depending on the age of the system and the availability of Radiation Dose Structured Reports (RDSR). The data covers a variety of neuro-interventional and vascular-interventional exam procedures as coded under NIMIS national exam codes. Typical radiation dose metrics include Fluoroscopy Time, Dose Area Product (DAP) and Reference Point Air Kerma (RPAK). More recently the estimation of Peak Skin Dose (PSD) has been added to the suite of dose metrics available within dose tracking software. The aim of this study was to:

- Obtain the distribution of doses per interventional procedure (e.g. Mean, Median, 3rd quartile of Fluoroscopy Time, DAP and RPAK, PSD where available)
- Compare locally determined Dose Reference Levels to published literature
- Compare Peak Skin Dose (PSD) values (where available) with published thresholds for deterministic effects to the skin (e.g. erythema, epilation etc)
- Identify patients who have had single or multiple high dose procedures – for Out-Patient follow-up where appropriate
- Use the collected dose metric data for the optimisation of radiation safety for both patients and staff in an effort to provide continuous improvement within the hospital's radiation safety environment

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Radiotherapy Session 11:25 – 12:55

Benchmarking novel optical fibre sensors for applications in radiation therapy

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Detecting ionising radiation using scintillation light is a long-established technique, yet scintillator-based dosimetry in radiotherapy was not commercially available until recently. Scintillator materials can be organic or inorganic. Organic based scintillator detectors suffer from low light conversion efficiency and Cerenkov light ratio (CLR) coefficient energy dependence. The aim of this study was to characterise novel optical fiber sensors (OFS) based on an inorganic scintillating material for external beam radiotherapy due to the high sensitivity and high light conversion efficiency of inorganic scintillators. The sensor was constructed using a polymethyl methacrylate (PMMA) plastic optical fibre. The core of the PMMA was micro machined to make a cavity with a 700 μm diameter and a 3 mm depth. The cavity was filled with the scintillating material terbium doped gadolinium oxysulphide (Gd2O2S:Tb) and then sealed with an epoxy. The scintillation material fluoresces on exposure to ionising radiation and the resultant emitted fluorescent light is detected using a multi-pixel photon counting module. Essential dosimetric properties were quantified, including the repeatability of the OFS system response, linearity of the output signal with radiation doses and dose rate and dose per pulse (DPP) dependency of the system. Percentage depth dose (PDD) and lateral dose profiles were measured for different field sizes and compared to the commercial W1 plastic scintillator and Monte Carlo simulations using BEAMnrc/DOSXYZnrc codes.

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Using a deep neural network to predict deviations in mean heart dose during the treatment of left-sided deep inspiration breath hold patients

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Purpose We investigated if a deep neural network could be used to predict the change in mean heart dose when a patient's heart deviates from its planned position during radiotherapy treatment. Methods Predictions were made based on parameters available at the time of treatment planning. The dose prescription, deep inspiration breath hold (DIBH) amplitude, heart volume, lung volume, V90% and mean heart dose were used to predict the increase in dose to the heart when a shift towards the treatment field was undertaken. The neural network was kept as simple and institutive as possible with a single hidden layer. The network was trained using of 3 mm, 5 mm and 7 mm shifts in heart positions for 50 patients' giving 150 data points in total. The neural network was tested using random cross-validation to evaluate the model's robustness to new data. Results The optimal neural network found was comprised of a single hidden layer of 30 neurons. Based on twenty train/test splits, 94% of all prediction errors were below 0.2 Gy, 97.3% were below 0.3 Gy and 100% were below 0.5 Gy. The average RMSE and maximum prediction error over all train/test splits was 0.13 Gy and 0.5 Gy respectively. Conclusions Our approach using a deep neural network provides a clinically acceptable estimate of the increase in MHD, without the need for further imaging, contouring or evaluation. The trained neural network gives clinicians the information and tools required to evaluate what shift in heart position would be acceptable and which scenarios require immediate action before treatment commences.

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Dosimetry assessment of patient-specific 3D printable material for HDR surface brachytherapy

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Purpose: 3D printable material water equivalence was investigated within the range of Iridium-192 source energies. The aim is to validate it for superficial brachytherapy treatments.

Methods and materials: 3D Cheetaflex material (bolus) was examined both in a water tank and with CIRS anthropomorphic phantom, performing an end-to-end test. In water tank, a GafChromic EBT3-V3 film was oriented perpendicular to the source axis obtaining percentage depth dose (PDD) from 7 mm to 30 mm of distance from the source, with and without a bolus 5 mm thick. Two films were oriented parallel to the source at 5 mm and 15 mm of distance and results were compared with TG-43 implemented on Oncentra® Brachy treatment planning system (TPS). A set of CT images of CIRS phantom was acquired and a bolus with 7 trajectories (1 cm inter-distance and 5mm from skin) was created. A new CT set of images with bolus and phantom was imported on TPS where a target was