



## C1 Patient and Public Involvement (PPI)

### Evaluations on the clinical effectiveness of a bespoke prostate PROMS baseline questionnaire

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**Objective:** In prostate cancer management, it's prudent to assess patients' baseline status to accurately assess treatment toxicity post radiotherapy. A bespoke PROMS pre-radiotherapy baseline questionnaire was implemented at our department and this study aims to evaluate its clinical effectiveness in terms of patients' feedback and cost savings.

**Method:** From January 2017 to May 2017, 50 prostate cancer radiotherapy patients filled out the PROMS pre-radiotherapy baseline questionnaire. If the patient indicated current function of genitourinary (GU), gastro-intestinal (GI) or sexual function (SF) were causing poor quality of life the patient had a telephone consultation and any suggestions recorded.

**Results:** 45/50 patients indicated they would need further support prior to starting radiotherapy. 64% of patients needed advice on pharmacological intervention for current GU symptoms. 48% of patients needed further support for current GI symptoms and 17% needing advice on pharmacological intervention. 44% of patients needed advice on pharmacological intervention for current SF. The patients were asked to access the pharmacological intervention via their primary care providers. This resulted in departmental savings of £114.60 with the 50 patients in this study. With an estimation of 500 prostate radiotherapy patients per year at our department, this would result in a total annual saving of £1145.

**Conclusion:** This study suggested that there was a role in using baseline PROMS to address prostate cancer patients' physical/psychosocial needs prior to radiotherapy in terms of better patient-centred care and economical savings for our department.

### Turning the corner: A mixed-methods investigation of the radiotherapy information needs of GPs

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**Background:** NHS cancer strategy emphasises delivery of integrated care across primary and secondary environments. However, previous studies have highlighted a radiotherapy knowledge gap amongst GPs. This study aimed to identify the radiotherapy information needs of GPs and explore how these could be met by a large regional cancer centre.

**Method:** A 10-item questionnaire developed by the researcher was distributed to all 123 practice managers in a single health board. To add depth and detail volunteers were then recruited for semi-structured interviews.

**Results:** 93 valid questionnaires were received in the four week data collection period. Although 95% had cared for a patient undergoing radiotherapy, only 4% agreed that radiotherapy information was easy to access. Confidence in indications for emergency radiotherapy (65%) and indications for palliative radiotherapy (64%) were highest, while confidence in how radiotherapy interacts with other treatments (2%) and in managing acute side effects beyond skin reactions (14%) were lowest. 70% of GPs reported having radiotherapy education. This was correlated with confidence in explaining radiotherapy ( $p=0.013$ ), discussing long-term side effects ( $p=0.036$ ) and indications for palliative radiotherapy ( $p=0.02$ ). GPs preferred easily accessible electronic information, and suggested adding radiotherapy information to an existing platform. They also perceived a division between specialist and primary care.

**Conclusion:** The integrated care outlined in NHS cancer strategy is challenged in practice by lack of knowledge and an underlying perception among GPs of fragmentation of care. This affects patients and should be addressed as a priority with straightforward electronic information and more complex strategic interventions.

1. Baart et al. (2009) GPs and referral for palliative radiotherapy. *Rad and Onc*. **91**, 267-270. 2. Berendsen et al. (2015) The expanding role of primary care in cancer control. *Lancet Onc. Comm*. **16**, 1231-1272. 3. De Bock et al. (2012) Role of the GP during the active breast cancer treatment phase. *Supportive Cancer Care* (April), 705-714.

## C10 The needs of contemporary knowledge based planning

### Automated prostate radiotherapy scripting - a step towards quality improvement

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**Background:** Faced with an increase in the number of patients undergoing radical pelvic radiotherapy (RT) for urological cancers, methods of efficient, safe and reproducible target volume delineation are required. Automated scripts in pelvic radiotherapy planning could reduce human error, produce reproducible target volume delineation, increase consistency and reduce radiotherapy treatment planning times. We developed an automated multistep prostate RT planning script.

**Methodology:** Predefined organs at risk (OARs) such as bladder, bowel Planning Risk Volume (PRV), rectum and Clinical Target Volumes (CTVs): CTVprostatic +/- CTVseminalvesicle, CTVnodes were outlined according to the PIVOTAL trial guidelines.

Automated prostate scripts were developed and tested in conjunction with RT physics and Clinical Oncologists to mimic this trial's RT target volumes. The final script was run to generate corresponding PIVOTAL compliant planning target volumes (PTVs): PTVprostatic +/- PTVseminalvesicle and PTVpelvic, whilst bypassing the OARs. Script commands did not run if set critical target



volumes were missing/duplicated. Results PTVs were generated that were compliant with the PIVOTAL trial and reduced clinician planning time by more than 50%. However, there was an increased dosimetrist time. To overcome this, bespoke target volume atlases including 'Bone-Muscle-Rim' were developed that decreased the dosimetrist time by approximately 30% and further improved consistency.

**Conclusion:** This automated prostate script consistently and efficiently generated the expected PTVs. The script is now locally routinely used in clinical practice. There is potential to modify this script for use in adjuvant prostate bed radiotherapy and other pelvic malignancies and this has been exploited locally with gynaecological pelvic outlining.

### The first UK survey of doses from radiotherapy treatment planning CT scans for adult patients

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**Background:** The first UK wide dose survey for radiotherapy CT planning scans has been completed. The survey was initiated by a working party of the Institute for Physics and Engineering in Medicine (IPEM).

**Method:** Patient dose metrics were collected for prostate, gynaecological, breast, 3D-lung, 4D-lung, brain and head/neck scans. Median values per scanner and examination type were calculated. National dose reference levels of CT dose index (CTDIvol) and dose-length-product (DLP) values for each examination type are proposed based on the third quartile values from the whole data set.

**Results:** 68 radiotherapy CT scanners were included. Patient numbers per scan type ranged from 664 to 1527 across the seven examinations. The proposed reference levels for CTDIvol (mGy) and DLP (mGy.cm) respectively are prostate 16 and 570, gynaecological 16 and 610, breast 10 and 390, 3D-lung 14 and 550, 4D-lung 63 and 1750, brain 50 and 1500 and head/neck 49 and 2150. Head/neck and 4D-lung had the largest differences (18 times) in dose between lowest and highest dose scanners. Problems with the data collected included some older scanners indicating maximum CTDIvol not scan average; the lack of standardisation as to whether CTDIvol is indicated for a 16 cm or 32 cm phantom for head scans; the lack of patient weight information available in many centres.

**Conclusion:** Evidence of clustering of results by scanner type suggests there is scope for protocol adjustment in some centres. Dose reference levels have been recommended to aid this.

### The introduction of dedicated planning MR-CT fusion for radical radiotherapy of prostate cancer

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**Purpose:** Advances in radiotherapy planning and delivery have made target definition increasingly important. While CT images are required for plan calculation, MR fusion is increasingly used to more accurately define tumour and normal tissue. There is often significant variation seen between diagnostic and therapeutic imaging; hence, MR carried out in the treatment position is desirable.

**Method:** A multidisciplinary team of diagnostic and therapeutic radiographers, treatment planners, medical physicists and clinicians was convened. Planning MR was integrated into the radiotherapy pathway and carried out in the days immediately following CT simulation. All men underwent identical preparation (administration of a micro-enema and drinking 300mL of water thirty minutes prior to imaging/treatment). Patients were set up in the treatment position using MR-compatible radiotherapy immobilisation. T2SE axial and sagittal images were acquired (Siemens Aera 1.5T E11, incorporating RT software platforms/LAP Laser Bridge/Civco RT Indexing Flat couch top/coil bridges), imported into the Eclipse planning system (V13.6, Varian), and fused to the planning CT for volume delineation.

**Results:** The service opened in mid-September 2017. 26 patients were scanned to the end of November 2017. All patients tolerated preparation and imaging without difficulty.

**Conclusion:** This service has been successfully introduced and will shortly expand to include other sites (rectum, lung, head and neck, complex palliative). A study is planned to assess the impact of the addition of MR on target delineation. Additional considerations include the need for dedicated radiology input and the potential role of collaboration with industry with a view to stand-alone MR simulation.

## D8 Respiratory motion management

### A respiratory motion management strategy for both abdominal and thoracic VMAT radiotherapy

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The London Clinic

**Purpose or objective:** When targeting with radiotherapy, it is important that this respiratory motion is accounted for. This is typically done by creating an Internal Target Volume (ITV). Alternative approaches include a breath-hold (BH) technique. This

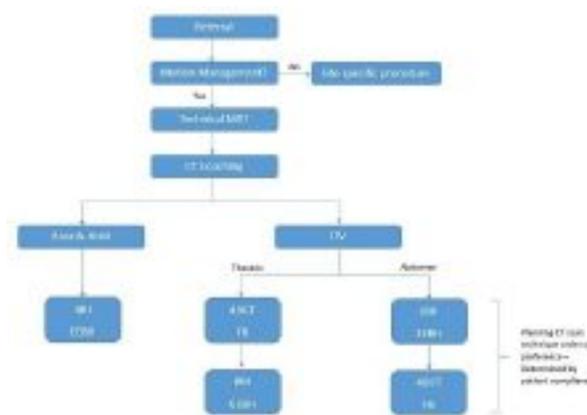


study investigates a motion management strategy which aims to provide the optimal motion management technique for each individual patient. This is shown in figure 1.

**Material and methods:** 43 patients were assessed within our motion management strategy were reviewed (mix of abdominal and thoracic sites). For each patient, Planning Target Volumes (PTV) were generated using both ITV and BH techniques and compared.

**Results:** The difference in the PTV between the two techniques varied, with a mean volume difference for all patients of 51cc (15% relative change). For pancreas, BH was smaller in 7/11 patients with a mean reduction of 60cc (28.4%) and maximum of 143cc (35%). For liver, BH was smaller in 6/7 patients with a mean reduction of 93cc (14.9%) and maximum of 189cc (38.7%). For lung, BH was smaller in 4/7 patients with a mean reduction of 15cc (13.9%) and maximum of 38cc (46%). For oesophagus, ITV was smaller for 4/6 patients by a mean of 52cc (14.6%) and a maximum of 85cc (10.4%). For mediastinum, ITV was smaller for 4/5 patients by a mean of 12cc (4.5%) and a maximum of 14cc (5.6%).

**Conclusion:** Results show that the optimal motion management strategy to minimise the irradiated volume is patient-specific. Therefore, it's important to have a flexible approach to motion management.



**Controlling motion in radiotherapy: Rapid shallow ventilation for thoracic targets**

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**Objective:** In radiotherapy, accounting for respiratory motion increases the volume of normal tissues irradiated, increasing healthy toxicity and constraining treatment efficacy.

**Aim:** To assess rapid shallow non-invasive ventilation (rsNIV)<sup>[1]</sup> for controlling internal respiratory motion for radiotherapy purposes. To our knowledge, this is the first study to evaluate internal anatomical motion using rsNIV to regularise and minimise respiratory variations over a period long enough to image and deliver complex high dose radiotherapy.

**Materials and methods:** 10 healthy volunteers (21.7-53.9yrs; mean 37.5yrs; 6f/4m) were scanned on an MR scanner in 3 respiratory modes; normal breathing and 2 non-invasive mechanically ventilated frequencies of 20 and 25 breathes per minute using a non-invasive ventilator. Sagittal and coronal cinematic datasets were acquired, and the resulting respiratory motions assessed. Respiratory amplitudes were measured across the lung-diaphragm interface and physiological parameters quantified tolerability of the mechanical ventilation.

**Results:** Basic physiological observations and subject experience questionnaires demonstrated our rsNIV technique was tolerable and comfortable. Motion analysis of the lung-diaphragm interface demonstrated that mean respiratory amplitude reduced considerably (55-82%) using rsNIV compared to subject initiated normal respiration (Figure 1).

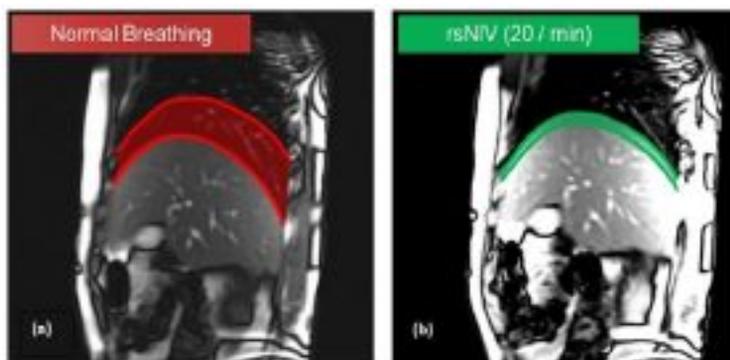


Figure 1: Sagittal cinematic MRI scans showing the range of respiratory motion in (a) normal breathing and (b) rapid shallow non-invasive ventilation (rsNIV) at 20 breathes per minute for a healthy volunteer.

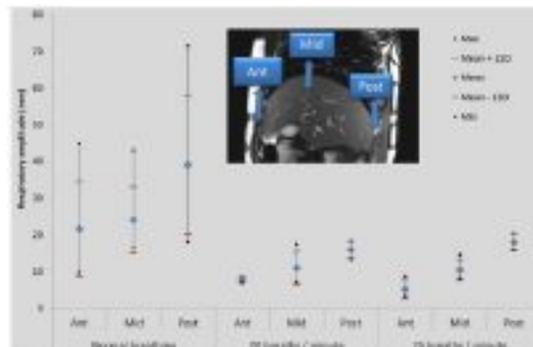


Figure 2: Mean respiratory amplitudes normal breathing, and under rapid shallow non-invasive ventilation control at 20 and 25 breathes per minute for the healthy volunteers.

**Conclusion:** Simple rapid shallow ventilation has demonstrated notable reproducible reductions in internal thoracic and abdominal motions. Clinical applications of large respiratory motion reductions could be profound; facilitating reduced motion will allow dose escalation and increased treatment efficacy. Particularly important for lung cancer patients where local control is limited by normal tissue toxicity. This work is currently being extended to patients referred for thoracic radiotherapy.

1. Parkes, M.J. (2016) Reducing the within-patient variability of breathing for radiotherapy delivery in conscious, unsedated cancer patients using a mechanical ventilator. Br J Radiol 89 20150741



## F1 Workforce challenges

### Development of a consultant radiographer led radical prostate radiotherapy service: An effective use of skills for patient benefit

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Curative treatment options for prostate cancer include surgery or radiotherapy, with neither modality being demonstrated as superior<sup>[1]</sup>. Prostate patients account for 25% of our radiotherapy department's workload and is set to rise. Consultant clinical oncologists are currently in short supply and so clinical capacity is reduced. Delays in oncology appointments to discuss radiotherapy as a treatment option cause anxiety for patients and their families, as well as resulting in breeches in cancer targets. Therefore, some patients opt for surgery as their treatment rather than waiting for an oncology appointment, thereby not making a fully informed treatment decision. In 2015, Macmillan supported the development of a consultant radiographer (CR) post with the aim of streamlining the pathway as well as offering additional oncology capacity.

For two years training needs were addressed through shadowing consultant oncologists, clinical supervision and assessment and self-directed learning. Competency in roles outside of the traditional radiographer scope of practice such as consent, referral and contouring were evidenced through records of supervision, developed into a clinical portfolio. Aspects such as clinical review and non-medical prescribing were addressed through formal qualifications. A streamlined radical prostate radiotherapy service has now been developed. A radiographer led service mimics that offered by a consultant oncologist. The CR can carry out all aspects of the role autonomously. A new referral system is now in place to ensure patients receive timely appointments with either the CR or the clinical oncologist, ensuring patients are fully informed of their treatment options and cancer pathways are adhered to.

1. Hamdy, F. C., Donovan, J.L., Lane, J. A., Mason, M., Metcalfe, C., Holding, P., Davis M., Peters, T. J., Turner, E. L., Martin, R.M., Oxley, J., Robinson, M., Staffurth, J., Walsh, E., Bollina, P., Catto, J., Doble, A., Doherty, A., Gillatt, D. and Kockelbergh, R. (2016). 10 year outcomes after Monitoring, Surgery or Radiotherapy for localized prostate cancer. *The New England Journal of Medicine*, (375), 1415-1424.

## I1 Adaptive radiotherapy

### Hybrid I-123 MIBG SPECT/CT - radiotherapy planning CT scanning for neuroblastoma

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**Background:** Neuroblastoma is the third most common tumour in children and I-123 MIBG SPECT/CT imaging is a well-established diagnostic tool that has not been previously used for radiotherapy target delineation at our centre, or routinely in the UK. This work will present our experience of two patients undergoing a hybrid SPECT/CT-planning CT scan, using a dedicated radiotherapy SPECT/CT scanner.

**Method:** Hybrid SPECT/CT-planning CT scans were performed for two patients aged <7yrs on a Siemens Symbia-T16 SPECT/CT enabled for radiotherapy treatment planning. A sequential SPECT/CT-planning CT in the radiotherapy treatment position; to be used for diagnosis, delineation, planning and radiotherapy dose calculation, was acquired. Co-ordinating the patient pathway involved an extensive multi-disciplinary team from Radiotherapy, Nuclear Medicine and Children's Services. Virtual-Simulation Software ProSoma (MedCom) was used for image fusion and target delineation.

**Results:** Clinicians reported increased confidence in outlined volumes using MIBG SPECT/CT compared to the CT planning scan alone. The benefits of a single imaging session were:

- A decrease in appointment time with an average scan time of 80 mins;
- The CT and SPECT are implicitly registered and no uncertainties in spatial alignment are introduced;
- The patient was saved an additional hospital visit and general anaesthetic procedure with associated risks and costs;
- More efficient diagnostic work-up and treatment planning preparation.

**Conclusion:** For the first time at our centre, a hybrid I-123 MIBG SPECT/CT-planning CT scan has been acquired and used for radiotherapy planning. This process will be developed into a clinical service for all neuroblastoma patients.

### Co-relationship between 3D surface imaging system and conventional volumetric registration in radiotherapy pelvis treatment positioning

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**Background:** 3D imaging has shown advantageous results on breast patients in detecting set-up errors without any radiation (Deantonio et al 2011 & Alderliesten et al 2013). This study aims at studying the co-relation of the surface registration with the cone beam computed tomography (CBCT) in radiotherapy pelvis treatment positioning.

**Method:** 12 pelvis patients with 267 fractions were selected which all of them had CT planning scans. During treatment, 3D surfaces were captured by a surface imaging system (AlignRT) prior to subsequent setup procedure. The set-up errors were



verified by the CBCT before treatment beam delivery. The discrepancies were calculated when comparing with the original planning CT scans. The resulting errors were compared with linear regression analysis and Bland-Altman plots.

**Results:** The Pearson correlation between setup errors were 0.57, 0.51, 0.65 in left-right (LR), craniocaudal (CC) and anterior-posterior (AP) directions respectively. For the differences between setup errors: The group means, systematic errors and random errors were 0.10cm, -0.30cm, -0.09cm; 0.13 cm, 0.37 cm, 0.29 cm and 0.18 cm, 0.22 cm, 0.22 cm in LR, CC, AP directions respectively. The paired t-test for random errors showed a significant difference between the two systems along all direction (all with  $t < 0.0001$ ).

**Conclusion:** The setup measurements by the 3D surface imaging has good correlation with the setup errors detected by CBCT. It can be used to assess the setup reproducibility for pelvis patients and reduce the number of setup corrections while using the CBCT.

1. Alderliesten T, Sonke J, Betgen et al 2011. Accuracy Evaluation of a 3-Dimensional Surface Imaging System for Guidance in Deep-inspiration Breath-Hold Radiation Therapy. *Int J Radiation Oncol Biol Phys.* 85(2) 536-542

2. Deantonio L, Masini L, Loi G et al (2011). Detection of Setup uncertainties with 3D surface registration system for conformal radiotherapy of breast cancer. *Rpt of Pract Onco and radiother* 16:77-81

### Dose painting for prostate cancer with external beam radiotherapy: factors affecting the feasibility of treatment planning and dose delivery

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**Background:** Dose painting is a promising technique<sup>[1,2,3]</sup> which enables dose escalation to tumour nodules within the prostate. This study aims to determine factors affecting treatment feasibility for 20 patients with intermediate-high risk disease.

**Method:** Patients were imaged using a 3T MRI scanner and visible nodules outlined and registered with the planning CT. Plans were produced using OMP(Elekta). CHHIP constraints were used<sup>[4]</sup> and urethra and small bowel also delineated. Plans were assessed dosimetrically to determine whether the boosted distribution could be safely delivered.

**Results:** MRI scans were successful for 19/20 patients. 14 showed 1-2 nodules with 11/14 overlapping the urethra and/or rectum, 1 abutting the urethra and 2 not overlapping. The target boost of 86 Gy was achieved in 6/14 plans (see figure). For one patient this was limited to 82 Gy due to the constraints for rectum and urethra and 80 Gy for 5 more patients whose GTV overlapped or abutted the urethra. For the remaining 2 patients it was difficult to match CT & MRI images using rigid registration due to changes in prostate position between modalities. Dosimetric measurements were made on 5 plans using Compass (IBA). One marginally failed the gamma comparison (3% 3 mm) with 3.9% of failing points within PTV1 (limit 3%).

**Conclusion:** It was feasible to produce dose-painted plans for approximately half the patients with nodules. The main issue limiting the feasibility of dose painting was the proximity of organs-at-risk to the boost volumes. A strategy for improving CT/MRI registration issues is also required.

1 Bauman G et al (2013) Boosting imaging defined dominant prostatic tumors: A systematic review. *Radiother Oncol* 107 (2013) 274-281

2 Monnikhof EM et al (2018) Standard whole prostate gland radiotherapy with and without lesion boost in prostate cancer: Toxicity in the FLAME randomized controlled trial. *Radiother Oncol.* 2018 Jan 11. [Epub ahead of print]

3 Uzan J, Nahum AE, Syndikus I (2016) *Clin Oncol (R Coll Radiol).* 2016 Mar;28(3):165-70.

4 CHHIP Conventional or Hypofractionated High Dose Intensity Modulated Radiotherapy for Prostate Cancer (2006) Protocol Version 3.0 ICR-CTSU, Sutton, Surrey UK.

### UK clinical trials in the spotlight

#### Does the size of CTV-PTV margin in dysphagia-optimised intensity modulated radiotherapy (Do-IMRT) affect the quality of plan produced in the DARS head and neck cancer randomised trial?

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The DARS trial (CRUK/14/014) compares Do-IMRT versus standard IMRT in head and neck cancer treatment. For Do-IMRT, centres using a 5mm CTV-PTV margin experienced more difficulty meeting the pre-trial QA requirements than centres using a 3mm margin. This study aims to determine the effect of CTV-PTV margin on plan quality.

Centres completing the Do-IMRT oropharyngeal QA case were required to meet mandatory DVH constraints and encouraged to try to achieve optimal constraints. Compromise in coverage was permitted in PlanPTV\_5400 (54Gy PTV cropped from body and 65Gy PTV) only in the region of PlanSMPCM (Superior and Middle Pharyngeal Constructor Muscle cropped from 65Gy CTV) and PlanIPCM (Inferior Pharyngeal Constructor Muscle cropped from 65Gy CTV), see figure 1. DVH statistics for PTVs and OARs for the final plans were compared according to the CTV- PTV margin.

PlanIPCM, Brainstem PRV and ipsilateral parotid (parotid\_IL) dose statistics achieved by centres using a 3mm margin were statistically significantly lower than centres using a 5mm margin (table 1). Centres using a 3mm margin achieved poorer PlanPTV\_5400 D99%(Gy) compared to centres using a 5mm margin.



Initial experience in DARS suggests that the CTV-PTV margin affects plan quality for Do-IMRT plans; larger margins were associated with higher doses to some OARs. However, centres using a 5mm margin may be achieving better PlanPTV\_5400 coverage at the expense of PlanIPCM dose, therefore accounting for some of the differences. These findings do not take into account the possible effect of other factors such as treatment planning system.

Petkar I, Rooney K, Roe JWG, Patterson JM, Bernstein D, Tyler JM, Emson MA, Morden JP, Mertens K, Miles E, Beasley M, Roques T, Bhide SA, Newbold KL, Harrington KJ, Hall E, Nutting CM. (2016) DARS: a phase III randomised multicentre study of dysphagia- optimised intensity- modulated radiotherapy (Do-IMRT) versus standard intensity- modulated radiotherapy (S-IMRT) in head and neck cancer. BMC Cancer 16(770).  
DARS QA team. DARS Radiotherapy outlining and planning QA guidelines. Version 1.4. January 2016.

**Planning benchmark cases for IMRiS phase II trial: Will different optimisation techniques in bone sarcomas impact on clinical outcomes?**

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<sup>1</sup>National Radiotherapy Trials Quality Assurance (RTTQA) Group; <sup>2</sup>University College Hospital; <sup>3</sup>Cancer Research UK & University College London Cancer Trials Centre

**Background:** IMRiS (Clinicaltrials.gov id:NCT02520128) is a multicentre phase II trial of Intensity Modulated Radiotherapy (IMRT) in bone and soft tissue sarcomas. Here we report on the non-Ewings primary bone sarcoma of pelvis cohort. Primary high grade bone sarcomas require high radiation doses (70-74Gy). IMRT is used to limit dose to organs at risk while maximising dose coverage of the target. The differences observed in two optimising approaches and their potential clinical implications are reported.

**Method:** A high grade bone sarcoma of the sacrum was outlined and planned in 5 centres, as part of IMRiS QA programme. Dice Similarity Coefficient(DSC) was calculated as [see image] where A and B represent regions of interest.

$$DSC = \frac{2 |A \cap B|}{|A| + |B|}$$

The plans were categorised into two groups according to optimisation technique(OT): OT1= 1 dose level; OT2= 2-3 dose levels. An outlining ratio(OR) was calculated as OR=VA/Vgroupmean, A represents a region of interest. Conformality Indexes were calculated as CI= V95%/VPTVtotal.

**Results:** DSC shows good agreement of GTV and CTV outlines compared to reference volumes [Table 1].

GTV	0.86 (0.803-0.909)
CTV	0.75 (0.675-0.838)

Optimisation technique (OT)	Number of plans	GTV Outlining ratio Average (Range)	CTV Outlining ratio Average (Range)	V <sub>95%</sub> of PTV (mL) Average (Range)	V <sub>95%</sub> of PTV (mL) Average (Range)	Conformality Index Average (range)	Conformality Index (Lower dose) Average (range)
1	4	0.97 (0.86-1.00)	1.03 (0.84-1.20)	918.9 (768.1-1335.7)	1714.5 (1563.5-1858.1)	0.71 (0.45-0.96)	1.23 (0.92-1.4)
2	3	1.04 (0.84-1.24)	0.96 (0.84-1.07)	534.6 (229-756.8)	1296.1 (825.9-1590.8)	0.99 (0.86-1.17)	1.01 (0.97-1.1)

OT1 treats a higher volume PTV in comparison to OT2. OT1 resulted in less conformal dose distributions than OT2 [Table 2].

**Conclusion:** Differences observed in the volume treated are attributed to the two OTs to a larger extent than to voluming variation. Currently there is no evidence to support one OT over the other, and therefore the IMRiS protocol allows both approaches. This is the first time such discrepancy is described and in future research long-term toxicity outcomes may provide evidence on the clinical impact of these differences.

**Standardising practice for solitary bone plasmacytoma radiotherapy through the IDRIS (NCT02544308) trial**

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<sup>1</sup>RTTQA, MVCC; <sup>2</sup>Velindre Cancer Centre; <sup>3</sup>St James University Hospital; <sup>4</sup>CRUK & UCL CTC; <sup>5</sup>Mount Vernon Cancer Centre

IDRIS is a multicentre PhIII randomised trial of immunomodulatory therapy in high risk solitary bone plasmacytoma (SBP) aiming to establish whether adjuvant therapy with lenalidomide+dexamethasone after RT can improve progression-free survival. SBP is a rare multi-site disease and most RT centres see 2 cases/year. IDRIS proposes to recruit 140 patients from 30 centres over 5 years.

Planning and treatment protocols within most centres are not formalised hence a robust QA programme is key to delivering consistent treatments. Implementation of an effective programme to incorporate treatment aspects including immobilisation, scanning protocols, planning/delivery technique, PTV margins and IGRT tailored to the disease site is challenging. Also, IDRIS patients have RT before trial registration making during-accrual prospective case review unfeasible. The approach was to consider SBP patients by anatomical site, which had the potential to result in a lengthy pre-accrual QA process for a minimal number of patients recruited. Streamlining was therefore essential whilst ensuring protocol compliance and consistency across departments.



A summary of pre-accrual QA is shown in [Table 1].

Table 1: Pre-accrual QA programme participation

Pre-accrual QA	Cases submitted	Streamlined	Approved	Revision required
Outlining benchmark case: Femur	16		12	4
Outlining benchmark case: Vertebra	16		12	4
Planning benchmark case: Lum	15	8 (IMRT: sarcoma, INTERLACE: cervix, ENZARAD prostate)	9	6
Planning benchmark case: Rib	15	4 (ICE SARR and lung track: IDEAL, isotoxic lung, ADSCAN)	8	3
Facility questionnaire	14		3	11

During-accrual QA uses retrospective case reviews. 13/27 participating centres have completed the QA programme (4 others in the process). Outlining the vertebra was most challenging, its obliquity often being missed. Planning of the rib presented problems with PTV coverage and sparing of contra-lateral breast. Facility questionnaires breached trial protocol for patient positioning/immobilisation or PTV margins. A workable QA programme was devised that did not delay trial participation but ensured accuracy and consistency of treatment across centres recruiting small patient numbers.

**A survey of UK bladder imaging practice: Pre-trial quality assurance for RAIDER phase II trial of adaptive image guided bladder radiotherapy**

**Amanda Webster**<sup>1</sup>; **Shaista Hafeez**<sup>1</sup>; **Rebecca Lewis**<sup>2</sup>; **Helen McNair**<sup>3</sup>; **Vibeke Hansen**<sup>3</sup>; **Emma Patel**<sup>4</sup>; **Robert Huddart**<sup>2</sup>

<sup>1</sup>National Radiotherapy Trials Quality Assurance Group; <sup>2</sup>The Institute of Cancer Research; <sup>3</sup>Royal Marsden NHS Foundation Trust; <sup>4</sup>University College Hospital, London

**Purpose:** To evaluate pre-fraction imaging for bladder cancer radiotherapy patients to determine change in clinical practice required for RAIDER (CRUK/14/016) trial participation.

**Method:** A facility questionnaire was sent to 38 UK radiotherapy centres, investigating pre-fraction imaging practice with cone beam CT (CBCT). Five areas of application in bladder cancer radiotherapy were assessed:

1. Utilisation
2. Frequency of acquisition
3. Image match process
4. Set-up correction process
5. 'Plan of the day' (PoD) experience

**Results:** 37 questionnaires were returned. 32 centres proceeded to complete the pre-trial quality assurance (QA) programme.

1. Utilisation: 20 centres using CBCTs for all patients, 11 centres using CBCTs for some patients and 1 centre not using CBCT.
2. Frequency: 4 centres acquired daily CBCTs for all bladder patients and 8 acquired daily CBCTs for some patients. 31 centres were compliant with minimum NRTG recommendation of CBCT acquisition for the first 3-5 fractions (1).
3. Image match process: 29 centres doing soft tissue match for all patients, 2 centres doing soft tissue match for some patients and 1 centre doing a mixture of bony and soft tissue match.
4. Set-up correction process: 30 centres incorporating an online process in bladder imaging and 2 centres had offline correction process.
5. PoD experience: 10 centres had experience in PoD.

**Conclusion:** The changes in bladder imaging required reflect the complexity of the first UK multicentre radical adaptive trial. This has been supported by a comprehensive pre-trial and on-trial imaging QA programme. In on-going research, the impact on standard radiotherapy practice will be assessed.

National Cancer Action Team (2012). National Radiotherapy Implementation Group Report. Image Guided Radiotherapy (IGRT) Guidance for implementation and use. NHS, pp.77-79.



## A3 Service optimisation and QA proffered papers

### Assuring a representative research sample: importance of evaluating the demographics of those who decline to participate in research

*Craig Roe*<sup>1</sup>; *Maryann Hardy*<sup>2</sup>

<sup>1</sup>Leeds Teaching Hospitals NHS Trust; <sup>2</sup>University of Bradford

**Background:** Research evidence based on a sample of patients recruited against defined inclusion criteria is often assumed to be representative of the wider population. However, rarely do studies overtly determine the representativeness of patient sample. This paper evaluates the demographic diversity (age, gender and socio-economic status) of patients accepting and refusing to participate in a research study and potential impact of systematic sample bias.

**Method:** This study was undertaken at a large teaching hospital Trust in the North of England. The primary focus of the study was to determine patient anxiety prior to CT examination. A sample size of 60 was calculated and the age, gender and postcode data of all patients approached to participate was collected. Postcode data was used to determine socio-economic status of home neighbourhood (Index of Multiple Deprivation measure) as a proxy for individual socio-economic status. HRA ethical approval was received (16.LO.2211).

**Results:** 230 patients were invited to participate in the study. Of the 170 patients approached but not included in the study, 62.3% (n=106) refused to participate. Systematic differences were noted in the age, gender and socioeconomic status of those recruited to the study (more likely to be female, younger and high socio-economic status).

**Discussion:** The diversity within the recruited sample did not reflect the diversity of patients refusing to participate. Few research studies evaluate the demographics of non-participating invitees to establish the presence of sample bias. If researchers ignore this step in data evaluation, we may wrongly promote the generalisability and implementation of research.

### Impact of a radiographer led teleradiology hot-reporting service on an emergency department missed-fracture rate

*Paul Simpson*; *Julie Howson*; *Cherise Lambert*; *Laura Mallinson*

City Hospitals Sunderland NHS Foundation Trust

**Background:** It is recognised that there is an ever-increasing number of radiology examinations waiting for longer than 30 days before a formal report is issued<sup>1</sup>, despite current guidance recommending that all Emergency Department (ED) imaging is reported the same day, with urgent cases being reported within 30 minutes<sup>2</sup>. The use of reporting radiographers to reduce these delays is well established<sup>3,4</sup>, but is often a cold-reporting system<sup>5</sup>. The purpose of this study was to see if a small team of reporting radiographers could successfully use teleradiology to offer an extended hot-reporting service, and subsequently reduce the ED missed-fracture rate.

**Method:** 3 reporting radiographers had reporting workstations installed in their homes, to allow them to offer a 14-hour weekday hot-reporting service, and a shorter weekend service. The number of ED missed-fractures was then measured preceding and following the start of the trial and compared.

**Results:** Of the 10,935 musculoskeletal (MSK) examinations undertaken in the 9 months preceding the trial, 136 fractures were missed (miss rate = 1.24%). During the 8 months following the start of the trial, 13,737 MSK examinations were undertaken, with 60 fractures being missed (miss rate = 0.44%). However, the use of teleradiology had an impact on the reporting radiographer's ability to work as a team and consult on complex images. There were also a number of technical issues encountered regarding working remotely.

**Conclusion:** The provision of a hot-reporting service reduced the missed-fracture rate by 65%, however the use of teleradiology has an impact on the service providers.

1. Faculty of Clinical Radiology. (2016). Diagnostic radiology – our patients are still waiting. (Available from: [https://www.rcr.ac.uk/sites/default/files/backlog\\_survey\\_feb\\_2016.pdf](https://www.rcr.ac.uk/sites/default/files/backlog_survey_feb_2016.pdf)) [accessed 12 December 2017]. Royal College of Radiologists, London. 2. National Diagnostic Imaging Board (2008). Radiology Reporting Times Best Practice Guidance. (Available from: [https://www.bnms.org.uk/images/stories/downloads/documents/radiology\\_reporting\\_times\\_september\\_2008.pdf](https://www.bnms.org.uk/images/stories/downloads/documents/radiology_reporting_times_september_2008.pdf)) [Accessed 12 December 2017]. National Diagnostic Imaging Board, London. 3. Milner, R., Culpan, G. and Snaith, B. (2016). Radiographer reporting in the UK: is the current scope of practice limiting plain-film reporting capacity?. *The British Journal of Radiology*, 89(1065), p.20160228. 4. Hardy, M., Johnson, L., Sharples, R., Boynes, S. and Irving, D. (2016). Does radiography advanced practice improve patient outcomes and health service quality? A systematic review. *The British Journal of Radiology*, 89(1062), p.20151066. 5. Hardy, M., Spencer, N. and Snaith, B. (2008). Radiographer emergency department hot reporting: An assessment of service quality and feasibility. *Radiography*, 14(4), pp.301-305.

### Radiological assessment of nasogastric tube position - a quality improvement project

*Naomi Fenton*; *Steven Morgan*; *Paul McCoubrie*; *Michael Darby*

North Bristol NHS Trust

**Introduction:** In December 2016, a patient within our hospital was fed through a misplaced nasogastric tube (NGT) following a suboptimal radiograph. The National Patient Safety Agency has provided guidance on the quality of radiographs taken for confirmation of safe NGT placement and also advises that reports should explicitly state whether or not the tube is safe for use. This 'Never Event' prompted an audit of our practice, to assess whether we are meeting the NPSA standards and implement changes in order to prevent another Never Event.



**Method:** 100 NGT radiographs were reviewed retrospectively. Degree of rotation and tube visibility were assessed. Reports were assessed on their compliance with the NPSA guidance.

**Results:** 19% of radiographs were sufficiently rotated to hinder interpretation. In 8% of radiographs the tube was not visible in its entirety. 2 tubes were radiolucent. 31% stated whether or not the tube was safe for use.

**Conclusion:** Radiographer education about NGT radiographs was implemented. A specific examination code (XNASG) was introduced to improve workflow. A departmental 'traffic light' protocol was introduced to aid decision making and production of unambiguous reports. Using a phantom we compared visibility of multiple NGTs and are piloting the best feeding tube and a radiopaque Ryles tube. Quality of radiographs and reports has subsequently improved. A re-audit using the same method demonstrated that 100% of radiographs were diagnostic (degree of rotation within acceptable limits), with the entire NGT visible in 98%. 75% of reports stated suitability for use, an increase of 44%.

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### How do patients prefer to receive their radiology results in the 21st century?

**Amritha Ajith;** Julie Cox; Yitka Graham

Sunderland Royal Hospital

**Background:** We aimed to understand patient opinions relating to the way in which they receive results from radiological investigations and whether they would be willing to receive results via the internet or SMS messaging.

**Method:** An objective and structured questionnaire was designed and distributed to patients undergoing CT or MRI scanning over a 2-month period. Forty-six completed questionnaires were returned. Patients were given the option to provide additional free text comments.

**Results:** Patients from all age groups and genders completed the questionnaire. The majority of respondents were within the 56-75 age groups (35%). Thirty-two patients (70%) expressed that they would expect to be provided with either a written report of their investigation or be shown images from their scan. Forty-two patients (91%) expressed a preference towards being provided direct access to their own results. Nineteen patients (41%) stated they would be willing to receive their results either through email or through a website. Eighteen patients (39%) were willing to receive their results via SMS messaging.

**Conclusion:** Our study suggests that patients want to access results from their radiological investigations directly. Providing patients with their radiology results may allow for better healthcare engagement and accountability. Further study, potentially through targeted focus groups could provide further data and allow for services to be developed accordingly.

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### Report requirements for specialist non-medical referrers requesting MRI

**Darren Hudson;** Martin Mitchell

Canterbury Christ Church University

**Background:** In many specialist MSK pathways it has become common place for non-medical referrers, such as Extended Scope Physiotherapists (ESP), to triage and refer patients on for MRI scanning to best utilise resources and management options. Following review of report complaints raised by 2 such referral groups and other internal audits, an increasing number of issues were highlighted specifically relating to report content, style and quality.

**Aim:** The aim of this review was to engage with specialist non-medical referral groups to better understand what they want from a report of an MRI.

**Methods:** SurveyMonkey was used as an online tool, and non-medical referrers from the identified MSK services were asked to rate the quality of the current reporting system, their requirements from a good report and their opinions on several different spine reporting styles.

**Conclusion:** Results support the common themes being seen with queries and complaints around reports not answering the clinical question, lack of description on normal anatomy as well as the abnormal, and unhelpful recommendations. It also supports how important these areas are to the referral group in question so that they have sufficient detail in the reports to assure all anatomy has been assessed and that their clinical question is answered by the report. It also showed that a more structured report style commenting on all areas of interest with a summary that answers the clinical question is better suited for this referral group.

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### The accuracy of three-dimensional computed tomography images using different scanning protocols

**Rob Stroud**<sup>1</sup>; Richard Wellings<sup>2</sup>; Gregory Gibbons<sup>3</sup>

<sup>1</sup>Warwick Medical School; <sup>2</sup>University Hospitals Coventry and Warwickshire; <sup>3</sup>University of Warwick

**Background:** 3D images created from Computed Tomography scans are increasingly used in clinical practice. Modern scanning protocols allow slices to be overlapped with an apparent increase in accuracy of images. Only limited study has been conducted into whether overlapping slices improves spatial accuracy, and which image filters produce the most accurate 3D images (Whymys, 2013). This study investigates these issues further and makes suggestions for clinical applications.

**Method:** Linear measurements of landmarks were taken on a test object to produce a set of fiducial measurements. The object was scanned using standard and overlapping methodologies with different image filters applied, and the resulting images were measured. Comparison was made using Absolute Relative Error (ARE) measurements, and Paired T-Tests were used to determine statistical significance. An ARE of  $\leq 0.05$  was used as the accuracy threshold following previous work.



**Results:** Measurements of larger landmarks met the ARE accuracy threshold in all images. The most accurate images were the overlapped Boneplus and Edge filters, which were both capable of meeting a higher threshold of  $ARE \leq 0.01$ . Measurements of the most geometrically complex landmark demonstrated a statistically significant difference between the standard and overlapping protocols, but no significant difference was observed for the landmarks combined.

**Conclusion:** The threshold for accuracy of measurements should be varied according to the intended clinical use of the image. The use of overlapping protocols improves spatial accuracy for more complex features, which may be applicable in clinical scenarios.

1. Whymys, B.J. et al. (2013) The effect of CT scanner parameters and 3D volume rendering techniques on the accuracy of linear, angular, and volumetric measurements of the mandible. *Oral Surgery, Oral Medicine, Oral Pathology and Oral Radiology*. 115 (5), 682-691.

## Evaluation of occupational exposure from electromagnetic field radiation on mobile magnetic resonance imaging units

**Ana Filipa Sousa**

InHealth

**Purpose:** The health staff exposure to electromagnetic fields in Magnetic Resonance Imaging (MRI) has been increasing and no evidence is found regarding the mobile MRI units and their exposure measurement. This study intends to measure the staff exposure to static magnetic fields on these units to assess compliance with exposure limits.

**Method:** This investigation was performed in the United Kingdom, in 5 mobile MRI units, Siemens Symphony 1.5T and was divided in three phases: analyses of the examinations frequency; Measurement of the first operator exposure using a TAOMA TS/001/UB combined with a TS/002/BLF probe during routine protocols (n=98); Quantification of the exposure variation in different locations using a homogenous phantom.

**Results:** The lumbar spine, knee and brain are the three most common anatomic regions examined. On the second phase, no significant differences were found between the anatomic region selected and the amplitude or frequency. However, significant differences were found (between the anatomic regions and the maximum value detected on the lumbar spine. On the third phase, the amplitude values shown significant differences between the amplitude value and the probe's position).

**Conclusion:** The obtained results are in compliance with the Electromagnetic Field Directive. However, it would be interesting to promote training for MRI mobile workers, in order to present methods for their exposure reduction during patients attending. Further research on this subject would be helpful and interesting, not just on the mobile units but also at other facilities.

## A7 History proffered papers

### British mobile X-ray units in WWI

**Francis Duck**

University of Bath

The British placed fewer military mobile X-ray units during WWI than other nations. This review will examine the evidence for those units that were deployed by the British Army and also those operated by charitable organisations such as the Red Cross and the Scottish Women's Hospitals. No single design was used. The Army units evolved from the small Mobile X-ray Unit No 1, first deployed in June 1915, to the large well-equipped Unit no 14, sent to Mesopotamia, which carried three interrupters of different designs and with at least one Coolidge tube. Most vehicles were Austins, but Daimler, Wolesley and Fiat chassis were also used. Critical to their success was a reliable dynamo, usually coupled to vehicle engine. Other design criteria included the dimensions of the van, tent and dark room, the selection of the radiological equipment and the provision of spare parts. They were used at first to support any military hospital without X-ray facilities. As these became better equipped, they were deployed to support casualty clearing stations. They also found use in rapidly-changing battle situations or in regions of rugged terrain. Units were eventually sent to France, Salonika, Serbia, Russia and Mesopotamia. Operational challenges included frozen batteries and dark-room chemicals in winter, electrical shorts from damp conditions and, in the Mediterranean, sufficiently light-tight protection for fluoroscopy and the dark room, and heat management. Funding, even for the army units, sometimes came from local fund-raising, examples including Cheltenham Ladies' College and Hull Royal Infirmary.

Head H.C. (1918) Mobile x-ray wagon unit. *J. Rönt. Soc.* Jul 1918, 93-99.

### William Hampson (1854-1926): An early radiologist from the far left

**Francis Duck**

University of Bath

William Hampson (1854-1926) is one of the lesser-known early radiologists. His practical radiological contributions included a method for improved platino-cyanide dosimetry using standard illumination, and a simplified method for X-ray localisation by using a fixed tube/screen distance, in both cases by using standardised conditions to improve speed and accuracy. However, he is now remembered primarily as the patentee of a method for liquefying air, developed while he was a medical student at St Bartholomew's Hospital.



After qualification he retained his interest in physics, publishing 'Radium Explained and Paradoxes of Nature and Science'. As honorary physician in the medical electricity department at Queen's Hospital for Children in Bethnal Green, he proposed a haemodynamic cardiac pacemaker using electrical stimulation of peripheral muscles, conceptually far ahead of its time. In his third book, 'Modern Thraldom, A New Social Gospel', he demonstrated his strong social conscience and a concern for the causes and effects of poverty. He explored how society could evolve, without revolution, into one without credit, removing finance as a central power base. Other proposals included an equitable allocation of housing and the transfer of responsibility for hospitals and schools from charities to the state. Hampson is an example of an early radiologist with a very wide range of talents who does not fit within the conventional mould, neither professionally nor politically.

### Ian Donald and the 60th anniversary of his classic paper on ultrasound

**Arpan Banerjee**

[Birmingham Heartlands Hospital](#)

2018 is the 60th anniversary of Ian Donald's landmark paper on ultrasound which went on to revolutionise medical practice. In this talk I will reflect on his achievements and cover some of the important moments in the history of ultrasound imaging. Important figures in the development of ultrasound include Dussik, Howry, Edler and others who paved the way for the best known clinical pioneer in this new clinical field. Ian Donald was born in Cornwall, UK in 1910. He qualified in medicine in 1937 from St Thomas's Hospital London. He served as medical officer in World War 2 and eventually performed research at the Hammersmith Hospital, London. In 1954 he was appointed to the Chair of Midwifery in Glasgow, Scotland. In 1958 he built the first ultrasound machine with Tom Brown from Kelvin and Hughes. Their 1958 Lancet paper became a classic and revolutionised medical practice. In 1955 he published his classic Practical Obstetric Problems which has continued through several editions even after his death. The many honours he received included the Gold Medal of the Royal College of Obstetrics and Gynaecologists, the CBE as well as honorary fellowship of the British Medical Ultrasound Society in 1984. He died in 1987.

Thomas AMK Banerjee AK 2013 The History of Radiology ( OUP) Thomas AMK , Banerjee AK and Busch U 2005 Classic Papers in Modern Diagnostic Radiology (Springer)

### Eponymous signs in plain film reporting - who were the eponymists?

**Arpan Banerjee**

[Birmingham Heartlands Hospital](#)

Throughout the history of medicine, diseases have been identified by their eponyms. Their usage is sometimes condemned by some but there is no getting away from the fact that eponyms are here to stay. The subject of radiology is no stranger to eponym usage. During radiology training, eponymous signs are used as important descriptors of disease. However little information is offered about who these people were and what was actually described by them and when. In this talk I will cover some of the common eponymous signs in plain chest X-ray and abdominal plain film reporting. An understanding by going back to the original sources helps clarify confusion which may have been propagated inadvertently down the line. An understanding of the pioneers' achievements helps inspire the future generations to make their own advances. The contributions of Kerley, Felson, Fleischner, Golden, Westermarck and Rigler are some of the names whose signs will be described with short biographical vignettes, the original descriptions and current examples demonstrated.

## B8 Radiation protection and dose proffered papers

### Use of a digitally reconstructed radiograph (DRR) based computer simulation for optimisation of tube voltage for chest imaging using a digital radiography (DR) system

**Craig Moore**; Tim Wood; Ged Avery; Hiten Joshi; Najeeb Ahmed; Liam Needler

[Hull & East Yorkshire Hospitals NHS Trust](#)

**Background:** There is currently no published guidance that recommends optimised tube voltage (kVp) for chest imaging with digital radiography (DR) systems. Using a well-established digitally reconstructed radiograph computer simulator, this study presents preliminary results of a tube voltage optimisation exercise for chest imaging of adults with a DR imaging system.

**Method:** Three experienced image evaluators blindly and randomly graded simulated images of average adult patients (n = 20) at different tube voltages on diagnostic reporting monitors. The quality of the images was evaluated using visual graded analysis on a flexible continuous scale. Quality of lung, hilar, spine, heart and diaphragm regions were assessed.

**Results:** Image quality (VGAS) peaked between 80 and 90 kVp. This matches the physical absorption efficiency of caesium iodide (CsI) phosphors used in most DR systems.

**Conclusion:** The preliminary results of this study demonstrate the optimum tube voltage for chest imaging of adults with DR systems lies between 80 and 90 kVp. We have since changed local clinical protocol to reflect this; real image quality is acceptable.



### Optimisation of neonatal radiology

*Belinda Gorell; Matthew Williams*

Radiation Protection Service Cardiff

Chest X-rays are a key diagnostic tool in the healthcare of neonatal patients. Despite the legal requirement for additional special radiological consideration under IR(ME)R 2000, there is a paucity of evidence-based optimisation techniques. This project aimed to provide specific advice in respect of optimisation of neonatal exposures. For neonatal patients imaged within incubators exposure index and weight were audited, along with a literature review, to determine equivalent radiological chest thicknesses in terms of polymethyl methacrylate (PMMA). Image quality was assessed using the Artinis CDRAD contrast detail phantom and the results were subsequently used to inform recommendations for adjustment of radiological exposure factors.

Recommendations were further verified by imaging a Gammex-610 neonate phantom. Premature and term neonate chests were found to be radiologically equivalent to 3.5cm and 5.0cm of PMMA respectively. The existing exposure parameters of 60kV and 1mAs, used for imaging the majority of neonates with computed radiology, could be reduced to 60kV with 0.5mAs following a transition to the digital radiology (DR) system tested, whilst maintaining clinically acceptable image quality. A further reduction to 0.32mAs could maintain the same image quality for premature infants, although further work, including specialist radiologist input, is required prior to clinical implementation. Preliminary results using Visual Grading Characteristics analysis of images of the Gammex-610 phantom support the proposed reduction in exposure parameters on transition to the DR system. This project concluded that local neonatal doses could be reduced based on transitioning to DR equipment, with scope for further dose reductions to premature infants.

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### A comparative study to evaluate dose and image quality for adult phantom chest radiography using 17 diagnostic radiography X-ray units

*Sadeq Al-Murshedi; Peter Hogg; Andrew England*

Salford University

**Background:** Using routine acquisition factors for adult chest X-ray, this study evaluated image quality and radiation dose on 17 X-ray machines located in 8 hospitals.

**Method:** The CDRAD phantom, with medical grade PMMA slabs, was used to acquire radiographic images of an adult chest radiography in 8 hospitals using 17 X-ray machines; routine local chest radiography protocols were used. Image quality was measured using the CDRAD analyser software and was represented by an inverse image quality figure (IQFinv). Signal to noise ratios (SNR), contrast to noise ratio (CNR) and conspicuity index (CI) were calculated as an additional measures of image quality. Incident air kerma (IAK) was measured using a solid state dosimeter. A figure of merit (FOM) was calculated.

**Results:** Image quality and radiation dose varied between hospitals and X-ray machines. IQFinv ranged from 0.83 to 2.18, SNR 15.39 to 58.88, CNR 2.26 to 6.92, CI 22.12 to 197.88, IAK 17.26 to 239.15  $\mu$ Gy and FOM from 0.01 to 0.14. The correlation between the IQFinv and IAK was observed to be equal to  $r=0.45$  ( $p=0.06$ ).

**Conclusion:** Between the hospitals there was a wide variation in image quality and radiation dose and a weak correlation was observed between the IAK and IQFinv among the x-ray rooms. These results are likely to reflect the different types of X-ray imaging equipment and acquisition parameters used between the different hospitals and rooms. These results may have clinical consequences, in terms of potential lesion detection performance between hospitals or even between different X-ray rooms within the same hospital.

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### A comparative assessment of pathology visibility and radiation dose for routine neonatal chest radiography examinations in eight hospitals

*Sadeq Al-Murshedi; Peter Hogg; Andrew England*

Salford University

**Background:** To investigate pathology visibility and radiation exposure when imaging a phantom using routine neonatal chest radiographic protocols.

**Method:** The Gammex RMI 610 phantom, which includes a collapsed lung and surfactant deficient lung disease, was used to simulate the neonatal chest. Images were acquired in 17 diagnostic radiography x-ray units using local routine protocols. Pathology visibility (PV) was evaluated visually using a relative visual grading analysis (VGA) by six observers. Furthermore, a signal to noise ratios (SNR) and contrast to noise ratio (CNR) were calculated as a physical method for assessing image quality. Dosimetry calculations were undertaken including measurements of the entrance surface dose (ESD) using a solid state dosimeter. A figure of merit (FOM) was calculated.

**Results:** The range in ESD between hospitals ranged from 8.91 to 54.93  $\mu$ Gy. PV values ranged from 1.83 to 3.5. SNR values ranged from 31.48 to 97.99, CNR ranged from 7.65 to 33.18 and FOM ranged from 0.11 to 0.5. Correlation between the ESD and PV was  $r=0.46$  ( $p=0.06$ ).

**Conclusion:** Between the hospitals there was a wide variation in pathology visibility and radiation dose and a weak correlation was observed between them among the X-ray rooms. These results are likely to reflect the different types of X-ray imaging equipment and acquisition parameters used between the different hospitals and rooms.

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### Are we fatter when flatter? A prospective cohort study exploring technique change in pelvic radiography

**Kevin Flintham**<sup>1</sup>; **Bev Snaith**<sup>2</sup>; **Andrew England**<sup>3</sup>; **Kholoud Alzyoud**<sup>3</sup>; **Peter Hogg**<sup>3</sup>; **Martine Harris**<sup>1</sup>

<sup>1</sup>The Mid Yorkshire Hospitals NHS Trust; <sup>2</sup>University of Bradford; <sup>3</sup>University of Salford

**Background:** There is increasing evidence of the importance of spinopelvic alignment and consideration of the impact of weight-bearing on radiographic appearances. Hip morphology has been shown to vary in different anatomical positions, yet radiographic technique texts persist in only demonstrating supine acquisition. This study has considered the implication image acquisition parameters for pelvis radiographs from supine to erect positioning, focusing on changes in body morphology and dose.

**Method:** Ethical approval was gained for 180 patients who were referred for pelvic radiographs to undergo measurements of body habitus, including height, weight, abdominal circumference and thickness in both erect and supine positioning. Stratification into differing body mass index groups from underweight to obese and modelling of the changes in body habitus between the different patient positions. Anthropomorphic phantom experimentation was also undertaken to produce a range of radiographs at different exposure techniques with the use of additional fat layering to reproduce different BMI groups of patients.

**Results:** 180 participants were recruited. Variations in abdominal thickness were observed between the supine and erect positions. A lack of compressive force and gravitational influences are suggested as reasons for this change. Modelling of different body fat thicknesses at different kVp ranges demonstrated high levels of clinical image quality, giving confidence that the observed changes in body habitus will not adversely affect image quality.

**Conclusion:** Changes in body habitus measurements for patients when changing between the erect and supine positions should be considered in clinical practice changes and the impact on radiation dose and image quality.

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### Construction and implementation of a low cost paediatric pelvic imaging phantom for dose optimisation studies

**Ali Mohammed Ali**; **Peter Hogg**; **Andrew England**

University of Salford

**Background:** Imaging phantoms can be cost prohibitive and a need therefore exists to produce low cost alternatives which are fit for purpose. Consequently, this paper outlines the development and validation of a low cost dose/image quality pelvis phantom for a 5-year-old child.

**Method:** Tissue equivalent materials representing paediatric bone (plaster) and soft tissue (PMMA) were used. PMMA was machined to match the bony anatomy identified from a CT scan of a 5-year-old child and cavities were created for plaster infusion. Phantom validation comprised physical and visual measures. Physical included CT density (HU) comparison between a CT scan of a 5-year-old male one of the phantom, a Signal to Noise Ratio (SNR) comparative analysis of AP DR phantom X-ray images against a commercially anthropomorphic phantom. Visual analysis used a psychometric image quality scale.

**Results:** For HUs, the percentage difference between cortical bone and soft tissue and the equivalent tissue phantom substitutes were 88.4% and 86.1%, respectively. For SNR, (mAs response) there was a strong positive correlation between the two phantoms ( $r > 0.95$  for all kVps). For kVp response, there was a strong positive correlation (1-8mAs ( $r > 0.85$ )), this decreased as mAs increased ( $r = -0.21$  at 20 mAs). Psychometric scale results produced a Cronbach's Alpha of almost 0.8.

**Conclusions:** Physical and visual measures suggest the low cost phantom has suitable anatomical characteristics for X-ray imaging. Our method produces a low cost phantom which could have utility in dose and image quality optimisation studies.

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### Focused CTPA: Dramatic dose reduction is achievable using a restricted field of view

**Amy Greenwood**<sup>1</sup>; **Helena Barton**<sup>2</sup>; **Russell Bull**<sup>3</sup>; **Rajiv Singh**<sup>1</sup>; **Garrett McGann**<sup>1</sup>

<sup>1</sup>Cheltenham General Hospital; <sup>2</sup>Bristol Royal Infirmary; <sup>3</sup>Royal Bournemouth and Christchurch NHS Foundation Trust

CT Pulmonary Angiograms (CTPAs) have traditionally been performed as a helical scan including the shoulders, lung apices and liver, areas of low diagnostic yield. With increasing CT detector arrays, single rotation scans gain a large volume of data with potentially reduced dose and movement artefact, but cannot cover the whole chest in one rotation. An initial retrospective study of 61 consecutive positive CTPAs was conducted, confirming that no solitary pulmonary embolus (PE) occurred outside the region of a single rotation 320 slice (16cm) scan centred around the hila. Following this, 50 single rotation CTPAs were performed. Diagnostic quality and scan dose were prospectively recorded. If the patient had a previous standard CTPA, the dose from this was used as a control.

Where patients did not have a previous scan for comparison, a standard CTPA performed on another patient on the next available list on the same scanner was used. Average DLP in the single rotation group was 63mGy.cm vs 217 mGy.cm in the standard group, a dose reduction of 70%. Diagnostic quality of the scans was better in the single rotation group, with 82% of scans being deemed good quality, vs 66% in the standard CTPA group. Single rotation CTPAs can offer substantial dose reduction and scan quality improvements without diagnostic compromise. There appears to be a good case to consider restriction of the field of view, "focused CTPA", in scanners with narrower detector arrays to reduce dose in CTPA.

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### Foundation doctors' knowledge of radiation legislation and exposure: A completed audit cycle

**Szeji Laj**; Keng Peng Lim; Ratidzo Parirenyatwa

North Tees and Hartlepool NHS Foundation Trust

**Background:** Radiological investigations provide clinical benefit as well as radiation risks. Junior doctors are duty-bound by Ionising Radiation (Medical Exposure) Regulations 2000 (IR(ME)R), yet it has been shown that they have limited understanding of radiation legislation and exposure. Our audit looked to evaluate the awareness and knowledge of these regulations surrounding radiation, as well as knowledge of dosages associated with common radiological investigations amongst foundation doctors. A re-audit was done following the implementation of an IR(ME)R teaching session to Foundation Year (FY) 1 doctors.

**Methods:** A baseline audit was performed in October 2016, where the 'Foundation Doctors - Radiation Legislation Awareness' questionnaire produced by Royal College of Radiologists was distributed to the FY1 doctors at University Hospital of North Tees. A re-audit was done in April 2017 following an IR(ME)R-based teaching session delivered during FY1 weekly teaching.

**Results:** In the initial audit, 64% of FY1s were aware of governmental regulations on radiation, while knowledge of radiation doses was poor (0%). Introduction of the teaching indicated significant improvement in awareness related to radiation legislation and exposure (100%) and knowledge of radiation doses (50%). The IR(ME)R legislation exists to ensure all aspects of patient safety surrounding radiation exposure.

**Conclusion:** Our initial audit identified a deficit in knowledge and awareness of the regulations amongst foundation doctors, with significant improvement following an IR(ME)R teaching session. IR(ME)R training should be incorporated into the undergraduate and Foundation Programme curriculum, as well as at trust induction, with regular re-audits to ensure up-to-date knowledge and improved patient care.

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### ASRT Exchange Lecture: On-table treatment adaptation and motion management using MR-guided radiotherapy: 4 Years of clinical implementation

**Erin Wittland**

RoyalBarnes Jewish Hospital and Washington Univeristy and Siteman Caner Center, USA

This presentation will familiarize the attendees with the emerging technology of MR-guided radiotherapy and discuss considerations that the radiation oncology team must take into account when introducing MR into the treatment room, such as changes in immobilization methods and patient safety concerns. This session will present benefits of using MR guidance for treatment localization and real time tumor tracking, as seen in our 4 years of clinical experience with this treatment modality. Our current workflow for MR-IGRT hypofractionated stereotactic treatments and the role of the radiation therapist in the on-table adaptive radiotherapy (ART) process will be discussed. Participants will leave with a new understanding of how MR-guided radiotherapy and on-table treatment adaptation is changing the landscape of radiation oncology care.

#### Presentation objectives

1. Understand the impact of introducing MRI into the radiotherapy treatment room
2. Understand the required changes in patient simulation and immobilization methods when treating with MR-IGRT
3. Identify the treatment workflow when using MR-IGRT for on-table adaptive radiotherapy
4. Learn the benefits and challenges of using real-time MR-guided motion management
5. Understand patient satisfaction and compliance considerations when treating a patient with MR-IGRT

## H4 Late breaking proffered papers

### Lessons learned from the Manchester terrorist attack

**Amanda Martin**

Royal Bolton Hospital

Major incident training for radiographers has historically focused on dealing with casualties from aeroplane crashes or multi-vehicle accidents. However, over recent years, the type of incident that we are dealing with has changed and their nature is unpredictable as outlined in a review of terrorist attacks within the UK over the years. We need to plan our response to these attacks, which bring with them injuries that we are not used to dealing with in civilian life, many requiring changes in our imaging practice. The attack at Manchester Arena was an event like we had never seen before. The detonation of an improvised explosive device (IED), packed with nuts and bolts, at a venue attended by teenager concert goers, took this major incident to another level. Through the personal reflections of 2 experienced radiographers, one leading the radiology input in a District General Hospital and the other dealing with seriously injured children in a Regional Children's Hospital, learning points from this event will be discussed so that they can be considered in major incident planning going forward. Such incidents require a different approach both radiographically and psychologically and the impact on those involved cannot be underestimated.



## Identification of vertebral fractures in Fracture Liaison Services (FLS) in the UK

**Jo Sayer**

National Osteoporosis Society

**Background:** Fracture Liaison Services (FLS) prevent secondary fractures through systematic identification of fragility fractures using case finding, with assessment and treatment of osteoporosis where necessary. Services are measured for quality against the National Osteoporosis Society (NOS) Clinical Standards for FLS [1]. Standard 1 asserts that all patients over 50 with a newly reported vertebral fracture will be systematically and proactively identified. This analysis sought to establish to what extent this standard is being met in the UK.

**Methods:** A rolling gap analysis of FLS provision for identification of vertebral fractures (VFX) in patients aged over 50 was undertaken. This measured service provision against the national standard. Data was collected at 110 sites across the UK between 2014 and 2018.

Results:

77% (85) of sites had no systematic process in place to identify VFX. Only 8% (9) sites identified all newly reported VFX. 15% (16) had procedures in place to identify some VFX, i.e. within certain cohorts. There was considerable disparity across the UK. Sites in Scotland were significantly more likely to have comprehensive processes in place (38%, 6/16) than in the rest of the UK (3%, 3/94).

**Conclusion:** Gap analysis shows a lack of systematic identification of VFX. Responsibility for VFX identification in secondary care falls across a range of departments, which poses a challenge to clinicians. The NOS published clinical guidance in 2017 that recommends that Diagnostic Imaging departments identify VFX, report them unambiguously, and alert referring clinicians to the need for onward management or referral to FLS.

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2. National Osteoporosis Society (2017) Clinical Guidance for the Effective Identification of Vertebral Fractures. Bath:NOS.

## Frailty screening in patients with colorectal cancer using CT assessment of sarcopenia

**Carina Brolund-Napier; Nirav Kaneria; David Shipway; Paul McCoubrie**

North Bristol NHS Trust

**Background:** Sarcopenia has been shown to be an objective measure of patient frailty and is associated with long term post-operative outcomes. Frailty screening of older patients with cancer is recommended to risk assess and optimise patient care through complex geriatric assessment, however this is not widely carried out.

**Method:** Data collection was retrospective. We included patients newly diagnosed with colorectal cancer discussed in a local tertiary centre colorectal MDT between June and December 2017. Exclusion criteria included metastatic disease and previous spinal surgery. Clinical frailty was scored using patient records at first diagnosis using the Rockwood clinical frailty scale. Cross-sectional CT images were reviewed on Synapse PACS. Using freehand drawing at L3 vertebral level we measured the right and left (i) Total paraspinal muscle area (cm<sup>2</sup>), (ii) Total paraspinal muscle density (Hounsfield units), (iii) Total psoas muscle area and (iv) Total psoas muscle density.

**Results:** Forty-one patients were included (median age 72). Clinical frailty scores ranged from 1 to 5 (median score 2). Most patients with a clinical frailty score above 4 were excluded due to metastatic disease. Only six patients (15%) had documentation of frailty screening. Clinical frailty scores had a better correlation with total psoas muscle area ( $R^2=0.1027$ ) compared to total paraspinal muscle area ( $R^2=0.0457$ ) and paraspinal muscle density ( $R^2=0.0436$ ).

**Conclusion:** This study demonstrated a lack of frailty screening. CT assessment of psoas sarcopenia could be a useful simple frailty screening tool. Study limitations included a small sample size. We plan to carry out a larger prospective study.

1. Buettner, S. et al. (2015) Inclusion of Sarcopenia Outperforms the Modified Frailty Index in Predicting 1-Year Mortality among 1,326 Patients Undergoing Gastrointestinal Surgery for a Malignant Indication. *J Am Coll Surg* 22 (4) 397 - 407. 2. Jeroen L.A. et al. (2015) The impact of sarcopenia on survival and complications in surgical oncology: A review of the current literature. *J Surg Onc*. 112 (6) 681 - 682. 3. Peng, P. et al. (2012) Impact of Sarcopenia on Outcomes Following Resection of Pancreatic Adenocarcinoma. *J Gastrointest Surg*. 16 (8), 1478-1486.

## The utility of imaging for atypical endometrial hyperplasia

**Hannah Morley; Yvette Griffin; Nicola Hartley**

University Hospitals of Leicester

**Background:** Atypical endometrial hyperplasia (AEH) is a precancerous stage of endometrial cancer. There is currently no optimal imaging strategy. It is a tissue diagnosis<sup>1</sup>, managed definitively with hysterectomy or exceptionally with progesterone<sup>2</sup>. We aimed to evaluate whether imaging yields useful clinical information or contributes significantly to management.

**Method:** A single-centre retrospective study of consecutive cases imaged for AEH. Cases retrieved from CRIS database search containing 'atypical endometrial hyperplasia', 'MR', 'CT' or 'US'. Pipelle and post-operative histology retrieved from electronic patient records (ICE). Imaging and histopathology results recorded.

**Results:** 38 patients between 2010 and 2017. Mean age 56 (range 36 - 85). All but 3 patients scanned within 1 month of pipelle biopsy. 33 MR Pelvis, 4 CT chest, abdomen and pelvis, 2 US. 35 proceeded to hysterectomy - all within 1 month of the scan. No nodal/visceral metastases diagnosed at imaging or hysterectomy. Patients with normal imaging (61%) were not less likely to proceed to hysterectomy than those with thickened endometrium (96% vs 86%). Final histology was upgraded in 11/35 (31%)



and downgraded in 7/35 (20%). Abnormal imaging did not correspond to upgraded histology (0/14 cases). Of 3 managed conservatively, 2 follow-up pipelle biopsy showed progesterone effect with no residual hyperplasia, atypia or cancer. 1 had insufficient sample. No recurrent disease documented.

**Conclusion:** Preliminary results suggest imaging does not contribute to the routine diagnosis and management of AEH. We will be analysing a larger cohort of patients by increasing our date range on the CRIS search to substantiate these findings.

1. Carinelli SG, Ellenson LH, Zaino R et al. Tumours of the uterine Corpus: epithelial Tumours and Precursors in Kurman RJ, Carcanglu ML, Herrington CS, Young RH, eds. WHO Classification of Tumours of female reproductive Organs. 4th ed. Lyon: WHO Press; 2014: 125-126. Royal College of Obstetrics and Gynaecology (2016) Endometrial Hyperplasia, Management of (Green-top Guideline No. 67). Available at: <https://www.rcog.org.uk/en/guidelines-research-services/guidelines/gtg67/>

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### The role of contrast enhanced ultrasound in the assessment of diagnostically challenging indeterminate lesions in native and transplant kidneys

**Aia Mehdi;** *Philippa Lee; Ali Alsafi; Chris Harvey*

Imaging Department, Imperial College NHS Healthcare Trust

**Background:** Microbubbles are safe (2) and well-tolerated intravascular ultrasound contrast agents that can be used in renal failure and obstruction where computed tomographic (CT) and magnetic resonance (MR) imaging contrast agents may be nephrotoxic or contraindicated (3). Their intravascular distribution allows assessment of the renal macro and microcirculation, interrogation of vascularity and enhancement patterns of renal lesions. Contrast enhanced ultrasound (CEUS) is advantageous in that it can be acquired in real time using low acoustic power, involves no ionising radiation and is cheaper in comparison to MR and CT.

**Purpose:** We demonstrate the use of non-nephrotoxic microbubble ultrasound contrast agents in the assessment of indeterminate focal solid and cystic renal lesions as an adjunct/ alternative to CT and MR, especially in the presence of renal impairment and obstruction, where CT and MR agents may have deleterious effects.

Using vascularity and flow enhancement patterns we demonstrate that CEUS can accurately distinguish pseudotumors from true tumours and help differentiate benign from malignant solid tumours and inflammatory lesions. Additionally, it can be used to classify Bosniak cysts (1).

Its accuracy exceeds that of non-enhanced US and rivals contrast-enhanced CT, particularly in the assessment of challenging complex cystic lesions. In conclusion, CEUS is useful in the characterisation of indeterminate renal masses and cysts.

**Summary:** This presentation demonstrates the use of real-time contrast-enhanced ultrasound in characterising indeterminate focal solid and cystic renal lesions found on MR, CT and B mode ultrasound and how CEUS can problem solve and facilitate accurate confident diagnosis.

1. Harvey CJ, Alsafi A, Kuzmich S et al. Role of US contrast agents in the assessment of indeterminate solid and cystic lesions in native and transplant kidneys. *Radiographics* 2015; 35: 1419-1430.

2. Piscaglia F, Bolondi L; Italian Society for Ultrasound in Medicine and Biology (SIUMB) Study Group on Ultrasound Contrast Agents. The safety of Sonovue in abdominal applications: retrospective analysis of 23188 investigations. *Ultrasound Med Biol* 2006;32(9):1369-1375.

3. Sidhu P, Cantisani V, Dietrich CF, et al. The EFSUMB guidelines and recommendations on the clinical practice of contrast enhanced ultrasound (CEUS) in non-hepatic applications. Update 2017. *Ultraschall Med* 2018; 39: 2-44.

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### Clinical benefit of the lateral chest radiograph in addition to posteroanterior radiograph in routine first-line imaging of haemoptysis

**Meghavi Mashar;** *Maria Tsakok; Rachel Benamore; Victoria St Noble*

Oxford University Hospitals NHS Foundation Trust

**Background:** Evaluation of haemoptysis includes imaging to classify the cause of bleeding. Using previous iRefer guidelines, the standard is to perform posteroanterior (PA) and lateral views as first-line. Our reporting experience was that the lateral rarely added value. Since the lateral radiograph has four times the radiation dose as the PA, we aimed to evaluate the clinical benefit it provided.

**Method:** We undertook a retrospective study of 184 GP-requested PA and lateral chest radiographs requested over 34 months, of which 142 (78%) were for haemoptysis. Data was collected from PACS and CRIS, and processed using Excel and SPSS.

**Results:** From the PA chest radiographs, 55 (39%) were abnormal: 47% infective change, 4% mass, 25% nodule, 16% cardiomegaly, 5% collapse and 2% bronchiectasis. No additional cancers were detected on lateral chest radiographs but 4 cases had additional findings: 2 perceived nodules with no corresponding findings on subsequent CT, a thoracic kyphosis and a Bochdalek hernia. There was no case of an abnormality detected on subsequent CT having been visible on preceding lateral, but not PA chest radiograph.

**Conclusion:** Lateral chest radiographs did not add any clinically relevant findings in our case series. Given the higher radiation dose versus the PA film, and the fact patients with persisting or concerning symptoms proceed to cross-sectional imaging, we recommend cessation of the lateral chest radiograph in the routine investigation of haemoptysis to benefit patients by dose reduction and stream-lining care.

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## Iodinated contrast induced nephrotoxicity

**Jamal Abdulkarim**

George Eliot Hospital NHS Trust

**Purpose:** The aim of the study is to assess the effect of intravenous iodinated contrast media on renal function in patients undergoing CT pulmonary angiogram (CTPA), CT thorax abdomen and pelvis (CT-TAPC) or CT abdomen and pelvis (CTAPC) with contrast.

**Methods and materials:** This was a retrospective study of 443 patients who underwent a CTPA, CT-TAPC or CTAPC in 2015/16 and were administered 60ml, 75 ml or of Omnipaque 350, respectively, during the procedure.

**Results:** 33.9% (n=150) of CT studies requiring administration iodinated contrast showed a decrease in eGFR within 72 hours after the procedure with an average decrease in eGFR of  $-11.8 \pm 10.9$  ( $p < 0.01$ ), median -9.3. 36.2% (n=17) of CTPA patients, 48.2% (n=31) of CT-TAPC and 32.2% (n=102) of CTAPC patients showed a decrease in eGFR post procedure with an average reduction in eGFR of  $-11.3 \pm 12.3$  ( $p < 0.01$ ), median -6.3;  $-11.1 \pm 8.9$  ( $p < 0.01$ ), median -8.6; and  $-12.4 \pm 11.6$  ( $p < 0.01$ ), median -10.6, respectively. Furthermore, 6.9% (n=7) of CTAPC patients continued to have a reduced eGFR after 28 days.

**Conclusion:** Administration of iodinated contrast medium in patients is associated with a decrease in eGFR in a significant proportion of patients undergoing CT studies. In patients receiving the higher dose of 75 ml, a significant proportion of patients continue to have a reduced eGFR after 28 days.

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## 17 Body imaging proffered papers

### Histological success rate of transjugular liver biopsies

**Nagushan Abimanue**; Simon Travis

Nottingham University Hospitals

**Background:** In patients where the percutaneous approach is contraindicated, the transjugular approach is used for liver biopsies. We aimed to look at outcomes and complications of TJLB compared to standards set by previous national studies. Target success rate -  $>95\%$ <sup>[1]</sup> should give histological diagnosis to be considered successful Target complication rate - Minor  $<7\%$  and major  $<0.6\%$ .

**Methods:** Large retrospective audit done for all patients who underwent a TJLB from 1/1/2011 to 05/06/2017 which gave a total of 482 patients Patients identified using interventional radiology database. Used NOTIS to collect data on age, gender, indications for procedure, histology results and discharge summaries to look for success of procedure and complications

**Results/outcome:** Commonest indication for procedure was for the staging of cirrhosis (56%). Success rate of TJLB at 96% (463/482) - able to give histological diagnosis. Optimal success rate (histological diagnosis but also able to comment on stage and grade of disease) - 446/482 (92.5%). Failures mainly due to small sample size and fragmented samples (75%). One patient with accessory hepatic vein giving renal tissue (image). Minor complication rate 2.7%, commonest complication – arrhythmias. Major complication rate 0.4%.

**Key messages:** TJLB results comparable to other tertiary centres, despite large sample size. TJLB therefore, offer a viable option if the percutaneous approach is contraindicated. Plan in place for improvement especially to get greater percentage of optimal samples, by recording and increasing number of passes to obtain 3-4 cores and taking better care with samples to avoid fragmentation<sup>[2]</sup>. Disseminate data across specialties.

References: Available on request (1) Behrens G, Ferral H. (2012) Transjugular liver biopsy. *Semin Intervent Radiol.* 29(2),111-7. (2) Vibhakorn, S. et al. (2009) A comparison of four- versus three-pass transjugular biopsy using a 19-G TruCut needle and a randomized study using a cassette to prevent biopsy fragmentation. *Cardiovasc. Intervent. Radiol.* 32, 508–513.

### Fluoroscopic imaging appearances in bariatric surgery

**Christopher Marsh**; Michael Smith; Biju Thomas

University Hospital of North Midlands

The surgical management of weight control in the severe to morbidly obese patients is becoming more common place<sup>[1]</sup>. Weight management is achieved through restriction of the available volume in the stomach, via removal or compartmentalisation of the stomach. Common procedures include laparoscopic roux-en y, gastric banding and sleeve gastrectomy, however these procedures are not without complications. Fluoroscopy is a fundamental imaging tool in the assessment of complications of bariatric surgery<sup>[10]</sup>. This abstract aims to present and discuss the post-surgical imaging appearances seen on fluoroscopy of the normal anatomy and complications seen in roux-en-y, gastric band and sleeve gastrectomy. Complications for roux-en-y include stricture, anastomotic leak, gastrogastric fistula, marginal ulceration<sup>[2]</sup>. Gastric band complications: GORD, ulceration, gastritis, slippage, oesophageal dysmotility<sup>[3]</sup>. Sleeve gastrectomy complications: staple line leak, strictures, gastric dilatation, GORD<sup>[4]</sup>.

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### **Migrating intra-abdominal mass on CT and MRI: Radiological appearances of large peritoneal loose bodies**

***Kyungmin Kim***; *Milan Sapundzieski*; *Grazvydas Gaikstas*

Fairfield General Hospital

**Background:** Peritoneal loose bodies (PLBs) are thought to arise from torqued, infarcted appendices of colonic epiploica that become detached from the colonic wall and form a calcified shell. These benign structures are classically 0.5-1.5cm in size and the patients tend to remain asymptomatic. However, large (>2cm) PLBs can be confused with gastrointestinal, urological or gynaecological tumours on imaging. This can cause unnecessary distress and/or surgical intervention for the patient. It is therefore important that radiologists consider PLBs as a differential diagnosis, when faced with a migrating intra-abdominal mass that does not arise from any internal organs.

Purpose of educational pictorial review:

The expected learning outcomes are:

1. To understand the aetiology of PLBs;
2. To outline the clinical presentation of PLBs;
3. To become familiar with the radiological appearances and characteristics of PLBs on different imaging modalities; and
4. To form a management plan for PLBs.

**Summary:** This educational pictorial review presents a case of large PLB identified on multiple CT and MRI scans. Furthermore, this review discusses the aetiology, clinical presentation and radiological appearances/characteristics of peritoneal loose bodies.

### **A pictorial review of the role of multiparametric renal MRI in investigating renal masses**

***John Spillane***; *Paul McCoubrie*

North Bristol Trust

The aim of this presentation is to detail the role of multiparametric MRI (mpMRI) in assessing renal masses by using relevant case studies identified after a retrospective review of 111 scans in 84 patients over a 5 year period (2012-2017). Computerized tomography (CT) is currently the standard modality for cross-sectional renal imaging, but MRI has many advantages over CT. Apart from the inherent lack of ionising radiation, valuable information can be obtained in patients who would be traditionally poorly served by CT such as in those with significant renal impairment or previous reactions to iodinated contrast media. When the superior soft-tissue contrast of MRI is complemented by functional information from Diffusion Weighted Imaging and Dynamic Contrast Enhancement, mpMRI aids the assessment and characterisation of renal lesions such as complex cysts and lesions that are borderline malignant on CT. The key benefits of mpMRI demonstrated include:

1. The use of T2 weighted images in identifying the pseudocapsule of renal cell carcinomas;
2. The role of chemical shift imaging in diagnosing angiomyolipomas (particularly the fat-poor variant);
3. The use of diffusion weighted imaging and dynamic contrast enhancement in detecting difficult to see masses;
4. Improved imaging of complex cysts, improving the accuracy of Bosniak classification;
5. The added value of mpMRI in dense lesions that enhance poorly on CT.

### **Liverpool healthy lung project: radiologist perspective**

***John Holemans***<sup>1</sup>; *Caroline McCann*<sup>1</sup>; *Sukumaran Binukrishnan*<sup>1</sup>; *Diana Penha*<sup>1</sup>; *Erica Thwaite*<sup>2</sup>; *Madhu Paravasthu*<sup>2</sup>; *Suzanne Amin*<sup>2</sup>; *Alberto Alonso*<sup>3</sup>

<sup>1</sup>Liverpool Heart and Chest Hospital NHS FT; <sup>2</sup>Aintree University Hospitals NHS Trust; <sup>3</sup>Royal Liverpool and Broadgreen University Hospitals NHS Trust

**Background:** Liverpool has one of the highest respiratory morbidity rates in England, with double the national lung cancer incidence, particularly in lower socioeconomic groups. In February 2016, in conjunction with Liverpool CCG, the primary care sector, secondary care & Liverpool University a 3 year Liverpool Healthy Lung Programme was commenced.

**Method:** In 5 boroughs with high deprivation scores individuals between the ages of 58-70 who have COPD, have smoked, or have been asbestos exposed are invited to a lung health check conducted by an experienced respiratory nurse. Spirometry is offered to those without a diagnosis of COPD, and a 5-year personal lung cancer risk calculated using the LLPv2 risk model. Those with > 5% risk were offered a low dose thoracic CT scan. The scans are read by expert chest radiologists applying BTS guidance i.e. ignoring nodules <5mm or with a benign appearance.

**Results:** Up to September 2017, 8732 individuals were invited, 3637(42%) attended health check, spirometry 2169 (60% attenders), CT recommended 1300(36% attenders), CT performed 1102 (30% attenders), nodule investigations 132 (12% scanned), lung cancer 24 (2.2% scanned). 75 % of were stage I cancers and were resected/SABR, 4% radical oncological therapy, 12.5% palliative oncological therapy.



**Conclusion:** This programme targeted deprived areas. Although more than half of people invited choose not to attend a clinic, of those who did, 85% offered a chest CT attended for the scan. Most lung cancers detected were at an early stage with a low rate of follow up scans compared to published screening studies.

1. Cassidy A, Myles JP, van Tongeren M, et al (2008). The LLP risk model: an individual risk prediction model for lung cancer. *Br J Cancer* **98**: 270-6.

2. Raji OY, Duffy SW, Agbaje OF, et al (2012). Predictive accuracy of the Liverpool Lung Project risk model for stratifying patients for computed tomography screening for lung cancer: a case-control and cohort validation study. *Ann Intern Med* **157**: 242-50.

### **Low diagnostic yield of haemoptysis referred initially for chest radiograph in the detection of lung cancer**

**Maria Tsakok;** Meghavi Mashar; Fergus Gleeson; Victoria St Noble; Rachel Benamore

Oxford University Hospitals Trust

**Background:** 19% of cases of lung cancer present with haemoptysis. NICE guidelines state unexplained haemoptysis over the age of 40 should receive a 2 week-wait referral and CT chest. However, GPs may refer initially for CXR in the work-up to explain haemoptysis. The diagnosis and follow-up for these patients is unknown. This study aimed to characterise this cohort's outcomes.

**Method:** We undertook a retrospective study of 142 GP-requested PA and lateral CXRs for haemoptysis. Data was collected using PACS and CRIS and processed using Excel and SPSS.

**Results:** The mean age of the cohort was 67, with 98% over 40. From the PA films, 55 (39%) were abnormal and 100 (70%) reports recommended follow up: 57 chest clinic, 22 repeat CXR, 8 CT chest, 7 2-week-wait and chest CT and 3 CTPA. 49 (34%) had a follow-up CT, 25 in those with normal CXRs. 30 (61%) reports suggested a cause of haemoptysis. Of normal CXRs, 9/14 had a demonstrated cause on CT; all had findings consistent with infection. 22 (55%) recommended further follow-up. Lung cancers were identified in 5 cases and all had an abnormal PA CXR. 2 CXR reports stated likely bronchogenic carcinoma.

**Conclusion:** Our data demonstrates a lower rate (4%) of lung cancer in patients over the age of 40 with haemoptysis who initially had a CXR, compared to the literature. Subsequent CT was performed in only 27% of patients initially presenting with haemoptysis, and only 17% with a normal CXR - this may highlight non-adherence to NICE.

### **An audit of lung cancer detection and the role of the radiology department within a large teaching hospital**

**Pia Charters;** Iara Sequeiros; Melissa Werndle

Severn Deanery / University Hospitals Bristol

**Background:** The incidence of Lung cancer in the UK is 46,403<sup>[1]</sup> accounting for 10% of deaths in Bristol under 75 year-olds<sup>[2]</sup>. Nearly ¼ of chest X-rays (CXRs) requested by primary care in lung cancer patients are negative. Further investigation is warranted with continuing or changing symptoms, even if the CXR is not suggestive of malignancy<sup>[3]</sup>. To accommodate the high number of false negatives, reports generated within the Radiology department suggest one of two concluding templates. Each template prompts the GP referrer to refer for CT and 2 week wait respiratory hot clinic based on either a suspicious CXR finding (Template 1) or their clinical assessment of the patient with a normal CXR (Template 2).

**Aim:** To determine whether GP referred CXRs, containing 'Template 1' or 'Template 2', are appropriately propagated along the lung cancer pathway.

**Results:** 98 patients were reviewed. The average time taken to generate a CXR report was 3 days. If patients had a suspicious CXR, 93% were referred via 2 week wait pathway. 45% were found to have cancer giving template 1 detection rate of 40%. 26% of those with suspicious symptoms and a normal CXR were referred for CT and only 7 (50%) were within 2 weeks.

**Conclusion:** Cancer suspicious CXRs are being referred on appropriately. Urgent referral with a normal CXR depends on GP clinical evaluation. All cancers picked up via GP referral were seen on CXR. 'Template 2' doesn't generate large volumes of unnecessary CT's. A standardised reporting tool can be helpful for communicating results with primary care.

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2. Bristol.gov.uk (2017). Living Well for Longer-The Case for Prevention. Director of Public Health Annual Report City of Bristol 2016 [online]. Available at: <https://www.bristol.gov.uk/documents/20182/1032244/Director+of+Public+Health+annual+report+2016/b3dd70c2-72c8-4e2b-9fcb-a1aee6d08931> [Accessed 28 November 2017].

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### **FDG PET-CT in haematological cancers: Are we adhering to RCR and NICE guidelines?**

**Lucy Diss**

**Background:** Clinical use of PET-CT has grown considerably in recent years. This is due to its increased diagnostic accuracy compared with CT in detecting disease in certain subtypes of lymphoma and myeloma<sup>[1,2]</sup>. PET-CT is recommended by both RCR and NICE for staging, interim and remission assessment of high grade lymphomas and also as a prognostic value for certain myeloma subtypes<sup>[3,4]</sup>. This audit reviewed current practice and patient outcomes against RCR and NICE guidelines.

**Method:** MDT data was collected retrospectively from January 2017 to June 2017 to include all patients who had PET-CT for various indications including lymphoma, myeloma subtypes and Hodgkin's disease.

**Results:** From our cohort of 59 patients, 44% were high grade lymphoma, 13.5% Hodgkin's, 15.2% myeloma subtypes and 27% low grade lymphomas. 73% of the cases were compliant with recent national guidelines and 27% non-compliant. PET-CT



resulted in significant change in management including initiating chemotherapy [33%]; change in type of chemotherapy [8.4%]; achieving complete metabolic response [45.7%] and stable disease [13.5%].

**Conclusion:** Most patients [73%] who had PET-CT were compliant with recent guidelines. Of note, these PET-CT scans lead to significant change in patient management. A minority of patients [27%] had PET CT for various reasons including suspected lymphoma, routine surveillance and disease progression. In these patients, a standard CT scan would have been as helpful as a PET-CT and resulted in less radiation exposure compared to a PET-CT. The audit highlights the need for selective use of PET-CT in haematological cancers in compliance with current established guidelines.

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## J10 – Hand and neck & neuro proffered papers

### High-resolution ultrasound of the larynx: imaging technique, normal anatomy and spectrum of disease

**Ziyad Saloojee**; Susan Jawad; Sofia Otero; Simon Morley; Timothy Beale

University College London Hospital NHS Trust

Ultrasound is a vital adjunct to CT and MRI for accurate staging of laryngeal SCC as well as assessment of other laryngeal and anterior cervical masses. It can also be used as a non-invasive tool for assessing vocal cord movement. Despite its many advantages it remains an underutilised modality for assessment of pathology in this region, largely due to operator inexperience and unfamiliarity with the complex anatomy on ultrasound. This abstract will highlight the basic technique of performing an ultrasound of the larynx as well as some of the common benign and malignant pathologies encountered. Correlation between ultrasound and CT appearances for each case will be presented.

### Orbital ultrasound: The good, the bad and the ugly

**Lydia Guthrie**<sup>1</sup>; Chris Greenall<sup>2</sup>; Rhian Rhys<sup>1</sup>

<sup>1</sup>Cwm Taf University Health Board; <sup>2</sup>Abertawe Bro Morgannwg University Health Board

Orbital ultrasound is a procedure generally performed by ophthalmologists in the outpatient clinic. It is routinely used in the assessment of common pathologies such as retinal detachment, the 'swollen optic disc' and choroidal melanomas. Clinic based imaging however is ultimately limited by both user proficiency and the quality of outpatient ultrasound equipment. A national survey of all ophthalmology services found few offer formal orbital ultrasound. The benefits of a radiology led service would include greater investigator expertise in the use of ultrasonography, greater clinician exposure to the modality and access to superior technologies allowing for more accurate assessments, for example, choroidal melanoma tumour depth. This poster highlights how within our Radiology Department B mode ultrasound is commonly performed as an adjunct to that performed by our ophthalmology colleagues. The poster will describe the normal ultrasound anatomy of the eye. Additionally, it will demonstrate the ultrasound features of some commonly presenting pathologies, including melanoma, retinal detachment and optic nerve head drusen.

### The evaluation and further investigation of thyroid nodules in accordance with the British Thyroid Association guidelines

**Veena Vishwanath**<sup>1</sup>; Samuel Gregson<sup>2</sup>; Herbert Imalingat<sup>3</sup>; Niranjan Desai<sup>3</sup>

<sup>1</sup>Central Manchester Foundation Trust; <sup>2</sup>Salford Royal Foundation Trust; <sup>3</sup>Pennine Acute NHS Trust

**Introduction:** Whilst thyroid nodules are found on clinical examination in 3-7% of the population, the incidence of detectable nodules on ultrasound (US) varies between 30-70%, increasing progressively with age. Clinicians are becoming increasingly reliant on ultrasound grading within their MDT approach. Cytological outcomes depend on several factors including nodule morphology, operator and cytopathologist experience. High inadequacy rates lead to repeat procedures with the associated added costs and patient pathway delays. At Pennine Acute Trust, we aimed to re-evaluate cytology outcomes following implementations such as stricter use of U classification criteria for determining which lesions to FNA (U3-U5) and changing FNA technique to include a third pass for scant samples/samples from mixed nodules.

**Methods:** We retrospectively identified 203 patients between January-April 2017. Radiology reports, imaging and laboratory results were analysed for ultrasound grading (U1-5) of thyroid nodules, and cytology specimen outcomes. Results: Out of 203 patients, 177 patients had thyroid nodules detected with grading varying from U1-U4. For nodules which had FNAC performed, 12% were ungraded with 28% inadequacy rate for cytology specimens.

**Discussion:** Overall significant improvement has been demonstrated within 2 years, with up to 50% reduction in cytology inadequacy rates. This may be due to implementations such as including a third FNA pass for scant samples, samples from mixed nodules, and also using stricter criteria for performing FNAC (U3-U5). Minor improvements still need to be made with regard to



ultrasound grading. This may be attributable to the novelty of the grading system, ambiguity of multinodular goitres and equivocal nodules(U3).

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### Ultrasound-guided core biopsy as a preferred diagnostic technique for lymphoma - experience from a specialist centre

**Ziyad Saloojee**; Susan Jawad; Timothy Beale; Simon Morle ; Sofia Otero

University College London Hospital NHS Trust

**Background:** We present the data collated over the last 2 years from the largest centre for haematological malignancies in Europe. Traditionally lymphoma is diagnosed at many UK institutions with excisional biopsy (EB) of the suspected pathological lymph node under general anaesthetic (GA) which requires the patient having a day case procedure and pre-assessment to outline the potential risks of GA and surgery; all of this has a significant economic impact to the Trust. In addition, the patient is left with a visible scar after EB. In our institution we have moved away from excisional biopsy and instead perform ultrasound-guided core biopsy (CB) of the pathological node for diagnosis and subtyping of lymphoma to help guide further treatment. We also perform ultrasound-guided core biopsy to exclude lymphoma when other pathology is more likely, transformation from more indolent pathology and to confirm benign or reactive pathology.

**Aim and method:** We audited the outcomes of over 700 patients that underwent CB rather than EB over a 2 year period from 2016-2018.

**Result:** 98% of patients had their diagnosis and subtyping from the CB alone, which obviated the need for a EB procedure and has resulted in a significant financial saving for the Trust.

### Learning from error in neuroradiology

Muhammad Yaman Adi <sup>1</sup>; **Sherafqhan Ghauri** <sup>1</sup>; Tom Sulkin <sup>2</sup>; Ben Rock <sup>2</sup>; Nick Hollings <sup>2</sup>

<sup>1</sup>Plymouth Hospitals NHS Trust; <sup>2</sup>Royal Cornwall Hospitals NHS Trust

Misses and misinterpretations are well recognised in radiology practice, around four percent of reports contain them. It is incumbent on us as radiologists to acknowledge and learn from these errors. Our own personal experience over many years in a medium sized department of over twenty radiologists has lead us to appreciate that 'general' CT and plain films form the lions' share of errors discussed. However, we also know that neuroradiology cases are equally open to misinterpretation but are under-represented as they are reported by relatively fewer individuals and second read less often. As such we have collated recent discrepancy cases and grouped them into tumours, infarcts, abnormal vessels and bleeds.

Themes that emerge will be discussed with pictorial tips on what to look for in the future. This review will benefit all those reporting CT & MRI neuroradiology cases, sometimes, a neglected area of discrepancy analysis.

### 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 Foundation 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<sup>[1]</sup>. For neuro-radiologists and stroke physicians to achieve prompt revascularisation during thrombectomy, immediate imaging is recommended, either via CT angiography or MR imaging/angiography<sup>[2]</sup>.

#### 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<sup>[3]</sup>. 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.

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### **The mysterious cavern: Normal cross-sectional imaging appearances of the cavernous sinus**

**Hannah Marsh; Rebecca Hunt; Adam Youssef**

North Bristol NHS Trust

The cavernous sinus is a unique and complex paired venous channel, which is an important review area for radiologists interpreting cross-sectional imaging of the head. It is the site of potentially important pathology, yet this can be overlooked if the radiologist is not familiar with its normal imaging appearances. The cavernous sinus extends from the orbital apex anteriorly to Meckels cave posteriorly, and is bounded by dura superiorly and laterally. It receives tributaries from the cerebral and ophthalmic veins, petrosal veins, pterygoid plexus and contralateral cavernous sinus. Many of its borders are determined by adjacent structures, but the lateral border of the cavernous sinus is determined by its dural boundary and should be straight or concave in the axial plane.

Convexity and/or asymmetry of the lateral border is highly suggestive of pathology. The contents of the cavernous sinus are well-described and have fairly constant cross-sectional anatomy. These include the internal carotid artery, cranial nerves 3, 4, 5a, 5b, and 6, and the sympathetic carotid plexus. The development of high resolution imaging makes visualisation of many of the important structures within the cavernous sinus feasible, particularly in the coronal plane. Areas of abnormal density or signal within the cavernous sinus may reflect pathology. This pictorial review aims to delineate the normal anatomy of the cavernous sinus and to describe and demonstrate the normal cross-sectional appearance of this important structure, its dural boundaries, its contents and its close anatomical relations.

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### **South West survey on the use of MRI for cholesteatoma follow up**

**Anthony George; Hannah Marsh; Mandy Williams**

University Hospitals Bristol NHS Foundation Trust

**Background:** Magnetic resonance imaging is commonly used to evaluate the presence or absence of cholesteatoma in post-operative imaging. However, we have noticed that many of the institutions in our region use varying protocols. In particular, some centres use intravenous contrast and there is differing practice with regards to diffusion weighted imaging parameters. Our aim was to look at the protocols used by various centres in our region for the MRI evaluation of cholesteatoma in the post-operative setting. In addition, we wished to see how useful post contrast and diffusion weighted imaging was perceived to be. **Methods:** A survey was sent out to all head and neck radiologists in the South West region to collect information regarding can protocols for cholesteatoma imaging. In addition, these radiologists were asked to grade the perceived usefulness of diffusion weighted imaging and post contrast imaging (if used) using a 5 point Likert scale.

**Results:** A 100 % response rate was obtained from the 12 hospitals in the South West. 7 of these institutions use MRI for post-operative imaging for cholesteatoma. All centres use non echo planar diffusion weighted imaging however, only two centres use post contrast imaging. Overall diffusion weighted imaging was felt to be more useful than post contrast imaging.

**Conclusion:** This survey highlights the heterogeneity of MRI protocols in post-operative cholesteatoma imaging within the South West. It would be useful to have a standardised protocol throughout the region. Given the results, we can suggest an optimal protocol based on the most used sequences.

## **K3 Education and development proffered papers**

### **A comparison of diagnostic accuracy of parallel imaging versus conventional imaging in MRI practice: A systematic review**

**John Paul Sahibbil; Catherine Westbrook**

Anglia Ruskin University

**Background:** The advent of parallel imaging has changed the clinical use of MRI. It accelerates the scan time by skipping some phased-encoding lines resulting in improved spatial and temporal resolution. However, there are concerns about image quality including decreased SNR and increased reconstruction artefacts. Several studies explore the use of parallel imaging techniques but there is little consensus on its value compared to conventional imaging. A systematic literature review was therefore



performed to investigate the comparative accuracy of parallel and conventional imaging with respect to image quality and diagnostic accuracy.

**Data sources:** The study searched Science Direct, Springer, Wiley Library, IEEE Xplore, PubMed and Medline to identify relevant papers. An additional hand searching was carried out to identify eligible articles.

**Methodology:** Methodological quality was assessed using QUADAS. Data were synthesised, tabulated and then analysed to make comparisons between parallel and conventional imaging.

**Results:** Of 12, 481 publications on parallel imaging, 23 were identified to include in this review. The included reviews presented results of 6 neurology or head imaging studies, 3 spine imaging, 10 body imaging and 4 musculoskeletal imaging studies.

**Conclusion:** The findings of this study suggest that parallel imaging has little effect on diagnostic accuracy compared to conventional imaging. Image quality in parallel imaging depends on coil design, geometry factor and maximum acceleration factor. However, the research design of some of the articles in this review was unclear and further research is needed to explore the benefits and weaknesses of this technique.

### Transition from assistant practitioner to radiographer

**Emma Murdock; Sarah Naylor**

Sheffield Hallam University

**Background:** The research was chosen to explore why Assistant Practitioners decide not to stay in practice within their role. This pathway is of interest as to why APs are choosing to further fulfil their career and complete the degree in radiography. NHS trust are training Assistant Practitioners only for them to progress within a year or two of been in the role.

**Method:** The method used for the research was qualitative. The researcher used a mixed group of purposefully selected individuals who had previously been Assistant Practitioners within NHS practice before going on to qualify as radiographers. The participants were interviewed via face-to-face interviews to determine how they found the process of going back into education and how the transition worked for them. These interviews were transcribed and thematically analysed.

**Results:** The results identified that the Assistant Practitioners felt they had reached their full potential within their current role. Employers put some AP's forward to complete training and others decided to carry on with training/education rather than practicing as an AP. The AP role can be very limiting in its scope of practice.

**Conclusion:** Although practice areas will continue to train Assistant Practitioners this is a very limiting role. Not all employers have a definitive role in the work place for AP's and after a while the Assistant Practitioner feels that they need more, so decide to go on and finish the radiography degree to become the fully trained professionals.

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## The impact of a near-peer radiology teaching course on medical students' confidence at image interpretation and presentation at a District General Hospital

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**Background:** The limited focus of radiology teaching in undergraduate medical curriculums does not reflect the increasing diagnostic significance of radiology in the NHS (Jacob et al., 2016). Increasing work pressures can limit adequate formal tutorials by senior radiologists during medical school clinical attachments. As a result, medical students and junior doctors lack confidence (Nyhsen et al., 2013) and their radiological skills can be insufficient (Christiansen et al., 2014), which may detrimentally affect patient management. We evaluate the impact of a near-peer radiology course on student confidence in interpreting and presenting medical images.

**Methods:** Two final year medical students devised a radiology course for fourth year students on placement at a district general hospital. This included case-based tutorials on chest, abdominal and musculoskeletal radiographs as well as brain computed tomography and magnetic resonance images. The content was discussed and validated by a consultant radiologist. Two sessions were delivered, each containing 9 students. Post-session questionnaires were distributed to evaluate students' opinions.

**Results:** Out of 18 students in total, 89% strongly agreed that their confidence improved at both interpreting and presenting medical images. Furthermore, 94% of students strongly agreed that the course was useful, well-delivered, relevant to their undergraduate curriculum and found teaching from a senior medical student highly beneficial. Peer-tutors were described as 'interactive', 'approachable' and explained content at an 'appropriate level' in free-text comments.

**Conclusion:** A near-peer radiology course on a clinical attachment provides overall benefit and confidence to students and can address limitations in organising formalised teaching by senior radiologists.

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## Ensuring accuracy in diagnostic image interpretation: A new programme of peer review for plain film reporting radiographers

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**Introduction:** Self-audit is vital in ensuring high standards of reporting and is fully endorsed by the Royal College of Radiologists (RCR) and the College of Radiographers. Current RCR guidelines (2016) suggest that a minimum of 5% of reports produced should be reviewed - a value far exceeding previous peer review numbers. The following system was adopted in plain film to ensure this standard was met, to keep the process easy and keeping impact on clinical work to a minimum.

**Purpose:** This paper will outline the peer review process adopted by the plain film reporting radiography team, how discrepancies are categorised and dealt with, and the process of feeding this information back to the individuals. The peer review system was introduced in January 2017 and the number of reviewed images per month was below the 5% target. However, the number of reviews has increased over the following months, with all reporting radiographers fully engaged. By June the number of reviews totaled 5.8%, meeting the requirements of the RCR peer review standard. Despite this, the total reports reviewed by the team after 6 months is only 3.4% and therefore further promotion of the new system is needed to reach the desired target of 5.0% The accuracy rate is currently 99.91%, well within the national (95%) and local standard of 98%.

**Summary:** Although current numbers are encouraging, clearly more work is needed to reach the annual review target of 5% (in line with national standards). We believe however that this system will adequately facilitate this.



## Evaluation of shared teaching across MSc pre-registration and BSc (Hons) radiography students

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**Background:** A new two year Masters (pre-reg) Diagnostic Radiography programme was introduced in 2016 at the University. It is one of only 4 courses of this type in the country. To date no literature has been published to evaluate the impact of such a course. The Masters students (level 7) share multiple teaching sessions with the undergraduate students (level 4); mixed level teaching is a new development for the current academic team. These cohorts undertake their clinical placement at the same NHS site over the same time period. This has provided an opportunity to evaluate the perceptions, expectations and experiences of the students engaging in this new programme.

**Method:** The study used a questionnaire design to gather quantitative and qualitative data from all groups. Both the MSc (n=5) and BSc (n=38) students were included to provide comparative data. This will be enriched with qualitative data gained from small focus groups undertaken at the end of the MSc shared teaching.

**Results:** Analysis is ongoing but provisional results from the BSc students is that the presence of level 7 MSc students within the classroom is enjoyable and adds depth to the learning as they pose more challenging questions.

**Conclusion:** Mixed level teaching enriches discussion within the classroom, is more time and cost efficient. The results of the study will form part of the programme evaluation and provides opportunity to develop the curriculum in close partnership with placement providers.

## A clinical academy for radiographer reporting - the trainee's perspective

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**Background:** Radiology continues to face significant capacity challenges and innovative solutions to delivery are required. Radiographer reporting is now accepted within a team approach but education places increased stress on departments and clinicians. A pilot academy for radiographer reporting training based in a clinical centre proposed a new model for training advanced practitioners. We present the experiences of the trainees in this novel training environment.

**Method:** Alongside HEI education, the trainees attended a central academy for two days per week which provided the mentorship normally accessed through hospital sites. Ethical approval was obtained for an initial survey of expectations and follow up focus group to identify common themes and individual reflections on the trainee perspective of the scheme.

**Results:** The focus groups identified a number of key strengths and benefits of the academy model, but also highlighted a number of areas whereby the programme could be developed or improved. The initiative was described as intensive but ensured dedicated reporting time. Peer-support and access to experienced tutors were seen as significant benefits but suggestions included greater integration with the academic programme and utilisation of image banks in a more stimulating and effective way.

**Conclusion:** The academy model presents a number of benefits in terms of supporting departments in advanced practitioner development but also appears to provide an effective and supportive training environment for the trainees. The model will underpin future expansion of reporting capacity within the context of NHS workforce planning<sup>[1]</sup>.

1. Health Education England. Cancer workforce plan: Phase 1: Delivering the cancer strategy to 2021. 2017 (online) Available at: <https://www.hee.nhs.uk/sites/default/files/documents/Cancer%20Workforce%20Plan.pdf> [accessed 15 December 2017]

## Supporting newly qualified radiographers: Are we getting it right?

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**Introduction:** The radiography profession is undergoing significant change in response to social, economic and political influences. This has resulted in increasing service demands and a requirement for graduates to possess a much wider range of skills (Decker, 2009). The pressures now being placed on newly qualified health and social care practitioners has initiated research in both nursing and medicine which has focussed on the transition of student to practitioner (Ross and Clifford 2002; Mooney, 2006). The aim of this PhD was to explore the experience of transition from student to practitioner in diagnostic radiography.

**Method:** An interpretive phenomenological approach was used consisting of three face-to-face interviews of each participant at three months, six months and twelve months post qualification. These time intervals have been identified in the literature as critical times (Decker, 2009; Smith and Pilling, 2007). Thematic analysis was utilised and identified six themes the first entitled 'needing support' (Gibson and Brown, 2009).

**Results:** The theme of needing support was comprised of four subthemes; reality hits, structured support, support from colleagues and peer support.