Summary: Timeline and stages of implementation for the new imaging technique are presented. Stakeholder's involvement in this process, specifically the medical-physics department, are described. Preliminary imaging was undertaken using chicken legs, and the methodology for ascertaining the lowest achievable kV are shown. Scoring charts which use a fully validated system for assessment of image quality are given. Both radiologist and reporters' review of the images are included, where the preliminary results show 40kV/7.13mAs to be the highest scoring exposure factor. Further results will be presented. All audit results will be presented for review and discussion at interested centres in order to promote inclusive peer review on a national level to work towards standardisation of practice.

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DOSE / RAD PROT / IMAGING TECHNOLOGIES

P127 The use of a mechanical apparatus to improve the accuracy of dose delivery to patients undergoing superficial radiotherapy treatments

Peter Devlin; Graham Read; Mark Blinkhorn; Tracy Perry; Terry Laing; Natalie Thorp
Royal Preston Hospital

This cancer centre treats around 360 patients annually on a superficial X ray treatment machine. The majority of patients are referred for skin cancers such as basal cell carcinomas (BCCs), but we also treat Dupuytrens, keloid scars and severe cases of eczema. Patients being treated for BCCs will usually be prescribed a total of 10 fractions treated as one fraction daily over a two week period, whilst palliative patients generally receive the same prescription but twice daily over 5 days. Since the superficial unit delivers treatments using very short source-to-skin distances, any small variations in set up, such as stand-off distance or applicator position will mean that the treatment area will not receive the expected prescribed dose.

An in-house mechanical apparatus has been constructed to allow a precise and fixed set up for treatments that are prone to stand-off, such as areas on and around the nose, and around the inner and outer canthus. The apparatus, which has been used clinically for about a year, ensures that patient set up is accurate, reproducible and fast, leading to precise dose delivery, improved comfort for the patient and an improved patient workflow.

The poster will give a written and pictorial description of the apparatus. Images will demonstrate the apparatus in clinical use. Statistical data will be presented; indicating the improved change in set up in terms of both time and dose accuracy.

P128 Evaluation of a new third party independent brachytherapy dose check platform

Alice Brain; Louise Gately; Robert Biggar; Chris Lee
Clatterbridge Cancer Centre

Aim: To evaluate SunCHECK Patient's DoseCHECK for a range of HDR brachytherapy plans.

Method: The DoseCHECK platform was used to perform secondary (independent) dose calculations on cervical, prostate and skin HDR brachytherapy treatment plans. Oncentra Brachy v4.5 and Oncentra Prostate TPS were used for planning with a Flexitron HDR afterloader. DICOM data (plan, image, structures and dose) was exported from the TPS to SunCHECK's Patient platform. Secondary dose calculations were performed using the platform's TG43 calculation. The resultant doses were compared to the primary TPS dose for analysis.

Results: DoseCHECK effectively calculated secondary dose calculations for cervical and skin brachytherapy plans with a mean dose agreement of 98.8% [96.49%-100%] using 1%/1mm gamma analysis. DoseCHECK could not support prostate plans' DICOM format, so no analysis was possible.

Discussion: SunCHECK Patient DoseCHECK is a viable option for performing secondary dose calculations of cervical and skin plans produced using Oncentra Brachy v4.5. Resultant analyses include point dose comparison, gamma analysis and visual (calculated) distribution over the planning CT. The analyses provide a comprehensive secondary calculation of the treatment plan, giving assurance of the primary treatment plan calculation. DoseCHECK could not be used to calculate secondary dose calculations for prostate plans produced using Oncentra Prostate due to the platform's inability to handle ultrasound data. These issues have been fed back to Sun Nuclear who are investigating compatibility in future updates.

P129 Simple method for measuring CBCT deterministic dose safety limits in radiotherapy

Neda Shiravand; Frances Lavender; Niall MacDougall
Barts Health NHS Trust

Background: When introducing cone beam computed tomography (CBCT) online imaging in radiotherapy it is important that the associated imaging dose to the patient is considered. Although CTDI and CBDI measurements are useful for comparing different CBCT modes, they provide no information about the CBCT dose distribution within the patient. The purpose of this work was to develop a streamlined methodology for measuring doses to organs at risk (OARs) for clinical CBCT modes, using equipment readily available in most RT departments.

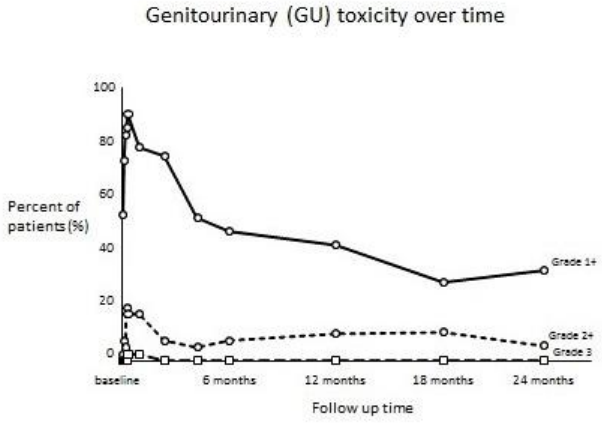
Method: Thermoluminescent dosimeters (TLDs) were calibrated for kV energies using an orthovoltage unit; TLDs with deviation of <2% of the mean dose value were selected for the measurements. The TLDs were then used to measure the dose to representative OAR points in an anthropomorphic phantom for three clinical CBCT modes.
Results: The dose to OARs per scan ranged from 0.55-1.25cGy (head and neck mode), 0.20-0.27cGy (breast mode) and 0.74-1.04cGy (thorax mode). Results were also reported in terms of the number of CBCT scans that would deliver 1Gy to each OAR.
Conclusion: This simple methodology allows rapid evaluation of the impact of any changes to CBCT exposure parameters and highlights the differences in OAR dose for clinical CBCT modes. Reporting CBCT doses in scans per Gray allows clinicians to make informed decisions regarding the imaging schedule and justification of concomitant doses.

P130 Late toxicity of prostate SABR with variation in planned dose to organs at risk

Lynsey Devlin [1]; Suzanne Currie [2]; David Dodds [2]; Azmat Sadoyze [2]; Stefanie Keatings [2]; Philip McCloone [3]; Aileen Duffton [2]
[1]; [2]The Beatson West of Scotland Cancer Centre; [3]The Institute of Health & Wellbeing, University of Glasgow

Background: Prostate stereotactic ablative radiotherapy (SABR) is an advanced technique delivering large doses. Steep dose gradients may amplify the effect geometric uncertainties have on dose to normal tissue.
Methods: 41 patients completed treatment in local safety, feasibility and efficacy study. Prostate SABR linear accelerator based technique 35Gy/ 5, 10X FFF. Matching to fiducial markers on pre treatment CBCT. Retrospective delineation of bladder and rectum on 205 pre-treatment CBCT image sets. CBCT registered to planning CT at treatment position. Daily CBCT rectum and bladder contours overlaid on planning CT for dosimetric analysis. The dose received by organs at each fraction measured on DVH using ratio of structure at the planning constraint. Total dose received by each organ evaluated to ensure planning constraints met despite organ motion. Gastrointestinal and genitourinary RTOG scoring recorded at baseline, 6, 12, 18 and 24 months.
Results: In 9 patients 35% of the rectum received > 18Gy. In 19 patients 10 % of the rectum received >28Gy. In 19 patients 5 % of the rectum received >32Gy and in 17 patients 1 % of the rectum received >35Gy. In 18 patients 1 % of the Bladder received >35Gy (table 1.). Gastrointestinal and genitourinary toxicity up to 24 months can be seen in figure 1.

Figure 1.



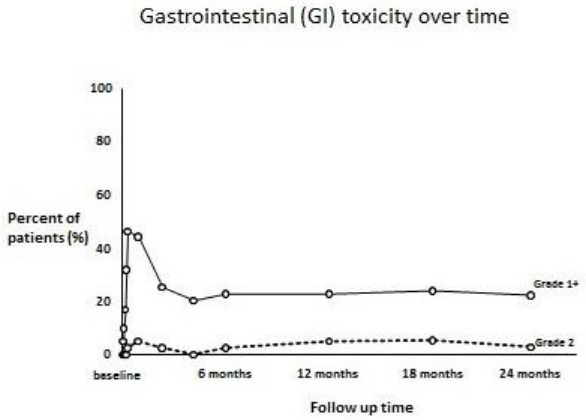


Table 1.

	Planning			Treatment			
Dose to ratio of structure	Patients failing constraint	%	95% CI	Patients failing constraint	%	95% CI	
Rectum							
D35%<18Gy	2	4.9	(0.6-15.5)	9	22.0	(10.6-37.6)	p=0.016
D10%<28Gy	7	17.1	(7.1-32.1)	19	46.3	(30.7-62.6)	p=0.004
D5%<32Gy	4	9.8	(2.7-23.1)	19	46.3	(30.7-62.6)	p=0.0001
D1%<35Gy	2	4.9	(0.6-15.5)	17	41.5	(26.3-57.9)	p=0.0001
Bladder							
D1%<35Gy	4	9.8	(2.7-23.1)	18	43.9	(28.5-60.3)	p=0.0001

p – value from Wilcoxon signed rank test of equivalence of planned and delivered do

Conclusion: Due to organ variations, rectal and bladder constraints are not met on treatment for some patients. Despite this, late toxicity is acceptable and comparable to that reported by the CHHIP trial[1].

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P131 **Evaluating SmartAdapt™ deformable registration as a tool in the adaptive radiotherapy decision process for H&N weight loss patients**

Nicola Snelson; Carl Rowbottom
The Clatterbridge Cancer Centre NHS Foundation Trust

Background: Deformable image registration (DIR) can be used to propagate contours between CT and CBCT images to allow new dose distributions to be calculated when changes are seen on CBCTs (see Moteabbed et al., [2015] and Rigaud, et a.l [2015]). We propose that DIR can be utilised to determine whether an adaptive replan is necessary in H&N patients.
Method: Analysis was performed retrospectively on data from H&N patients who received at least one adaptive assessment during treatment. SmartAdapt™ was used to propagate contours from patients' original CT images to the CBCTs on which dosimetry assessments were originally done. These CBCT contours were then copied back to the original CT dataset (adjusting the surface contour for weight-loss) before calculating the original plan on this altered dataset and comparing the resultant dose back to the original plan.
Results: In all cases the same decisions about whether or not to replan were arrived at with the SmartAdapt contours as was decided clinically. Having the physical structure and DVH data available made it easier to review the CTV coverage, e.g. one clinical adaptive assessment missed an area where the prophylactic CTV lost coverage that became obvious when it was contoured by SmartAdapt.
Conclusion: Using contours to perform the dosimetry assessment has qualified the original clinical decisions and would be beneficial to implement into the adaptive assessment process. The next steps for consideration when using SmartAdapt for adaptive assessments are the effect of variation in patient setup and the quality of CBCT images.

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P132 **The effectiveness of thyroid shields in protecting the orthopaedic surgeons from long-term effects of low-dose ionisation radiation**

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Background: The focus of this study was on the necessity of shielding the thyroid gland from radiation. There is currently little knowledge on this topic. The thyroid is a very sensitive organ and is not routinely shielded by lead rubber protectors. Moreover, there is no legislation regarding the mandatory use of thyroid shields. The aim of this poster is to assess whether orthopaedic surgeons should wear thyroid shields during x-ray guided operations.
Method: This literature review was conducted by using SCOPUS and MEDLINE databases. Additionally, University of Liverpool Discover search engine was used. Appropriate search terms and inclusion and exclusion were used in order to establish an up to date review of current literature. To assess the validity and reliability of the chosen literature, a critical appraisal tool was used.
Purpose: Papillary thyroid carcinoma (PTC) is the commonest type of thyroid cancer, which is predominantly caused by radiation exposure. Recent reports have shown that the rate of PTC occurrence has been rising in the past decade. It has been reported that a very small number of surgeons (11%) wear thyroid shields when carrying operations using X-rays. 1. Assess current practice/knowledge in relation to thyroid cancer and the use of thyroid personal protective equipment by orthopaedic surgeons. 2. To assess current use of thyroid PPE in the orthopaedic theatre. 3. To demonstrate the need for orthopaedic surgeons to wear PPE for thyroid to ensure dose reduction and minimisation of thyroid cancer.

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P133 **Awareness among junior doctors of radiation doses incurred in commonly requested investigations involving diagnostic ionising radiation**

Andrew Swali; Ghislaine Sayer; Umer Chaudhry
Betsi Cadwaladr University Health Board

Background radiation refers to exposure to ionising radiation in day-to-day life, excluding occupational exposures. In the UK, Public Health England has calculated that on average people are exposed to about 2.7 mSv of radiation each year. 16% is due to medical investigations and treatments involving ionising radiation. Biomolecular radiation damage occurs when tissues are exposed to ionising radiation. Ionisation leads to the production of free radicals. A chain reaction effect can result in significant alterations to organic material. If this occurs amidst molecules that are decisive to cellular metabolism, the fundamental function of the cell is at risk. Free radicals can affect nucleic acid molecules leading to cell mutation or cell death.
There has been an approximate three-fold rise in the number of examinations performed in the UK in recent years. Mainly due to the increase in CT examinations. The annual collective dose to the UK population from diagnostic medical procedures is increasing. Using radiological investigations is an accepted part of medical practice when justified in terms of clear clinical benefits to the patient, which should outweigh the radiation risks.
This poster demonstrates the results of a closed loop audit set out to determine whether foundation doctors had an awareness of the radiation doses for commonly requested imaging and their corresponding lifetime additional risk of fatal cancer. It also raises awareness of radiation doses and the potential hazards of radiation. The results revealed a lack of awareness of the estimated doses and and risks incurred with ionising radiation.

iRefer – Making the Best use of Clinical Radiology, Eighth Edition 23 May 2017
Ionising Radiation Exposure of the UK Population: 2010 Review
Foundation Programme curriculum 2016: https://horus.hee.nhs.uk/home/forms-start-new Royal College of Radiologist's

P134 **Dose optimisation: An audit to review local diagnostic reference levels (LDRLs)in a district general hospital**

Theresa Noon
Royal Bolton Hospital

Rationale: Diagnostic reference levels (DRLs) have been recommended by the International Commission on Radiological Protection (ICRP). Radiographers have a professional and legal responsibility to apply a mindful approach whilst maintaining a dose which is As Low as Reasonably Practicable (ALARP). LDRLs must be reviewed annually to improve practice.
Standard: Diagnostic reference level s (DRLs) should be available for all common examinations and they are a requirement under (IR(ME)R 2017)
Method: DAP readings were audited over a 6-month period, from November 2017 to April 2018 for all plain film examinations only. n=29172 examinations. Retrospective data from the CRIS system was used. All appendicular and axial examinations undertaken with the department during the time period and following the local protocol projections. All DR rooms within the department had undergone their QA/QC which had been recorded as per departmental protocol. The DAP reading recorded for standard projections. The data was compared to the recently set LDRLs and tabulated.
Results: Variation In results between CR & DR with overall difference in DAP readings from -8% to +24%. Some examination areas have been breached and we need to be mindful of why this is happening and how to optimise these examinations.
Conclusion: There is some variation, factors include: Increased work demands, Subjectivity of 'Gold standard' images, Lack of attention to detail. Radiographers should check every exposure against LDRL charts and report any breaches. Improvements in DR equipment do not allow for poor practice. Every department should follow.

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P135 **Optimisation of region of interest in CT pulmonary angiography**

Anna Ffrench-Constant; Carina Brolund-Napier; Mark Hamilton
University Hospitals Bristol

Background: IR(ME)R 2017 advises regular review of CT protocols and that exposure to ionising radiation should be as low as reasonably practicable[1]. A previous study has shown that excess scan length, and thus mean organ dose, in CT pulmonary angiography (CTPA) can be reduced by addition of a lateral topogram[2]. Current practice in our trust is to perform an anteroposterior (AP) topogram only. We assessed adequacy of region of interest in CTPA scans at our trust.
Method: All CTPA scans performed over a 2 week period in November 2018 were retrospectively identified. Images were reviewed to assess whether entire lung parenchyma had been imaged and measure excess scan length. We excluded pregnant patients and CTPA scans performed for indications other than pulmonary embolus.
Results: 62 scans were reviewed. No scans had a lateral topogram performed. 71% of scans included the entire lung parenchyma (29% were inadequate). Mean excess scan length was 31.9mm (SD 18.5mm) compared to 19.5mm in the previous study. This equated to 11% of the scan length being unnecessary overscan.

Conclusion: 11% excess scan length beyond the region of interest represents excess radiation dose. Mean overscan was much higher than in the previous study where lateral and AP topograms were performed. High variability in excess scan length highlights the difficulty in selecting region of interest. Addition of a lateral topogram can optimise region of interest and thus minimise radiation dose. The CT manufacturer has advised a method to perform both AP and lateral topograms for CTPA scans.

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P136 Evaluation of a novel imaging method to reduce patient dose while assessing "lost" intrauterine coil devices (IUCD)

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University Hospitals Bristol NHS Foundation Trust

Background: In patients with a possible mal-located IUCD, ultrasound is used first for assessment of IUCD position. If the IUCD is not located with ultrasound, usual practice is to obtain an abdominal radiograph (AXR). We have replaced AXR with a CT topogram: If the IUCD is seen on the topogram, an additional thin-section axial image through the IUCD is taken, to define whether the coil is within the uterus or is extra-uterine. We present a service evaluation of this technique.

Method: For all CT examinations performed in 2018 for this purpose, kV, mAs and DLP were recorded. Effective dose was calculated using a conversion factor of 0.02mSV/mGycm (Shrimpton et al 2016). We compared this with our departmental female mean effective dose for AXR (0.25 mSv).

Results: After the switchover there was a learning curve while radiographers adapted. 13 patients were examined with correct technique. In 9/13 patients the IUCD was not seen on the CT topogram and so the examination was complete without the additional axial imaging; estimated mean effective dose was 0.11mSV. In 4/13 with a visible coil on the CT topogram, additional axial imaging was performed, allowing accurate location of the IUCD; estimated mean effective dose was 0.17mSv. Mean effective dose for all 13 patients was 0.13mSV.

Conclusion: Based on the estimated effective dose calculated with a conversion factor, this novel method for locating IUCD reduces radiation dose in this cohort of patients by up to 48% while providing better anatomical information.

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P137 To mag or not to mag... that is the question? An audit to show dose optimisation in Barium swallows

Helena Hill
Northern Care Alliance

The barium swallow examination is one that has been around for many years and is well known in the world of radiology. This can mean that we may become stuck in our ways of how to perform the examination. Going back to when we used to print images onto film. We have always magnified on Barium Swallow procedures. Even through, CR and then to DR. This has been tradition and practice hasn't changed since. During Dose Optimisation, we worked closely with our Applications support from the equipment manufacturer, we discussed improvements. As a reporting radiographer, we would always magnify the image on PACS when reporting. So through discussion, we wondered whether magnification is still needed if we can magnify/zoom in the image. This audit aims to show that we can change!

I decided to have a look and see if I could reduce the radiation dose for this examination. Using 148 patients (before and after change of practice) in total I looked at the doses given and found that we can reduce the dose significantly but still maintain the exacting standards set out in our Standard Operating Procedure. I will compare this with the National Dose Reference Levels. This poster aims to show you the dose reduction percentage and how I did it. Hopefully it will prompt you to look at ways to optimise your dose.

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P138 Audit of the standard of horizontal beam lateral hip x-rays - re-audit

Jennifer Little; Jeanette Carter
University Hospital of North Midlands

Background: The image quality of horizontal beam lateral hips has been variable with varying radiographic techniques, a re-audit from 2012 due to staff turnaround.

Aim: To improve the quality of the images produced and provide guidance on the possible techniques to be used.

Method: Data collected from November 2017 to March 2018. 130 images were collected however 8 could not be retrieved. Patient size, exposure factors, dose, and use of grid were all recorded. Images were assessed by an Advanced Practitioner and a lead general radiographer and put into 3 categories: good, adequate and poor.

Overall results:

- Good, 29.5% in 2012 and 31.4% in 2018
- Adequate, 41.8% in 2012 and 50.1% in 2018

- Poor, 28.7% in 2012 and 17.1% in 2018

Conclusion:

- Exposure factors were higher for good images however gave lower doses
- Poor quality images generally under-penetrated making poor visualisation of the head of the femur
- Good images showed good collimation, centring, used a grid, had both high kVp and mAs with no AEC
- Poor images used high kVp, low mAs causing them to be under-exposed. The AEC was used but were poorly centred and used lack of collimation.
- Poor patient positioning with the 'good' leg overlying the area of interest as the leg support was not used. Plus the patient was not always positioned at 45 degrees from the detector, the patient should be positioned at 45 degrees not just the trolley.

The results were presented to the staff with the aim to re-audit in 2019.

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P139 An audit of clinical evaluations for auto-reported plain film X-ray examinations

Theresa Russell; Caroline Harrison
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Background: IR(ME)R 2017[1] requires that a documented clinical evaluation is made of the outcome of all radiology examinations. This usually takes the form of a Radiology report but employers may delegate the responsibility to appropriately trained non-radiology staff (e.g. the referrer) via a process commonly known as auto-reporting[2]. Where examinations are auto-reported employers are required to provide assurance that a documented clinical evaluation is made on every occasion. An audit of clinical evaluations of auto-reported plain film examinations was therefore undertaken at a large acute NHS trust.

Method: A random sample of 20 plain film examinations was identified for each of the nine referral sources auto-reported at the Trust. The care records (case notes and electronic clinical letters) of the relevant patients were searched for a recorded clinical evaluation. Since IR(ME)R compliance is a legal requirement the audit standard was set at 100%.

Results: The case notes for 3 patients could not be retrieved, and for 2 examinations a formal report had subsequently been provided by radiology. Of the remaining 175 examinations, 123 (70.3%) had a recorded clinical evaluation. Compliance by individual referral sources ranged from 52 - 84%.

Conclusion: The audit standard was not met; where plain film examinations are auto-reported a clinical evaluation is not consistently recorded in the patient's care record. Substantial improvement is necessary to achieve IR(ME)R 2017 compliance, requiring significant engagement from the relevant referring clinicians. Further work is also required to confirm the accuracy of those clinical evaluations that are recorded.

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P140 Experiences of critical examination and acceptance checks of the kV on-board imaging system of a Varian ProBeam proton therapy gantry

Dan Shaw; Conor Clancy; Daniel Burke; David Lines
The Christie NHS Foundation Trust

The Christie is home to the first high energy NHS proton beam therapy (PBT) centre in the UK, which is now in routine clinical use. Each clinical PBT gantry houses on-board kV X-ray imaging devices capable of planar and cone beam CT (CBCT) imaging. These are used to assess anatomical changes and assist in the accurate positioning of patients immediately prior to delivering the proton therapy. These, along with the other positioning aids, ensure that the treatment is delivered in-line with the treatment plan to the correct anatomy. As part of the acceptance and commissioning process we assisted Radiotherapy Physics with the critical exam and acceptance testing of kV X-ray imaging device to ensure it was performing as expected. We intend to summarise our experiences of critical examination and acceptance testing of this unit, including images taken during the measurements, including a description of the difficulties encountered in performing the measurements on this unique equipment and the difficulties encountered in assessing the results from some very novel technology.

P142 Identifying osteoporosis on pelvic radiographs using textural analysis

Andrew Creeden
UHCW NHS Trust

Background: Osteoporosis is very common in older age but vastly under-diagnosed[1]. Fragility fractures can have a devastating impact on individuals and place a huge financial burden on health systems. Textural Analysis can detect changes on radiographs

which are imperceptible to the eye. In England over 10 million radiographs are undertaken annually on patients over the age of 60. These radiographs contain enormous amounts of textural data, some of which could potentially be leveraged to identify individuals at risk of osteoporosis. This study investigated whether textural analysis of routine clinical radiographs can be used to identify patients with unsuspected osteoporosis.
Method: Pelvic radiographs and Dual X-Ray Absorptiometry (DXA) results were obtained for 150 patients who had undergone both examinations within a 6 month period. Textural Analysis software was used to calculate 300 textural parameters for Regions of Interest (RoI) corresponding to the femoral head, neck and shaft on each radiograph. Nine Machine Learning algorithms were then employed to generate models for predicting a patient's DXA classification using only the textural measurements. The accuracy of each model was evaluated using tenfold cross-validation.
Results: The greatest improvement over baseline accuracy (simply predicting the most common outcome) was obtained using textural measurements made at the femoral neck to predict Femoral Neck DXA classification (10.8 percentage points).
Conclusion: The textural analysis approach used shows potential but further research is required into the effect of radiographic exposure conditions and patient positioning on textural measurements to allow prediction accuracy to be optimised.
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P143 Evaluating deep learning artificial intelligence use in radiotherapy target volume definition: A systematic review

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Background: Artificial intelligence (AI) uses computer algorithms to learn from database of information to perform specific tasks autonomously. Deep learning is the latest branch of AI. Radiotherapy target volume delineation is where oncologist outline tumour and organ at risks (OAR) volumes to deliver radiotherapy. We performed a systematic review on the application of deep learning method to the radiotherapy target volume definition.
Method: Search was performed using the MEDLINE, EMBASE and CINAHL databases in accordance to PRISMA guidelines up to October 2018.English language papers were included. Search terms "artificial intelligence", "machine learning"," deep learning", "radiotherapy" and "radiotherapy target delineation" were used.
Results: 658 papers were identified of which 89 full papers were assessed for eligibility. 18 publications were included in this analysis. AI was used in delineation of tumour volume (11), OAR (6) and both in 1 study respectively. Radiotherapy modality used were CT (61%), MRI (22%) and PET/CT (17%). Top tumour sites studied were head and neck (33%), lung (28%) and colorectal (17%). Median number of patients contours used for validation was 22 (range 5-800). Outcome was poorly reported and not standardised. AI are capable of producing good contours but not yet able to be used clinically with 17% of studies reporting saving clinician time.
Conclusion: Deep learning AI technology is still at its infancy and not yet capable of producing clinically acceptable radiotherapy contours. The major hurdle to AI method is it requires a large dataset to train its model. AI improvements with time will potentially have a role in future radiotherapy workflow.
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P144 Assessment of Velocity and Mirada auto-segmentation tools

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Background: We assessed 2 software packages (Mirada Embrace:CT and Varian Velocity) for auto-segmentation and adaptive re-contouring .
Methods: Auto-segmentation tools were assessed using 15 CT scans previously contoured by an experienced clinician (5 pelvis, 5 thorax, 5 head and neck (H&N)). For each patient, a consultant oncologist carried out a blinded evaluation of organ-at-risk (OAR) contours generated by Mirada, Velocity and the original clinician. They scored quality of contours (1-5), and estimated potential time saving. Adaptive re-contouring was similarly assessed using data from 7 patients who had previously been contoured on one CT then re-contoured on a subsequent scan (3 H&N, 2 thorax, 2 pelvis). Adaptive dose re-calculation was assessed for 8 patients (3 H&N, 3 pelvis, 2 chest). Delivered dose was calculated for the CBCT geometry using Mirada and Velocity, and compared to dose calculated on a CT rescan.
Results: For auto-segmentation of H&N OARs, clinician contours scored an average 4.4, Mirada 3.4 and Velocity 2.2. The assessing clinician reported that all auto-contoured structure sets required editing, but provided an estimated time saving of approximately 20 minutes per patient. For pelvis and thorax patients, automatically generated contours required extensive editing and did not provide a significant time saving. For adaptive re-contouring, H&N clinician contours scored average 3.3, Mirada 4.0 and Velocity 3.0. Dose re-calculation using CBCT was similar for both packages (within 1-2% of CT rescan calculation). This gave a quick method to assess the impact of anatomical changes.
Conclusions: Both packages are potentially useful for some patient groups.

P145 **The effect of time of flight and attenuation correction on image quality of PET in patients with different BMI**

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Background: The image quality in Positron Emission Tomography (PET) improves with adding Time-to-flight (TOF) combined with attenuation correction (AC). The aim of this work was to investigate the effect of TOF and AC on PET images for patients with different BMI.
Method: 80 studies (40 from F18-FDG and 40 from F18-NaF) with different BMI were retrospectively processed. The image quality was compared between TOF and NTOF (no time of flight) and AC and NAC (no attenuation correction) using SNR and SUV. SUVmax was used to test the contrast and 4 regions over the liver for SNR. Two nuclear medicine physicians have evaluated the impact of TOF and NTOF on the contrast of lesions for F18-FDG and F18-NAF.
Results: SNR was significantly increased using TOF AC compared to NTOF AC with mean 17.2 ± 2 and 9.7 ± 3.5 respectively for all BMI. The SNR for TOF AC data (17.2 ± 7.16) was improved compared to NAC (5.6 ± 2.2). A significant improvement of SUVmax was noticed in TOF AC versus NTOF AC with mean 11.3 ± 6.8 and 10.6 ± 6.7 respectively. All Patients have shown significant increase in the contrast and SNR using TOF and AC regardless of their BMI. Both observers were supporting images with TOF AC compared to NTOF AC (kappa=0.82) as the contrast of lesion was improved with p value 0.002.
Conclusion: TOF combined with AC offers a better contrast, SNR and more accurate SUV. This will help in improving the quality of images and detectability.

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P146 **The effect of reconstruction times on PET radiomic features**

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Background: Radiomics involves extracting quantitative features from medical images which cannot be determined by the naked eye. Several studies claim that radiomic features could play an essential role in predicting the treatment outcomes. Purposes: The objective of this study is to evaluate the variation of PET image radiomic features with time of imaging post injection.
Methods: Eight mice with large 4T1 tumours in their lower flank were scanned after injection with 10.0 ± 2.0 MBq of 18F-FDG. Each mouse was scanned for 20 minutes between 50 and 70 minutes post injection and images were rebinned into 4 x 5 minute PET scans. Tumors in the first time point image were segmented and copied to all other points. 289 radiomic features were extracted and the coefficient of variation (COV) was calculated for each parameter. COV was categorized into four groups.
Results: Fifty eight (20%) features exhibited COV ≤ 5% and thirty three (11%) exhibited a combination between COV ≤5% and COV ≤ 10% for all mice. Eighty (27%) features showed COV > 10%.

Conclusions: This study demonstrated that the majority of features vary on images acquired at different timepoints. Further studies are needed to investigate the impact of imaging time on PET/CT image radiomic parameters. Radiomic parameters that are very sensitive to imaging times should be standardized before they can be used in patient management.

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P147 The effect of edge-enhancement on the precision of maximum abdominal aortic diameter measurements using three different ultrasound measurement techniques

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Background: Three measurement techniques are documented as being implemented for assessment of aortic diameter using ultrasound; inner-to-inner (ITI), outer-to-outer (OTO) and leading-edge to leading-edge (LELE). It is also suggested in the literature that edge-enhancement algorithms may improve measurement precision. This project tested this hypothesis.
Method: Observers (n=5 including a consultant sonographer) assessed the maximum anterior-posterior abdominal aortic diameter by completing repeated measurements using ImageJ software using the ITI, OTO, and LELE methods from one transverse abdominal aortic image obtained from a Siemens X700 ultrasound machine and a Kyoto Kagaku 'ABDFAN' ultrasound phantom. Intra- and inter-observer precision was assessed by comparing the coefficients of variation (CV%) for each technique.
Results: The use of edge-enhancement did not improve the precision of measurements for ITI or OTO measurements. The CV%s for non-edge enhanced measurements ranged from 1.5 to 3.3 for ITI, 1.3 to 2.0 for OTO and 1.4 to 2.3 for LELE. For edge enhanced measurements CV ranges of 1.5 to 2.9, 1.2 to 2.0 and 1.6 to 3.0 were noted for ITI, OTO and LELE respectively.
Conclusion: Good inter-operator precision is demonstrated for all measurements in this study. The edge enhancement algorithm used in this study was not shown to have any significant effect on measurement precision.

P148 Identifying metallic foreign bodies prior to MRI scan

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MRI scanning has dramatically increased in popularity over the last decades. One of the largest risks of exposing a patient to the high magnetic field of the MRI scanner is that of disturbing any metallic foreign object (MFO) lodged in the body. Depending on the location and material of a MFO, any forces or torque applied to it from the magnetic field could potentially cause injury. For this reason it is commonplace for MRI centres to have screening questionnaires to identify patients at higher risk for metallic foreign objects, and if necessary to carry out screening X-rays to confirm their absence prior to the MRI scan[1].
Because x-rays do not differentiate between types of metal, patients with a non-specific MFO visible in their x-ray may be contraindicated for MRI[2,3]. Some of this contraindication could be unnecessary, because non-ferromagnetic materials (such as lead or aluminum) are not subject to the magnetic field in the screening room, only the heating effects undergone by any conductive material in a magnetic field.
This poster will describe some different methods currently used to identify MFOs prior to MRI scan, discuss types of MFO that might be encountered and whether they are ferromagnetic.

1. British Association of MR Radiographers, MR Safety Document 2016
2. Safety in magnetic resonance imaging, Society of Radiographers
3. Review article - X Radiation dose implications in screening patients with ferromagnetic IOFBs prior to MRI: a literary review OPTIMAX 2014 – radiation dose and image quality optimisation in medical imaging

P149 Adequacy of contrast enhancement in CT pulmonary angiograms - an audit

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Blackpool Victoria Hospital

Background: Suboptimal enhancement of CTPAs leads to non-diagnostic studies and therefore poses unnecessary exposure to contrast and radiation. A minimum enhancement of 210 Hounsfield Units (HU) is reqired to identify chronic thrombus. *(Wittram et al. 2005)*
Target: As per RCR AuditLive proforma, no more than 11% of scans should have inadequate contrast as approximately 10.8% may be suboptimal based on all causes. *(Jones & Wittram 2005)*
Aims: To establish the percentage of inadequate CTPAs at a UK based trust.
Method: Retrospective sampling of 100 consecutive CTPAs was undertaken. The HU at the pulmonary trunk were measured with a standardized method. HU<210 was defined as inadequate. Patient age, sex and radiology report findings were also noted.

Results: The mean patient age was 67.57. 16 out of 100 scans were suboptimal. 5 studies were reported as non-diagnostic, all of which fulfilled the criteria for an inadequate CTPA. 16 Pulmonary embolisms (PE) were reported, 3 of which (18.75%) were from inadequate scans.
Conclusions: The percentage of adequate CTPAs does not meet RCR targets. No direct correlation between age, sex and non-diagnostic studies was observed. Larger PEs may still be reported despite suboptimal contrast enhancement.
Suggestion: Disseminate the result to radiographers to raise awareness of adequate contrast enhancement. Ensure radiographers realise the importance of a large cannula in the antecubital fossa with appropriate arm positioning and proper breathing instructions. This will be re-audited with larger sample size to further establish the age correlation and check improvement.

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P150 Introducing an O-arm for complex spinal cases

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As a busy recognised spinal centre in the heart of a major city dealing with complex spinal cases ranging from scoliosis correction to oncology cases, the spinal team and radiology recognised the need for better, more accurate ways to image the spine during surgery. The Medtronic O-arm was introduced a year ago and we have currently performed over 20 cases. As radiographers providing an intra-operative service we have had to implement strict protocols and systems that meet surgeon demand and expectations whilst maintaining our own obligations under IRR 17 & IR(ME)R 17 to ourselves, other staff and patients. The poster aims to outline a brief overview of the O-arm & its functions.

The positives we have experienced in the year from the perspective of the surgeon and radiographer including:

- Advantages of the kit such as real time navigation of individual screw paths
- Impact on radiographer time in theatre
- Increased communication
- Impact on budget and wastage
- Role expansion for staff.

The disadvantages we faced including:

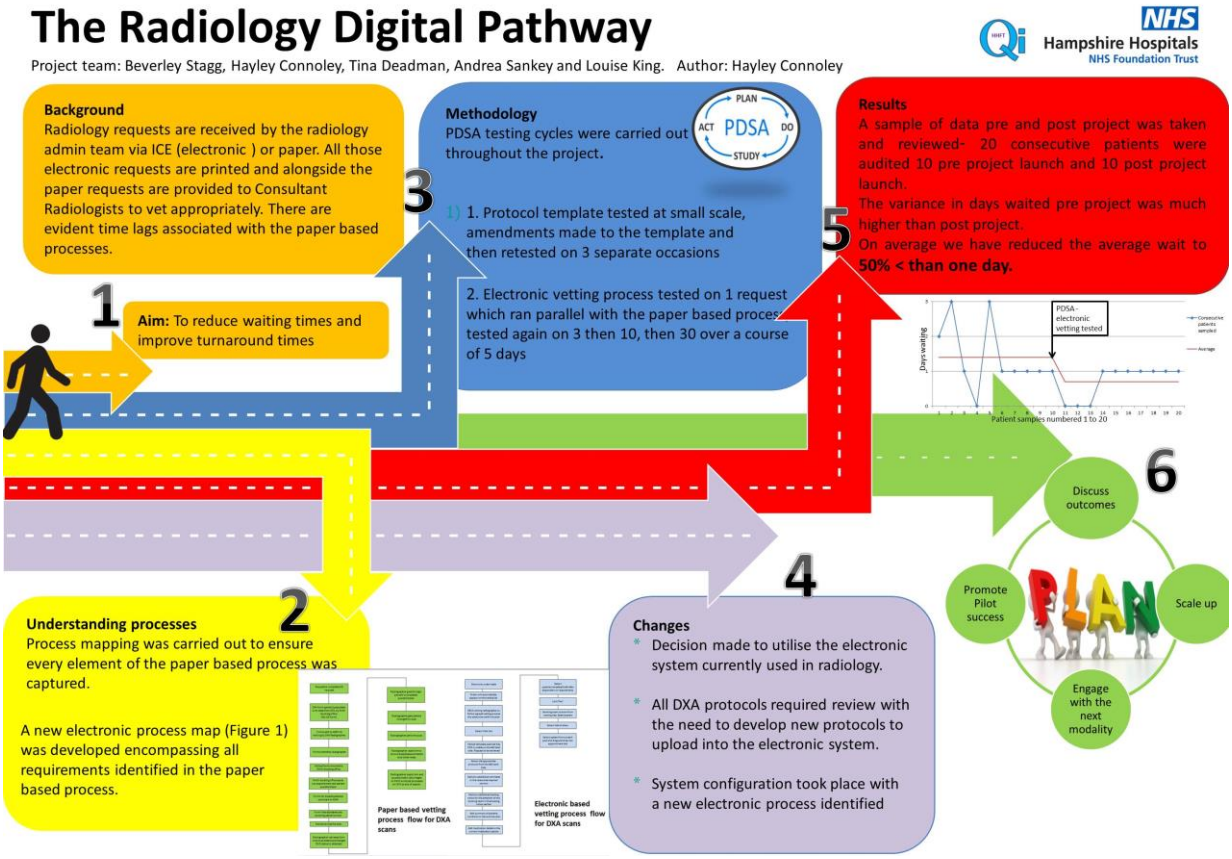
- Increased dose to patient and potentially staff
- Limitations to practice with input from RPS/medical physics
- Staff training issues and limitations to service.

Future learning possibilities including:

- Audit opportunities in terms of dose
- Advantages & disadvantages on long term patient outcomes & management.

P151 **The radiology digital pathway**

Hayley Connoley; Beverley Stagg
Hampshire Hospitals NHS Trust



The Radiology Digital Pathways (RDP) project will deliver paper light processes within the radiology department. This has provided great benefits to patients by reducing the time at all stages in the process between request, vetting, booking and scanning. We hope that this will take days off the diagnostic pathway, and particular benefit will be seen in those pathways under significant time pressure, such as 2 week wait cancer diagnosis. This will also benefit staff at all levels working in the radiology department, as time will no longer be spent chasing paper forms between various locations.
Several members of staff will be able to access the same information simultaneously, editing will be visible to all who need access, vetting processes will be faster and scanning protocols will be standardised across the trust. Digitalisation of these processes will also reduce the risk of error due to duplication of paper forms. The team working on the RDP project have had to work with many clinical and non-clinical staff groups within and outside radiology. Engagement levels have been high and this reflects positively the collaborative way in which the project has been run so far.

P152 **The role of PSMA for patients with advanced prostate cancer**

Joseph Drabble
GenesisCare

Prostate cancer is the second most common cause of cancer related deaths in men in the UK. Accurate staging of prostate cancer plays an important role in patients treatment management. Current practice for staging prostate cancer is to use bone scans (BS's) to detect bone metastases and morphological CT/MRI imaging to predict malignant lymph nodes. BS's effectiveness is limited due to insensitivity of early metastatic lesions and morphological imaging is limited in that 80% of malignant lymph nodes are smaller than the 1cm short axis that is used as a predictor of malignancy. PSMA PET/CT imaging can be beneficial to staging patients with advanced prostate cancer as it shows a significantly high expression in the majority of prostate cancer cells. This can help earlier detection of bone metastases and also detection of metastatic lymph nodes therefore enabling faster treatment and more accurate treatment interventions improving patients prognosis. PSMA is also being trialed therapeutically using 177Lu-PSMA-617 for compassionate treatment of patients with castrate-resistant prostate cancer. Results have shown a significant reduction in 50% PSA decline and improvements to overall survival times. Currently published results are limited to mainly retrospective data but PSMA therapy prospective trials are currently in progress.

P153 **End to end electronic Multi-disciplinary team meeting workflow using order comms**

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Imperial College Healthcare NHS Trust

Background: MDT discussions have traditionally been difficult to arrange and track in a patient history. The requesting of the case to be discussed in an MDT is via various methods which were not always integrated with the existing database and EPR systems. After GDPR all this information needs to be transferred and stored in a compliant manner which is difficult when multiple systems are being utilised. We describe a new workflow which has allowed clinicians to check MDT reviews in the same place in the EPR/PACS under the patient record. By utilising the existing HL7 interface between Cerner EPR and the radiology system. The various MDTs were built as exams that could be ordered via the existing order Communication. MDT discussions orders placed in Cerner were used to drive the PACS system using the existing desktop integration. Users could place notes in the form of unauthorised reports on the system and then authorise formal reports once the discussion was concluded. The report was then sent back to Cerner.
Purpose: To describe the HL7 based workflow for MDT discussions to be requested and recorded in the patient history in the EPR, RIS and PACS and to demonstrate the benefit of utilising the existing workflows.
Summary: It is possible to use existing radiology and electronic patient record systems and interfaces to create a GDPR compliant complete MDT workflow with existing information systems without specialist software or interfaces. Future developments include scheduling MDT discussions using existing radiology scheduling procedures.

P154 **Graves' disease and radiotherapy: The work of Florence Stoney**

Adrian Thomas
Canterbury Christ Church University

Radiologists and surgeons have always looked for treatments that avoid major surgery, which has a considerable morbidity and mortality. Following the discovery of X-rays its therapeutic potential was quickly appreciated, and treatments were given for a wide variety of conditions with considerable success. This presentation describes a technique that was used in the early 20th century, and places modern clinical practice within a historical context.
Florence Stoney started treating Grave's disease in 1908, and by 1912 had seen 48 patients. She described her experience at the annual meeting of the British Medical Association held in Liverpool[1,2]. This became a well-established treatment for this condition although as not without complications, and, whilst external radiation is no longer used today, radiation treatment continues with the use of radioiodine, which was introduced following the Second World War. Florence stated "It is to me rather terrible to see these patients subject to operation, where the risks are considerable, and shock in their nervous systems very severe and sometimes fatal."
Her patients were often very sick, and the oral anti-thyroid drugs used today were not yet developed; for example propylthiouracil only came into medical use in the 1940s, and methimazole was only introduced in 1954. Of her 41 completed treatments Florence had 14 complete cures and 22 had great improvement and returned to ordinary life. Her results, and importance of her work will be demonstrated.

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EDUCATION AND WORKFORCE

P155 **Radiation therapy education and certification in Ghana**

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In response to the need of adequately trained Radiation therapists in the health delivery system of Ghana, a Bachelor of Science in Therapy Radiography Programme was established by the University of Ghana School of Allied Health Science in 2014.It is the only institution training Radiation therapists. Over the years, the Radiation therapy programme in Ghana has grown from initially admitting local students to admitting foreign students from other Africa countries.
The program runs bi-annually with a maximum student intake of eight. The entire duration of the Programme is four years followed by a one year compulsory clinical internship at the National Centre for Radiotherapy and nuclear Medicine. There is also Vocational clinical training which is supervised during inter-semester breaks. Students take general courses together with their colleagues in the General Radiography Program during their first and second year after wish they branch into more specialised courses in their third and final year. An external examiner mostly from abroad examines the students in their final clinical practicum exams before students graduate.
In order to practice in Ghana, students then undertake their one year compulsory clinical training at the National centre for Radiotherapy followed by a registration exam with the Allied Health Profession Council. Successful candidates are issued with their licences and are posted to any of the three Radiotherapy Facilities in Ghana for job placement. In future, changes will be required to increase student intact, run it yearly, ensure that certification remains of high standard and recognition continues.