moderate, and major categories. Based on the classification and data obtained, a systematic approach was designed to aid radiologists in reducing the chance of making an error when using voice recognition software.

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P098 Stroke detection by scanning with low intensity radio frequencies

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Strokes are the 4th highest cause of death and the highest cause of long-term invalidity in the UK. ~110,000 people experience a stroke each year and ~1.2M people are already living with the consequences. The treatment and rehabilitation for these patients, together with social care entitlements and the decline in workplace productivity, costs the NHS and UK economy around £26bn annually[1]. The authors report on their development of an innovative new medical scanner that will help to dramatically reduce these costs. The latest test results are presented. The new scanner uses low intensity radio frequencies to determine whether a stroke has occurred. It is intrinsically safe for the patient and operator(s) and avoids the costly shielding and specialist infrastructure required by CT/MRI. This, combined with the inherently low cost of its component parts and the prospect of a compact, lightweight and portable construction, enables it to be carried in ambulances and first response vehicles and used on-scene, e.g. the patient's home or workplace. This avoids the delays in transporting the patient to a hospital to be scanned using CT/MRI before a diagnosis can be made and treatment commenced. The new scanner will greatly increase the percentage of stroke patients who are assessed, diagnosed and receive initial treatment within the 'golden hour': the first hour after their stroke. This will improve the outlook for these patients and reduce the number who require costly rehabilitation and long term care, which will help to reduce the enormous cost of stroke to the nation.

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DOSE OPTIMISATION AND MEASUREMENT

P099 Optimisation and implementation of size-specific pelvic CBCT

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Background: During the introduction of pelvic cone-beam CTs (CBCT's) for on-treatment verification imaging, the default manufacturer protocols were used on both Varian Clinac and TrueBeam linear accelerators. As experience with the imaging system increases, size-specific CBCT's are required to ensure imaging doses are optimised and justified in accordance with IR(ME)R 2017.

Method: A retrospective planning CT audit was performed to identify patient size categories. Imaging doses were quantified using 'PCXMC2.0Rotation' simulations with dose-area product (DAP) as the dose input. Quantitative image quality analysis was performed using size-specific Catphan annuli. A working party was created to qualitatively evaluate the clinical image quality of the size-specific protocols.

Results: Audit identified three patient size categories: small, medium and large. The default Varian protocol was assigned to the large category. To ensure equivalent imaging dose for all patients, small and medium size-specific protocols were developed with reduced mA. Quantitative analysis confirmed the image quality of the size-specific protocols were comparable to that of the Varian default protocol for the relevant size category. Twenty small and medium sized patients had their first CBCT using the Varian default protocol and subsequent CBCT's using the appropriate size-specific protocol. Qualitative analysis between the default and size-specific images identified no clinically relevant change in image quality, for treatment set-up purposes, due to the change in protocol.

Conclusion: Based on this work, size-specific pelvic CBCT protocols were clinically implemented, with the resulting imaging dose for medium and small sized patients reduced by up to 30%.

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P100 A comprehensive analysis of radiation dose to eye lens during external beam radiotherapy of head and neck cancer patients

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Background: The present study aims to evaluate and compare eye lens radiation doses in head and neck cancer patients treated with EBRT among various RT treatment delivery techniques.

Method: The present study recruited a total of sixty patients with head and neck cancer. The patients treated with conventional 2DRT, 3DCRT and Rapid ArcTM in separate treatment arms. All the patients were planned and treated with conventional fractionation regimes. The eye lens doses were assessed by placing the OSL dosimeter as close as possible to the eye.
Results: The average eye lens dose during 2DRT, 3DCRT and Rapid ArcTM treatment was measured 9.05 cGy, 3.84 cGy, 1.26 cGy per fraction, for a mean dose delivery of 200 cGy/#, i.e. 4.50%, 1.92% and 0.63% of the tumor dose respectively. EBRT of Nasopharynx and maxilla carcinomas treatment found to contribute significant dose to eye lens. The highest radiation dose to eye lens was observed in Telecobalt conventional 2DRT treatment. The possible cause of increased radiation dose is due to large collimator opening of field without conformity of radiation beam using MLC. Rapid ArcTM treatment were found to contribute lowest eye lens radiation dose as compared to Siemens 3DCRT treatment. The probable reason is use of tertiary MLC by Varian which provided slightly more radiation protection to eye lens during treatment as compared to Siemens secondary MLC in machines.
Conclusion: Treatment planning of patient, immobilization devices, beam shaping devices, treatment delivery modalities plays a vital role in reduction and magnitude of eye lens dose.

P101 Optimisation of on-board imaging protocols for patient positioning verification using Elekta's XVI (R5.0) cone-beam computed tomography system

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An optimisation review was carried out on three imaging protocols used for patient positioning verification (Elekta XVI (R5.0) system) with a focus on reducing dose with no reduction in image quality. The protocols chosen included the one with the single highest dose and the two most commonly used (Pancreas and two Pelvis protocols respectively). Using a phantom based approach (Catphan®503_The Phantom Laboratory, Salem, NY) image quality (IQ) was scored following variation of multiple exposure parameters including kV, mA, ms and rotation speed. Image analysis software IQWorks was used to calculate low contrast visibility, percentage uniformity, signal to noise ratio (SNR), modulation transfer function (MTF) and point spread function (PSF) of all image volumes acquired. Spatial resolution was scored visually. IQ was found to improve, for almost all IQ measures, with increasing current-time product. Improvement in both percentage uniformity and SNR from an increase in the rotation speed was also observed. Reduction of tube potential did not identify an optimisation strategy due to a calibration issue with 110kV and no clear IQ improvement at 100kV. Spatial resolution was found to be comparable for all combinations of exposure parameters tested, whilst analysis of MTF and PSF did not yield useful results. There is an opportunity to optimise two of the three clinical protocols, through an increase in the acquisition rotation speed coupled with an increase in mA to deliver an equivalent or slightly lower total mAs, with potential dose savings of up to 25% whilst maintaining, or even improving the IQ.

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P102 Optimisation of CT mandible protocol

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Background: CT scans of the mandible provide high resolution images to assess the position of impacted molars, prior to surgical extraction. Measurements determine the position of teeth in relation to adjacent structures.
Purpose: The aim of this study was to reduce the radiation dose in patients referred for CT of the mandible by decreasing the reference mAs and reducing the scan range. A retrospective audit was carried out to record the radiation doses (CT dose index, CTDi and Dose length product, DLP) of patients referred for CT scan of the mandible using the default reference 88mAs. Images were evaluated by a Consultant Radiologist and the image noise and quality graded. The reference mAs was gradually reduced to 72mAs, 68mAs and 58mAs respectively. After each change in mAs the doses were collected, and an image audit undertaken. Following discussion with referring maxillo-facial surgeons, it was agreed the scan range could be reduced when assessing the proximity of the inferior dental canal to surrounding teeth. Subsequent scans of the mandible with the limited range were undertaken, doses recorded, and an image audit completed.
Summary: After decreasing the reference mAs: The reference mAs was able to be reduced from 88mAs to 68mAs. The CTDi vol was reduced from 11.35 mGy to 8.8mGy. DLP reduced from 164mGycm2 to 114mGycm2. The image audit showed diagnostic quality was maintained. After decreasing the scan range: The CTDi vol increased slightly to 9.97mGy. The DLP reduced to 90.4mGycm2. The image audit showed good diagnostic quality.

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P103 Optimisation of technique for plain radiography of the chest when exceeding the diagnostic reference level

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Background: The National DRL (Diagnostic Reference Levels) values should be considered by employers when setting their local DRLs as required by the Ionising Radiation (Medical Exposure) Regulations 2018 (Northern Ireland). As Digital Radiography (DR) does not give a visual indicator whether an image is underexposed or over exposed, it is important that dose to the patient is continually monitored. This study explores reasons for exceeding DRLs and discuses corrective measures taken.
Purpose: The learning outcomes will be applicable to staff using Computed Radiography and DR. Evaluate the results of an audit of radiation dose levels. Describe how to investigate examinations exceeding the DRL. Recommend corrective measures to reduce doses below the DRL.
Summary: The poster will include the results of an audit of 13 x-ray rooms in one hospital Trust. Data will discuss the range of patient weight, exposure factors given, dose received and detector dose indicator (DDI) relevant to each manufacturer for patients between 50kg to 90kg. Initial results demonstrated that two of the DR systems were consistently above the DRL. Interrogation of the images showed sub optimal radiographic practice and suggested little evidence of collimation of the radiation field. Training sessions were held for staff and sample images were used to discuss corresponding image quality, collimation and dose levels. A repeat radiation dose investigation was undertaken after a period of 4 weeks. Results showed that all radiation doses were below the NDRL, resulting in the establishment of a new local DRL.

P104 Optimising default radiographic exposure factors using deviation index

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Background: Radiographers have a duty to ensure that radiation doses to patients are as low as reasonably achievable. With digital technologies employing post processing algorithms there are limited visual cues allowing radiographers to evaluate the appropriateness of exposures. Exposures used clinically have also been observed to increase gradually over time, a phenomenon known as 'dose creep'. In direct digital radiography the Deviation Index (DI) value provides the radiographer with feedback on the appropriateness of the exposure. This study reports on the utilisation of DI to optimise default radiographic exposure factors as part of a departmental quality assurance programme.
Method: In November 2017 exposure logs were extracted from six x-ray systems, collated and analysed. Five examinations were identified which frequently produced DI values outside the optimal range, classified as 'high' or 'very high'. Incremental improvements were made to the default exposure settings via a cyclical process of modification and re-evaluation, prior to a repeat of the full data collection exercise in April 2019.
Results: At baseline 10,658 of 29,637 (36.0%) of exposures had DI values outside the optimum range; for some individual examinations the proportion was as high as 547 of 725 (74.5%). Following multiple optimisation cycles, the overall proportion of examinations outside the optimal range had fallen to 7611 of 26,759 (28.4%). Default mAs values for the optimised examinations were reduced by between 22% and 50%.
Conclusion: Significant reductions in patient doses can be achieved through a departmental programme of DI value monitoring and targeted optimisation of default exposure settings.

P105 Radiation dose considerations in hybrid imaging

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Background: Hybrid imaging has increased the sensitivity of nuclear medicine procedures, due to image fusion for anatomical localisation and attenuation correction. The radiation dose from nuclear medicine procedures has increased by a factor of 8 from 1984-2006, this is partly due to a tripling in the amount of procedures, the founding of higher dose procedures and the implementation of hybrid imaging. Both gamma and x-rays contain ionising radiation which can cause stochastic and deterministic effects. To ensure nuclear medicine practitioners abide by current legislation it is vital patient doses are kept as low as a reasonably achievable.
Purpose: The main aims of this poster are to assess the appropriateness of ARSAC limits and recognise the implementation and importance of local/national diagnostic reference levels for SPECT/CT examinations. Highlight the benefits of delegated authorisation guidelines for SPECT/CT examinations, identify the importance of staff training and discuss advantages and pitfalls of retrospective fusion.
Summary: To abide by IR(ME)R 2017 practitioner's need to ensure that doses are kept to a minimum. Including considerations regarding ARSAC limits and the establishment of local DRL's and ensuring patients receive "the right test with the right dose

should be given to the right patient at the right time". If patients have had an appropriate anatomical examination effort should be made to establish if these are appropriate and fusible prior to authorisation of an additional CT scan. Staff training in the field of CT could aid with authorisation and image processing.

RADIATION PROTECTION AND QUALITY ASSURANCE

P106 New threshold detection references for DR systems

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Aim: The aim of this research is to present new TCDD curves for Konica, Fuji, Samsung, Philips, and Trixell DR systems. The TCDD data can also be used to provide an image quality factor (IQF) using the threshold detection index from the reference curves.

Detail diameter (mm)	Samsung	GE	Konica	Philips	Fuji	Trixell
11.1	32.2	32.2	29.2	23.4	29.5	27.5
8	41.5	39.5	31.8	32.5	36.4	29.1
5.6	54.9	48.9	39.9	37.9	49.4	39.7
4	48.7	49.1	43.1	41.9	53.3	43.8
2.8	61.6	63.8	49.6	52.6	68.2	57.7
2	77.4	74.4	53.3	58.3	84.0	63.5
1.4	50.6	48.2	46.3	53.1	57.0	51.1
1	59.4	52.6	46.9	61.5	69.3	61.9
0.7	64.4	53.2	51.6	67.1	69.2	65.0
0.5	27.9	29.3	26.4	34.7	32.0	32.1
0.35	29.1	33.4	25.9	30.0	31.1	27.2
0.25	28.0	33.5	21.6	30.2	33.1	21.1
Reference detector dose (µGy)	3.8	3.3	4.1	4.2	4.2	4.1
No. of detectors	10	6	17	8	17	12

Method: Dose to the detector was measured using a calibrated RTI Piranha dose meter. The grid was removed and the TO20 or TCD9 test object was placed on the detector and the detector was exposed to a known dose of ~ 4 µGy at 75 kV with 1.5 mm Copper filtration positioned as close to the X-ray tube as possible. The test objects were scored on a radiology reporting workstation according to the original test object manual, using a fixed viewing distance and with low ambient light conditions. The results were used to calculate reference data for each system.
Results: Table below shows the TCDD data for different DR systems. The data can be used to plot the best fit curves.
Conclusion: In DR systems, as expected, the same detector dose resulted in an improvement in TCDD performance comparing to CR systems. Although caution should always be taken when comparing TCDD data due to potential set up differences, scoring criteria and experience of the scorers, these data will prove useful for accepting new equipment, to give an indication of the expected image quality for new DR system.

P107 Utilising integrated dose monitoring software in radiology and its advantages for business management

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Background: The optimisation and regular monitoring of patient radiation doses is a requirement for radiology departments within the UK as stated by IR(ME)R 2017. This may prove challenging, especially within large Trusts, as significant amounts of data are needed to be sorted and evaluated for many different protocols. Dose Monitoring Software can be used to automatically collect relevant data from devices within departments. However it is up to the department to utilise this data in a meaningful way.
Purpose: This poster will outline the processes and tools which has enabled the efficient and regular monitoring of dose data within Nottingham University Hospitals (NUH) NHS Trust. Steps such as gathering raw data, standardisation, benchmarking, creation of dashboards and progress trackers are explored, as well as the business impacts these tools can make available to radiology departments. The role of multidisciplinary working between radiographers, clinical scientists and medical physicists is also highlighted.
Summary: Dose monitoring software provide a great amount of information to radiology departments. However if this information is not harnessed properly, the benefits of this information is lost. This poster highlights the processes which led to an efficient way of evaluating and monitoring doses within NUH, ultimately changing practice within the department in order to adhere to the optimisation regulations of IR(ME)R 2017.

P108 Audit of eye lens irradiation during CT Head scanning

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Background: The lens of the eye is highly sensitive to irradiation. Exposure to too much radiation will result in the formation of cataracts. Consequently in the Ionising Radiation Regulations 17, dose limit for exposure to the lens of the eye has reduced from 150mSv to 20mSv per year. To help achieve this, the Royal Collage of Radiologist state that the lens of the eye should be excluded from the scan field 100% of the time.
Method: Retrospective study looking at a sample of 100 routine CT Head scans performed within the trust found that only 3% of scans avoided the lens of the eye. The study was then repeated 6 weeks later after a poster and email campaign to increase radiographer awareness of issue and techniques to avoid lens irradiation. An emphasis on patient positioning ('chin