phenytoin in patients with epilepsy, results in vitamin D deficiency, reduction of the serum calcium concentrations, and low calcitonin levels associated with loss of bone, which is compensated by secondary hyperparathyroidism. Elevated parathyroid hormone levels exercise divergent effects on the appendicular and axial skeleton (catabolic, causing osteoporosis) as opposed to the calvarium (proliferative, causing hyperostosis). Phenytoin activates the common molecular pathway of cAMP in bone, increasing bone turnover with excessive osteogenesis, manifest as hyperostosis. On radiographs and CT images calvarial hyperostosis is visualized as osteosclerosis, with thickening of the trabeculae and the skull cortices. MR images confirm the formation of excess diploic bone seen as expanded diploic space.

Summary of content: Osteoporosis is common in patients receiving antiepileptic drugs. With chronic phenytoin use, however, there is promotion of bone formation in the skull, manifesting with calvarial hyperostosis.

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DOSE / RADIATION PROTECTION POSTER PRESENTATIONS

P086 Optimisation of elements beam model and Integral Quality Monitor (IQM) dose calculation model for single isocentre multiple brainmets patient specific dosimetry

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Background: Elements treatment planning system (*Brainlab AG, Germany*) and IQM (*iRT Systems GmbH, Germany*) were acquired in our department to enable single isocentre treatment for multiple brainmets (MBM) and patient specific dosimetry (PSD) for Elekta Agility Versa HD linac. This study aimed to find the best fit Elements multi leaf collimator (MLC) parameters and improve the accuracy of the IQM dose calculation model for small field dosimetry.

Method: Area output factors were measured for field sizes down to 0.3x0.5 cm2 for fine tuning the IQM dose calculation model, performed by iRT. Elements beam models were generated for Elekta Agility 6MVFFF energy, Versa HD MLC with varying minimum MLC gaps ranging from 0 to 5 mm. Single isocentre treatment plans for 2-7 MBM were generated using all 5 beam models which were measured with IQM. Additionally, 20 clinical test plans were measured with the best fit beam model parameters.

Results: A minimum leaf gap of 0 mm gave the best agreement with IQM measurements as it accurately modelled the varying effective rounded end leaf gap of unused MLCs between lesions. The average segment by segment deviation between calculated and measured IQM signals for small fields were found to be within 3%. All clinical test plans matched the final cumulative signal deviation criteria.

Conclusion: Best fit MLC parameters for the Elements beam model were determined and IQM small field dose calculation model was improved enabling clinical implementation of IQM for PSD of single isocentre treatment for MBM.

P087 Understanding dose reduction - AEC vs manual exposure

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Background: A key method of reducing radiation dose is the use of an Automatic Exposure Control (AEC) over manual exposure. While well regarded in literature, it is unknown why manual exposure results in higher doses. This study tests claims that AECs reduce dose over manual exposure and determines whether radiographer experience causes the disparity in dose.

Methods: In a prospective 4 week study in 2019, 20 radiographers were selected from an acute care hospital. Age, level of seniority, and years of experience were recorded. Participants evaluated a phantom model before providing exposure factors for lumbar spine, abdomen, and pelvis x-ray projections. These factors and an AEC were used on equivalent phantoms to generate dose readings. Tests of variance and difference in values allowed statistical analysis of doses.

Results: Compared to AECs, manual exposure increased median dose for AP abdomen by 72.14 $\mu Gy \cdot m^2$ (+68%, p=0.001), pelvis by 62.22 $\mu Gy \cdot m^2$ (+44%, p=0.001), AP lumbar spine by 52.59 $\mu Gy \cdot m^2$ (+63%, p=0.004), and lateral lumbar spine by 156.64 $\mu Gy \cdot m^2$ (+213%, p=0.001). Manual exposure variance was significantly larger than AEC (p=0.044, 0.001, 0.023, 0.005). Experience levels showed no impact on dose or variance (p>0.05).

Conclusion: The AEC significantly reduced dose compared to manual exposure. Radiographer experience had no impact. Literature points to poor coordination within radiography education, poorly updated exposure factor training, and reliance on outdated methods. This perpetuates when passed down from radiographer to student. Radiography education should incorporate practical teaching of modern exposure manipulation beyond theory, available to both undergraduates and practicing radiographers.

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P088 Gown artefacts on paediatrics -- how can we overcome this?

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Background: It has been noticed with the improved technology that gown artefact is a significant problem within general x-ray particularly within the paediatric demographic. This has caused a significant decrease in image quality associated with this. This poster aims to show the different options available for paediatrics and the best methods for imaging paediatrics. Aim to look at different body areas and the different effects/clothing artefact.

Method: With the use of a paediatric phantom, image the phantom in a variety of different "patient's own" clothing, hospital gown, different items for covering i.e pillow case or sheet and no gown on a variety of different body parts to assess the effect of the clothing options on the artefact to work out which is the best option when patient dignity is also required.

Results: To be portrayed in a pictorial format the overall outcomes with a table/diagram to grade best to worse for artefact.

Conclusion: Discuss the appropriateness of when no clothing is best with paediatrics -- with parental/guardian consent/guidance within the safe space of the x-ray room. When clothing is required for patient dignity which clothing/cover up options are best to reduce the artefact and the image quality risk to the patient.

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P089 An insight into the uses and misuses of digital radiography

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Introduction: The transition from conventional to digital radiography (DR) is one of the most significant changes in medical imaging. Radiology professionals must be trained to acquire new abilities and modify workflow procedures. Consequently, there is a definite and widespread need for thorough, hands-on teaching in digital image technologies. This study aims to identify gaps in the knowledge and skills of digital imaging by assessing radiology professionals' knowledge and practice regarding radiation protection, image post-processing, and image quality in digital imaging practice.

Methods: An exploratory cross-sectional survey was conducted among radiographers in the United Arab Emirates. The survey collected the participants' demographics, qualifications, experience, knowledge and practice during digital radiography.

Results: A total of 157 radiographers participated in the study. 50% of participants had training in DR, 34.4% adhered to proper collimation most of the time, and 32.5% used image crop instead of proper collimation sometimes. 45.2% sometimes depended on automatic exposure, and 55.4% mentioned they modified the exposure manually. 36.9% used image processing tools. 30.6% always monitored their repeat rate, and 12.1% mentioned they never did.

Conclusion: The study revealed that most participants had moderate knowledge and adherence to radiation protection. Education and training courses should be designed in collaboration between professional bodies and academic institutes to improve knowledge and skills. The curriculum should emphasise the typical errors that radiographers make when performing digital radiography.

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P090 Exploring advanced practice: An evaluation of the accuracy of therapeutic radiographer (RTT) dosimetrist clinical target volume (CTV) definition for low and intermediate risk prostate cancer

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Background: To demonstrate whether a therapeutic radiographer dosimetrist is competent to independently contour clinical target volumes (CTVs) for radiotherapy to the prostate +/- seminal vesicles on CT, as a possible component of advanced practice.

Method: A retrospective contour comparison of therapeutic radiographer outlined prostate and seminal vesicle contours across 55 datasets using CHHiP (ICR, 2010) guidelines for Group 1 and 2 risk cohorts. Contours were compared in terms of absolute volume, similarity using DICE coefficient and mean distance to agreement. This was completed across a purposive sample of low and intermediate risk prostate cancer patients treated with radiotherapy by 26 different clinical oncologists within the institution. Both prostate and seminal vesicle contours were considered independently.

Results: Prostate contours alone were comparable to clinical oncologist contours across the sample with a mean DICE coefficient of 0.8. Contouring for seminal vesicles was less similar with a mean DICE coefficient of 0.64. Mean distance to agreement across prostate contours was 1.45mm. Mean distance to agreement across seminal vesicle contours was 1.39mm. Mean absolute volume difference for prostate was 3.45cc. Mean absolute volume difference for seminal vesicles was 1.75cc.

Conclusion: Prostate contours were generally comparable to the clinically-delivered clinical oncologist volumes, achieving a good standard (Velker et al, 2013) which is in keeping with this being a fairly stable anatomical structure, and that in radiotherapy planning the prostate itself is contoured in its entirety in all cases. Confounding factors for this included the potential inclusion of MR imaging by the consultant clinical oncologists, variations in practice amongst the clinical oncologists. Seminal vesicle contours had less overlap. Seminal vesicle contouring varies according to clinical risk factors, and although the therapeutic radiographer contoured according to CHHiP criteria as a chosen baseline, the clinical oncologist contours were not necessarily based on the same set criteria but rather their clinical judgement at the time of outlining the patient informed by clinical practice recommendations.

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P091 CT KUB dose optimisation project

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Background: Our team were considering a change to our CT KUB protocol. Staff were scanning patients Cranio-caudally between fixed anatomical points. We wanted to assess potential radiation dose saving from, scanning caudo-cranially, and manually aborting the scan above the highest kidney.

Purpose of the Poster: Our audit demonstrated significant reductions in patient dose through simple protocol changes and staff education. Our lessons learnt around the impact of over-scanning can be applied to many CT scanning protocols. We aim to share our learning and highlight the utility of Dose Management System (DMS) in supporting Image Optimisation.

Summary: We reviewed a randomised sample of 50 male and 50 female patient CT KUB scans acquired over a 4-month period, to assess any gender variance in dose. Then utilised the interactive dosimetry module within Radimetrics to simulate the potential impact of reducing over-scanning. We re-calculated the dose the patient would have received if the scan-length had been limited to <0.5cm below the Symphysis Pubis, and <1 cm above the highest kidney. We found that there was potential to reduce patient dose by an average 15.82% (range 2.19% - 39.23%). As well as reduce Breast dose by an average 40.85% in women and testicle dose by an average 56.8% in men. The difference was considered significant, and the new protocol was implemented, and staff education delivered around the change in protocol. After 3 months we re-audited patient dose for all CT KUB scans performed within a calendar month and found our mean effective dose had actually reduced by 21.2%

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P092 CT Colonography optimisation project assessing the impact and issues with dose mmodulation

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Background: After the installation of a new scanner in 2019 we implemented dose modulation in our CT Colonography (CTC) protocol. We wanted to assess the impact of the new scanner on patient dose, by comparing against patient doses on our old scanner and establish new LDRL's.

Purpose of the Poster: Our audit demonstrated the utility of Radiation Dose Management Software (DMS) in interrogating patient dose data to support Image Optimisation. We discovered significant reductions in dose were achieved using dose modulation, however, a significant number of outliers were found in larger patients. Using our DMS allowed us to interrogate this data in detail, educate staff, and further reduce patient dose through a simple intervention. We aim to share our learning and highlight the utility of DMS software in supporting Image Optimisation.

Summary of content: We reviewed all CTC scans performed within a 3 month timeframe, the DMS was utilised to benchmark current patient dose using dose modulation versus our old scanner. CTC recommendations suggest at least one scan should be performed low dose aiming for 30-50mAs. We found that dose modulation had correctly used less than 50mAs in many cases, however we found multiple outliers to >200mAs. We performed a dose optimisation project with radiographers manually overriding any mAs the scanner wanted to set over what would have been manually selected for patients of equivalent size previously. Re-auditing found that we had less outliers, no notable decrease in image quality, and the average mAs, and therefore patient dose, had reduced by a further 12.5%.

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P093 Implementing from first principles gender-dependent radiotherapy

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Freelance

Clinical trials are the root, where an assumption of reference adult = reference man (70kg, caucasian, western lifestyle, 25-30y) lies deeply untrue. Consequently a gender data gap exists, which results in less than best practice evidence. Scientists when applying careful statistical manipulation to the collected data, often pool or remove gender differentials. Otherwise, studies would need twice the number of patients, time, and money. In radiotherapy, a small but significant difference in radiosensitivity (from a tumour control and normal tissue toxicity perspective) between genders has been well documented. Yet most radiotherapeutic guidelines are based solely on population averages (such as a person's BMI and effective dose) rather than demographic subgroups such as age, race and gender. Female are more radiosensitive, likely to be cured of cancer but worse side effects (greater toxicity). Male more radio-resistant, have fewer side effects, but shorter long-term survival rates. This is not considered in international guidelines for radiation dosages. Therefore, in clinical trials, males and females with non-sex-related cancers should be considered as biologically distinct groups, for whom specific treatment approaches merit consideration and further investigation. With oncological research and practice still largely sex and gender blind. This delay, may result in prescription of sub-optimal treatment doses and inaccurate long-term risk assessment. To accelerate precision medicine, a radiological concept and metric - personalised dose and personalised (long-term) risk index is discussed. This incorporates individual radiosensitivity; plus physiological, lifestyle and genomic variations. Addressing deep-rooted biases and challenging the status quo is vital to improving health outcomes for the female population.

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2. Criado Perez, C. (2019) Invisible Women: Data Bias in a World Designed for Men. Abrams Press. UK

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P094 Evaluation of organ at risk dose constraints 1 year after implementing partial breast irradiation

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Background: Partial Breast Irradiation (PBI) is a radiotherapy treatment option for low-risk breast cancers (3). In the UK, it is standard practice to apply The Fast Forward Trial Whole Breast radiotherapy (WBRT) Organ At Risk (OAR) dose constraints (1, 4) to aid PBI dosimetry planning. OAR dose should always be kept as low as reasonably achievable (2). This audit will evaluate if there is scope to apply reduced OAR dose constraints for patients receiving PBI.

Method: Primary dose constraint quantitative metrics for lung V7.8Gy, lung mean and heart mean (left-sided only) were collected for 25 patients in each of the following groups: right PBI; left PBI (breath-hold); right WBRT; and left WBRT (breath-hold). The mean was calculated for all groups. Standard deviation to one place was calculated for PBI groups.

Results: V7.8Gy lung dose constraint was reduced in left and right PBI groups compared to left and right WBRT groups, by 2.8% and 3.3%, respectively. Mean lung dose was reduced in both left and right PBI groups compared to left and right WBRT groups, by 0.7Gy and 0.8Gy, respectively. Mean heart dose for those receiving left PBI was 0.2Gy less than left WBRT. A standard deviation to one place, applied to the means of all PBI OAR dose constraints, demonstrated a significant reduction across all OAR dose constraints.

Conclusion: Reduction of primary OAR dose constraints for PBI can be applied to ensure OAR dose is kept as low as reasonably achievable. Implementation of breath-hold for right PBI may reduce lung OAR doses further.

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P095 Dosimetric comparison of intensity modulated radiotherapy (IMRT) planning methods for partial breast irradiation. A service evaluation

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NHS Highland

Background: Partial breast irradiation (PBI) offers an excellent treatment option for women with low risk breast cancer when compared to whole breast irradiation. PBI can be achieved using a variety of radiotherapy techniques. The purpose of this service evaluation was to compare four radiotherapy planning techniques and make local recommendations regarding the optimal technique for this department.

Method: Ten patients were randomly selected and SIMRT, DMLC, VMAT Full and Partial arc plans created. All plans were optimised to meet clinical constraints. Plans were compared for conformity, maximum dose and organ at risk dose (OAR) using clinical dose constraints and conformity (CI) and homogeneity indices (HI).

Results: The results revealed all plans met CTV coverage and maximum dose goals whereas PTV goals passed in 80 -- 90% of cases. Evaluation using CI and HI revealed both VMAT plan types had optimal CI and variable HI results whilst SIMRT demonstrated sub-optimal conformity. SIMRT and DMLC had improved OAR doses when compared to VMAT plans when comparing heart, ipsilateral lung and contralateral breast.

Conclusion: VMAT plans demonstrated excellent conformity, homogeneity and maximum dose, when compared to SIMRT and DMLC. SIMRT and DMLC showed better OAR doses with DMLC, demonstrating modest improvement when compared to SIMRT. Following this study the local recommendation is the implementation of DMLC technique for PBI, thus supporting standardisation of planning processes and training whilst offering modest improvement in OAR doses.

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P096 Standardisation of CT ENT protocols across a multi-site trust: An evaluation of current practice

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Background: The Trust houses five CT scanners run by multiple radiographers across three hospitals. Whilst standardised projections are relied on in conventional radiography across the UK, the same cannot be said for CT. CT can provide intricate detail of minute anatomical structures, such as those within the sinuses and mastoids. Accurate and comparable CT sinus and mastoid studies are instrumental in achieving good diagnostic outcomes for patients (Sachs *et al.*, 2017). Furthermore, replicating scan parameters and patient positioning consistently across multiple hospitals could be challenging without a clear standard. The author aimed to evaluate current practice of CT sinus and mastoid examinations and determine whether standardised protocols are required.

Method: 60 of each examination were evaluated for positioning (degree of head tilt using the hard palette) and parameters (exposure factors, reconstruction filter, reconstructed slice thickness and interval).

Results: A neutral or "chin down" position was most popular, although a variety of patient positions are used across the organisation. Parameters varied across the hospital sites. For example, a range of mA was recorded between the sites along with various reconstructed slice thicknesses and intervals.

Conclusion: Positioning and scan parameters varied across the trust representing a lack of standardisation. Without standardised protocols and image appearances, pattern recognition within these complex anatomical areas becomes challenging for the radiologist (Guenette *at al.*, 2019). Standardised protocols and a re-audit 6 months after implementation was recommended. This evaluation could be conducted across a multitude of CT protocols to assess standardisation in the modality as a whole.

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P097 Evaluation of dose reduction potential of a scatter correction software for AP lumbar spine X-ray imaging

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Background: For lumbar spine imaging, plain radiography is a crucial diagnostic technique. Radiation scattering is undesirable since it increases the patient dose. Radiation exposure must be kept as low as is practically possible (ALARP). Conventionally, an anti-scatter grid is used to reduce X-ray scattering. The inclusion of a grid increases patient dose because more X-ray photons are needed to compensate for the grid's absorption of primary X-rays. Image processing software (VG) has recently been developed to correct for scattered X-rays and reduce radiation dose. This study aims to compares radiation doses of virtual grid to conventional grid.

Method: An anthropomorphic phantom was scanned with different body mass index (BMI: 18.3, 29, 38, 42, 46 kg/m^2) using fat phantoms. AP lumbar spine X-ray projection was acquired with/without the physical grid (PG) and exposure factors kept constant (kVp and SID) with AEC was conducted. Image processing software was performed to Gridless images. Paired samples T-Tests were used to compare DAP values. PCXMC software calculated the effective dose E (mSv).

Results: DAP and mAs increase as BMI increased. A significant mean difference was found for mean DAP (Gy.m^2) between the virtual grid and physical grid (128.1, < 0.04) with 95% CI [5.5, 250]. The VG has far lower mean DAP values than the conventional grid (3425Gy.m^2) and (16265 Gy.m^2), respectively. The mean effective dose of VG was (0.030.02 mSv) and PG (0.200.15 mSv).

Conclusion: By comparison to PG, VG software promises to lower radiation dose levels in terms of DAP value and effective dose.

DIGITAL TECHNOLOGIES POSTER PRESENTATIONS

P100 Radiographer acceptance of a virtual reality tool for patients prior to MRI

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Background: A key part of a radiographers role within MRI is providing the required emotional support to help patient succeed with a scan. Many patients present with anxiety and concern which can present as claustrophobia due to the nature of the scan equipment. This can impact on patient outcomes as well as operational efficiency. Being informed is important to patients and despite use of information leaflets and videos, these are limited in their representation. This is where preparation using virtual reality could be beneficial. As part of a feasibility study looking at the use of a virtual scan experience for patients prior to MRI, the views of practitioners were sought to see how effective this might be and how best to implement its use in clinical practice.

Methods: 9 radiographers attended two focus group sessions to see the tool, undergo a virtual experience, complete a technology acceptance survey and participate in a discussion about its use.

Results: Perceived usefulness, ease of use, attitude and intention to use were all positive towards the virtual scan tool. All practitioners saw value in such a tool and how it could be implemented within practice, with insights into areas for improvement and development gained.

Conclusion: From a practitioner perspective, access to such a virtual scan experience could be of use to better prepare and support those patients needing extra support before a real scan. Acknowledgement of having time to discuss patient concerns was noted and this could provide a means of doing so away from busy scanning lists.

P101 A systematic literature review of clinical decision support systems utilised for radiology requesting

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Background: The impact of unnecessary imaging on healthcare systems is widely recognised. Interventions to reduce this include clinical decision support (CDS). We conducted a systematic literature review to evaluate the best evidence on the effectiveness of CDS for radiology requests.

Method: A systematic Boolean search in IEE Explore, MEDLINE, CINHL, Scopus, ProQuest, and Embase was performed, following the PRISMA framework. Studies reporting CDS interventions used within radiology requests, and outcomes including the number of examinations, positive yield rate, waiting times, and experiences were included. CDS as a teaching tool, or where the clinical decision rule was a simple tick box were excluded. Screening and quality appraisal were evaluated independently by two reviewers. Data extraction and synthesis were performed.

Results: The study is still in progress, a complete analysis is expected by May 2023. Thus far 60 articles have been identified. Studies are grouped by clinical indication or body area; most commonly pulmonary embolism (N=13), mild head trauma (N=7), appendicitis (N=4), and lumbar spine (N=4), with validated clinical decision rules embedded within the CDS. The predominant study design was before and after (n=23). The rationale of studies centered on high usage and a need to lower radiation dose.