic symptoms) at the time of diagnosis and 194 patients (63 %) had tumours diagnosed incidentally. Of the incidentally detected tumours, 80 (41%) were identified on US, 75 (39%) on CT, 35 (18%) on MRI and 4 (2%) on other modalities. Although the majority were identified on abdominal ultrasound or thoraco-abdominal CT, a significant number of tumours were identified on other tests including spinal, hepatobiliary and cardiac MRI as well as hybrid radionuclide examinations. Incidentally detected cancers were found in younger patients (median age 65 versus 69), and were smaller in size (median 5.5cm versus 7.2cm). There were no significant differences in cell type between symptomatic and incidentally detected cancers. Considering only the cancers of clear cell type, which comprised 80% of all tumours, the incidentally detected lesions were of a lower Fuhrman grade than those found in the symptomatic cohort.

Conclusion: Incidentally detected renal tumours differ in certain characteristics from those identified as a result of symptoms. Reporters of many different types of imaging studies should be alert to the possibility of making an incidental diagnosis of renal cancer.

J6.5 Exploring the potential relationships between microvascular haemodynamics and density in bone: A feasibility study utilising near infrared spectroscopy

Robert Meertens; Karen Knapp; Francesco Casanova; Susan Ball; William David Strain

University of Exeter

Background: Near infrared spectroscopy (NIRS) has shown promise at providing real time measurements of haemodynamics markers in bone tissue *in vivo*. This is an exciting prospect given existing difficulties in measuring haemodynamics in bone tissue, and the potential pathogenic role of microvascular dysfunction on bone health^[1]. To date there has been no attempt to associate NIRS derived haemodynamic changes with the primary clinically accepted method of assessing bone health: bone mineral densitometry (BMD) using dual-energy X-ray absorptiometry (DXA).

Method: 36 participants underwent NIRS testing of the proximal tibia using an arterial occlusion protocol of the thigh to observe oxygen extraction rates under ischaemic conditions, and subsequent recovery post occlusion release. Participants also underwent DXA testing for BMD of the total body and at the site of NIRS measurement.

Results: There were statistically significant correlations between oxygen extraction rates during arterial occlusion with NIRS and BMD at the proximal tibia ($r=0.45$, $p=0.01$), average leg BMD ($r=0.44$, $p=0.01$), and total body BMD ($r=0.43$, $p=0.01$). There were statistically significant correlations between NIRS markers of hyperaemic recovery post arterial occlusion and BMD at the proximal tibia ($r=0.44$, $p=0.01$), average leg BMD ($r=0.53$, $p=0.001$), and total body BMD ($r=0.52$, $p=0.002$).

Conclusion: Results suggest weak to moderate positive associations between BMD and haemodynamic changes during ischaemia and recovery at the proximal tibia. Whilst these associations should be interpreted tentatively, this is the first study demonstrating the potential for NIRS to complement DXA in research around the potential pathophysiological role of microvascular dysfunction within bone tissue.

1. Meertens R, Casanova F, Knapp KM, Thorn C, Strain WD. Use of near infrared systems for investigations of haemodynamics in human *in vivo* bone tissue: A systematic review. *Journal of Orthopaedic Research*. 2018 Oct;36(10):2595-603



J6.6 Recognising and sharing the benefits of participation in diagnostic imaging research

[Martine Harris](#)¹; [Judith Holliday](#)¹; [Beverly Snaith](#)²

¹The Mid Yorkshire Hospitals NHS Trust; ²The Mid Yorkshire Hospitals NHS Trust & University of Bradford

Background: Health research is undertaken in NHS organisations across the UK with outcomes informing evidence-based practice and advances in patient care. There is a strong drive to grow patient-focussed research activity within diagnostic imaging, particularly research which combines emerging technologies and innovative practice to improve quality and patient experience. Although evidence shows that research activity can influence care processes and impact hosting organisations, such outcomes are often not acknowledged. This work presents the application of an actionable research impact tool^[1] to assess the wider benefits of undertaking research within diagnostic imaging.

Method: The VICTOR tool (making Visible the ImpaCT Of Research) was used to evaluate six research impact domains for two radiology initiated research studies exploring point-of-care creatinine testing. This included service and workforce, health benefits, research capacity, economic impacts, knowledge, networks and influence. The focus was to capture stakeholder perceptions of where research impact mattered most to the organisation.

Results: A range of impacts were highlighted across all domains. Additional to recognisable advantages of research participation such as knowledge generation, the tool captured broader gains of research engagement. Although not exhaustive, this comprised patient safety benefits, increased knowledge of participants, enhanced change management, strengthened multi-disciplinary team relationships and collaboration with external partners.

Conclusion: Utilising the VICTOR tool, this case study has demonstrated the difference that research made in developing the clinical and research skills of staff, implementing sustainable workforce and service changes and partnership working with patients. Findings will inform future research delivery to maximise impacts to those involved.

1. The National Institute for Health Research Collaboration for Leadership in Applied Health Research and Care Yorkshire and Humber (2019) VICTOR: Visible impact of research

L6 Best practice short paper presentations

L6.1 Parathyroid isotope imaging: Best practice?

[Peter Strouhal](#); [Shahad Yahya](#); [Peter Turner](#)

Royal Wolverhampton NHS Trust

Background: Parathyroid imaging is challenging with isotopes as the glands are imaged only indirectly and there is no agreement on what is the overall best method: SPECT (or SPECT.CT), washout imaging, or dual-isotope subtraction imaging? Or a combination? Most institutions (from previous publications and surveys) use a compromised protocol due to time constraints what with no generic BNMS guidelines for the same. And what if the isotope study is discordant with concurrent ultrasound scan? Which modality to then rely on as correct? Should all these patients have 4D-CT post contrast study? And when to operate, based on which imaging?

Purpose: We summarise our experience over last 8 years in a tertiary/quaternary referral centre where combined medical/surgical clinics are run, with difficult cases further reviewed at MDT; we showcase how isotope imaging should include all of dual isotope thyroid-parathyroid imaging, washout and SPECT.CT imaging; we include tips and tricks to optimise these protocols from patient perspective and how to carefully correlate with ultrasound in an algorithm, so <3% need to go to CT (scanners that are usually already running to capacity in most hospitals) without compromising the surgical outcome. All cases included have pathology correlation or long-term follow-up.

Summary: We propose (will display) the 'optimum' parathyroid imaging algorithm, including patient prep and optimising scans to increase signal to noise and reduce artefacts; correlated to outcomes, we also propose (and will show) a patient pathway based on the imaging.

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L6.2 Investigating occult malignancy in patients with unprovoked venous thromboembolism at a large teaching hospital: Changing practice

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Background: 'Idiopathic' venous thromboembolism (VTE) can be the first manifestation of occult malignancy^[1]. The incidence of occult malignancy in unprovoked VTE patients studied in two recent, high-quality, randomised controlled trials was only 4% (previously considered >10%)^[2,3,4]. Routine screening with CT abdomen/pelvis did not provide a clinically significant benefit^[2]. We wish to establish the occult malignancy detection rate in our Trust and determine whether we are appropriately investigating patients in line with current NICE guidance^[5].



Method & results: A retrospective, observational, single-centre study analysed all pulmonary angiograms, ventilation/perfusion scans and lower limb dopplers between 23/06/2014-31/08/2014. 37% of 108 VTE's were unprovoked. 56% had subsequent CT abdomen/pelvis that demonstrated a malignancy rate of 2.6%. There was wide variability in other malignancy investigations performed e.g. none had mammography and <50% had serum calcium or chest X-ray. Patients as young as 28 were exposed to radiation without the first-line investigations having been performed first.

We produced recommendations based on NICE guidance^[5] for investigating patients with 'unprovoked' VTE that was distributed to all Trust consultants and GP practices. Findings and recommendations were presented locally.

A second study was performed with identical inclusion criteria from 03/08/2017—28/01/2018. Of the 49 unprovoked VTE's, 4% had subsequent abdominal imaging. The majority had standard investigations in line with the new guidance.

Conclusion: Our 2.6% rate of occult malignancy in unprovoked VTE is comparable to the literature. Following distribution of new Trust VTE recommendations the frequency of screening CT abdomen/pelvis reduced from 56% to 4% with projected financial and resource savings.

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L6.3 Time to Lego - re-thinking the radiology job plan

Melissa Werndle; Andrew Macallister; Nicholas Ridley; Sian Davies

Great Western NHS Hospital Trust

Background: Radiology workload continues to grow with little growth in radiology numbers. Radiologists along with Pathologists are relatively unique in that unlike many clinicians' work can be generated for them outside of the job planning process. They are often rota'd to perform two or more tasks at once. Current job plans reflect each session in a day by day hourly chart (we use CRMS). The complexity, overlap and workload within these sessions is not truly reflected. We wished to create an alternative approach to the job plan that would be more accurate.

Method: We reviewed some actual job plans in our department. Instead of viewing these in the standard format we created a single vertical job plan, where each task was given a precise sessional value. Overlapping tasks such as reporting double CT list, duty radiologist, meeting would get a true value and not be lost in the standard job planning chart. Once the values are stacked like lego bricks vertically in a single tower with the height in agreed sessions marked it becomes clear how the workload exceeds the allocated sessions.

Results: Work load in radiology is underestimated using the current sessional planning standard. This can be as much as a PA per week.

Conclusion: A vertical job plan will accurately reflect when work load exceeds the allocated sessions. A quart cannot be poured into a pint pot.

L6.4 How readable are radiology reports?

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Frimley Health Foundation Trust

Background: The objective of this study was to assess the readability of radiological reports in common imaging modalities and the reading grade required to understand them. We aimed to identify the ease with which a patient may read and understand their own report should it be provided to them, through increasing access to medical records.

Method: This retrospective study assessed 50 reports from each radiology modality (Radiographs, Ultrasound, CT, MRI, Fluoroscopy and Nuclear Medicine) between 01 and 30 January 2018 randomly selected using a random number list. Foreign film imaging and autotext reports were excluded. An online calculator was used to assess semantic (word length) and syntactic (sentence length) content and readability scores including Flesch Reading Ease (higher scores were easier to read) and Flesch Kincaid Grade level (score equivalent to the US grade level of education that the reader would require to be able to understand that text). Studies suggest a Flesch Reading Ease of 60 and Flesch Kincaid Grade level of 8 for the general public to understand a document.

Results: On average a radiology report had 2 syllables in each word and 11 words in each sentence, giving an average Flesch Reading Ease of 30.8 (range -4.2 to 55.2). The average Flesch Kincaid Grade Level showed 12.1 years of formal education were required to understand radiology reports (range 10.3 to 13.1). There was no significant difference in scores over different imaging modalities.

Conclusion: Readability scores suggest that in their present form radiology reports are not readily understandable.



L6.5 Performance of Nigeria-trained radiographers in X-ray interpretation

Christopher Ohagwu; Christopher Ilounoh; Joseph Eze

Nnamdi Azikiwe University, Awka

Background: There is currently a dearth of radiologists in many countries including Nigeria leading to many X-ray examinations not to being reported before getting to the referring clinician. Radiographers are the best placed allied health professionals to provide expert opinions on radiographs in the absence of the radiologist but there continue to be a debate on the suitability of Nigeria-trained radiographers for X-ray interpretation.

Aim: To assess the performance of Nigeria-trained radiographers in the interpretation of X-ray films from a selected range of X-ray investigations. **Material and Methods:** Ten Nigerian radiographers blinded to one another interpreted films from 1189 X-ray examinations. The interpretations of each radiographer were compared with the contents of a radiologist's reports which were regarded as the gold standard. The sensitivity, specificity and accuracy of the radiographers' interpretations were then determined.

Results: An overall sensitivity of 89.8 per cent, specificity of 93.5 per cent and an accuracy of 92.3 per cent were recorded for the performance of the Nigeria-trained radiographers in X-ray film interpretation. Results suggest that additional training in X-ray interpretation lead to significantly better performance in X-ray interpretation ($p < 0.05$).

Conclusion: The performance of the selected Nigeria-trained radiographers in X-ray film interpretation is very high and may be improved upon by an additional training in X-ray film interpretation. Therefore, Nigeria-trained radiographers with X-ray film interpretation skills may report the selected range of x-ray investigations in the absence of a radiologist or as an addition to the radiology workforce.

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L6.6 Barriers to research utilisation amongst diagnostic radiographers in the UK

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NHS Tayside

Introduction: Lack of research uptake and utilisation amongst radiographers compared to other allied health professions prompted the publications of four consecutive research strategies by the Society and College of Radiographers in attempts to bridge the gap.

Aim: The aim of this study was to find out perceived barriers to research utilisation amongst diagnostic radiographers in the UK.

Method: The BARRIERS scale questionnaire was used to solicit for the perception of 1020 radiographers working in the NHS.

Results: Response rate was 72.8%. The majority of radiographers were Band 6 (n=296, 47.0%) holders. Only 8(1.3%) of the radiographers held a doctorate. The greatest perceived barriers to research utilisation were departments not making time for research-related activities (n=437,69.4%), how to develop research questions (n=355, 56.3%), find relevant literature (n=320, 50.8%), workload (n=317, 50.3%) and interpret statistics (n=311, 49.4%). There was a positive attitude to research utilisation however, 198 (31.4%) held the view that research was not in their scope of practice. A further 127 (20.2%) felt radiologists and physicists should review research in their practice. Statistically significant differences existed for age range, highest educational



qualification, number of years qualified and area of practice in relation to attitude to research. It was found that the highest educational qualification was associated with a higher probability of research knowledge ($p=0.040$).

Conclusion: The study concludes that dissemination mechanisms to facilitate research utilisation are lacking within radiology departments. It is recommended that managers and lead radiographers create a platform that will enable practitioners to communicate research evidence in their practice.

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N5 Education short paper presentations

N5.1 Group coaching to support therapeutic radiography students during clinical placement

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Royal Surrey County Hospital NHS Foundation Trust

Introduction: With a history of high attrition rates attributed to feeling a low sense of belonging whilst on clinical placement^[1], there is a need for clinical educators to provide support which allows students to feel empowered and seek their own solutions^[2]. Coaching provides students with a safe, confidential space to discuss aspects of work, and has been successfully implemented within pharmacy to support their trainees. Thus, decided to trial this approach with therapeutic radiography students.

Method: A four week inter-professional group coaching programme for radiotherapy and pharmacy trainees focusing on Confidence and Self-belief, Resilience, Time Management and Interview Skills was run.

Results: Confidence and Self-belief saw a 75% decrease in feelings of low confidence and a 50% increase in those who now felt very confident. Similarly, Resilience saw a 100% decrease in those who expressed poor confidence initially.

Conclusion: Students embraced coaching and 9/13 participants would recommend this programme to others. Coaching addressed key barriers to learning such as confidence and resilience. Students enjoyed partaking in group discussion in a safe environment, collaboration across departments, and gaining perspectives of other professions. Moving forward we will monitor these students over the duration of their placement to assess for a tangible impact as feedback from the post questionnaire suggested it was too soon to fully appreciate the true impact of the sessions. Overall the results would support adopting coaching to support our trainees during their clinical placement.

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N5.2 Exploring and understanding research pedagogy in radiography, in a UK university

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Background: As a radiography educator studying for a Professional Doctorate in Education, research pedagogy and the importance of research for our profession form the focus of my study. The aims include addressing issues raised by The College and Society of Radiographers 'Research Strategy 2016-2021' (2015) around embedding research in the curriculum. This research explored how current practice in one educational setting endeavours to realise the aims of this research strategy from the perspective of educators and radiography students.

Methods: By developing an innovative use of imagery in both data collection and presentation of results, my method is symbolic of the practices of the radiography profession as it maintains the importance of images, their interpretation, and use in my research. Participants were invited to take part in individual interviews which included participant image making. Information gathered was reported as a pictorial and written narrative, in an echo of our professional work of image making and reporting. A thematic analysis was conducted, looking for patterns through all the data.

Results: The data has been viewed through a Bourdieusian lens, using concepts of habitus (Bourdieu 1977) and professional field (Wacquant 1989). The results suggest that radiography students and educators do see the importance of research to individuals and the profession but identify many constraints to teaching and learning.

Conclusion: The findings will be used to inform future research pedagogy and curriculum development in radiography, helping us to embed research in the curriculum in a way that educators and students recognise.

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N5.3 Adopt and adapt: Undergraduate diagnostic radiography student responses to technology enhanced collaborative assessment using online wiki and verbal MS PowerPoint presentations

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University of Cumbria

The views of diagnostic radiography students using two methods of computer supported collaborative learning (CSCL) are considered in this study. Second year students, in groups, used the the 'familiar' Microsoft (MS) PowerPoint presentation and the 'novel' wiki, a web communication and collaboration tool to explore the diagnosis of common diseases. Using an action research methodology, informed by grounded theory, outcome measures using the two group assessments are explored, particularly socio-emotional responses.

The influence of learning approach on identified themes is emphasised. This study was prompted by increasing opportunities for group formative assessment afforded by the virtual learning environments provided by universities. There has been relatively little previous work on the response of students with varying learning approaches towards using CSCL. Eight 'surface' and eight 'deep' learners were identified from online questionnaire responses and a number of key themes were clarified and explored. Findings demonstrated that all students had previous experience of MS PowerPoint; however, the wiki was new to students. Learning approach influenced students' experience of these CSCL assessments, with surface learners more likely to be passive and welcoming learning from others. Deep learners more clearly identified the benefits of online working, for example, working remotely from others in the group, and were concerned about effort from others in group work. Anxiety about verbal presentations was widespread, affecting the learning of surface learners particularly; wikis caused less anxiety, and were valuable to some students. This research increases understanding of the complex responses of students adapting to computer supported group learning.

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N5.4 Compassionate patient care in diagnostic medical imaging

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University of Exeter College of Medicine and Health

Background: Compassion is a poorly understood concept in medical imaging research, but an increase in its focus was recommended in the Francis Report (2013). Qualitative data were collected from student radiographers, service users and radiographers to conceptualise compassion and understand its meaning and manifestation in diagnostic imaging (DI) with a view to producing recommendations for radiography education and research.

Methods: The project was conducted from within a constructivist paradigm with appropriate ethical approval. Thirty-four semi-structured interviews were conducted with a purposive sample of DI ex-patients. Five focus groups with approximately six student radiographers recently returned from placement and one group of post-graduate radiographers were facilitated, and data were harvested from an online journal club discussion between radiographers of the author's published literature review. Data were transcribed and analysed thematically.

Results: The data reveal individual variations in needs, expectations, feelings and attitudes during DI, with preliminary results suggesting themes of humanity, kindness and understanding as key components of a compassionate radiographer-patient interaction. Asking targeted clinical questions during the introductory stage of the interaction establishes rapport between radiographer and patient and offering information about patients' X-ray images during the closing stages may limit or reduce uncertainty and anxiety. These findings have implications for scope of practice around training and competence in image interpretation.

Conclusion: Foregrounding the humanities in the radiography curriculum, in particular philosophy and ethics might personalise an otherwise technically focused radiographer-patient interaction. Understanding the nature of compassionate care could inform future interventions to re-structure patient examinations in DI.

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N5.5 A pilot study investigating the effectiveness of a collaborative workshop between medical students and diagnostic radiography students on justifying radiology request forms to comply with IRMER legislation

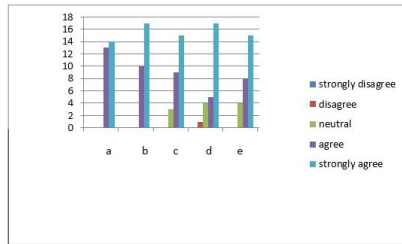
Joanne Holmes

The Dudley Group NHS Foundation Trust



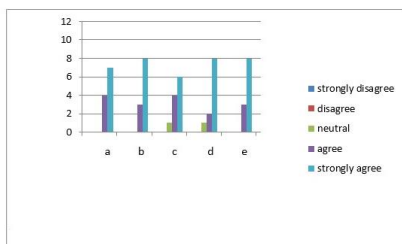
Background: Medical Students should be familiar with how to request and justify X-rays in preparation for working as a doctor.

Medical student feedback



- a) The workshop content was relevant to my course
- b) The workshop content was relevant to my future practice
- c) The workshop has increased my knowledge of what happens in an Imaging Department
- d) The workshop has increased my understanding of the risks of ionising radiation within a hospital environment
- e) I feel more confident about explaining imaging tests to patients

Radiography student feedback



- a) The workshop content was relevant to my course
- b) The workshop content was relevant to my future practice
- c) The workshop has increased my knowledge of what happens in an Imaging Department
- d) The workshop has increased my understanding of the risks of ionising radiation within a hospital environment
- e) I feel more confident about explaining imaging tests to patients

Existing literature is limited but has recognised a dearth of teaching in this area and examples of poor communication between medical teams and imaging departments is cited as a result of inadequate imaging requests.

Method: After briefly introducing the Ionising Radiation (Medical Exposure) Regulations (IRMER) the students were given clinical scenarios where diagnostic imaging of the patient was necessary. Working in small multi-disciplinary groups the medical students decided upon appropriate imaging for the patient and wrote a request form for the radiography students to justify. The interactive session was designed to encourage effective communication across the two professions and was facilitated by a qualified Diagnostic Radiographer and Clinical Teaching Fellow who answered questions and clarified best practice. Finally, students critiqued sample request forms and decided whether they were justified under IRMER.

Results: Feedback questionnaires indicated that the workshop was well received, with students from both professions citing the benefits of discussing appropriate imaging for patients and practically writing requests.

Conclusion: This pilot study although small scale, endorses inter-professional education to enable students to understand their future roles when communicating about and arranging for patients to undergo diagnostic imaging. Discussion of how similar workshops may be incorporated into academic programmes for both professions is recommended in the future with research into the effects of this training may have on communication and justification of radiology procedures in the clinical environment.

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Kruse J, Lehto N, Riklund K, Tegner Y & Engström Å (2016) Scrutinized with inadequate control and support: Interns' experiences communicating with and writing referrals to hospital radiology departments — A qualitative study Radiography 22 313-318

Nyhssen CM, Patel P & O'Connell JE (2016) Bullying and harassment — Are junior doctors always the victims? Radiography 22 e264- e268

Strudwick RM & Day J (2014) Interprofessional working in diagnostic radiography Radiography 20 235-240

N5.6 Personalised e-learning for MSc medical ultrasound students

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Purpose: The use of e-Learning is widespread in healthcare education^[1], however it can be controversial and have mixed results^[2,3]. Lecturers at the University of Cumbria have personalised e-learning programmes from e-Learning for Healthcare and the Society of Radiographers and used these as a basis for their course material. Lecturers have incorporated the e-learning within their teaching. Students who will start the course in January 2019 will have an opportunity to feedback on their experience.

Background: MSc Medical Imaging (Ultrasound) is a new fulltime programme at the University of Cumbria. This is intensive an accelerated pathway to a career in sonography, designed to address the UK-wide shortage. The University are working in partnership with Health Education England, e-Learning for Healthcare (HEE e-LfH) to provide a personalised learning pathway to help students acquire the academic knowledge to work in the field. e-LfH is a vast resource containing over 200 programmes, including several specialist imaging projects - Image Interpretation, Radiology, eProton, Radiotherp-e and e-IRMER. Within the radiography programme, Image Interpretation, there are over 400 sessions, a fantastic free resource, but where to start? Lecturers at the University of Cumbria have curated relevant content into a learning path, allowing material to be structured in a format that mirrors their university programme.

Summary: A joint project between the University of Cumbria, Society of Radiographers and e-learning for Healthcare. Demonstrating the value of collective working to make the most of existing educational resources by personalising the approach.

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