cess, the fabrication of prostheses involves taking a plaster cast of the area to be treated, hand carving wax models, multiple meetings with the patient to alter this model, before making a final prosthesis in silicone. Utilising the patient's pre-existing CT images and 3D printing technology, a patient specific prostheses can be created with improved efficiency and accuracy. However a method is required to validate this process. This study demonstrates the methods used to create a patient specific eye prosthesis using CT images obtained after reconstructive surgery. These images were manipulated in a way which allowed for the intact eye to be mirrored and used to develop a 3D printed model which acted as the starting point to create silicone prosthesis. A validation method is presented which uses freely available registration software (GOM Inspect, GOM GmbH, Braunschweig) to analyse the results at various stages of the process. The benefits of using this method include reduced manufacturing time, decreased patient outpatient appointments, improved personalised outcomes and a repeatable process allowing multiple prostheses to be made.

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Poster Session : P17

Removing limiting factors for Leeds Test Object TO.10 usage

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The Leeds Test Object TO.10 is routinely used to provide a subjective estimate of Signal to Noise Ratio (SNR) as a measure of overall image quality. Currently, calibrated contrast values are provided for a limited set of discrete peak voltage (65, 70, 75, 80 kVp) and copper filtration thickness (1.0, 1.5, 2.0 mm Cu) combinations. However, it can be challenging to attain these exact settings on modern interventional imaging systems incorporating Automatic Dose Rate Controls (ADRC) and varying amounts of additional copper filtration. These limit the accuracy of results obtained thus representing significant limiting factors for the TO.10. We describe two methods of removing these limiting factors: a three-dimensional (3D) Matlab interpolation and extrapolation algorithm, and a multivariate-polynomial function, the coefficients of which can be stored in Excel. Both methods make use of the available contrast values to generate contrast curves for any kVp and mm Cu combination. Results obtained from both methods are presented as Threshold Index (H_T(A)) curves modelled by best fit log-polynomials. Their accuracies are evaluated through comparison with H_T(A) curves obtained under calibrated conditions. Both methods are found to produce more accurate estimates of detail contrasts for non-standard kVp and mm Cu combinations. Although an inherent error of approximately 15% is associated with this type of contrast detail analysis, the ability to analyse TO.10 data for non-standard kVp and mm Cu combinations offered by modern systems increases the accuracy of calculated H_T(A)'s. These methods further reduce the time required for image quality tests and room downtime.

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Poster Session : P18

A novel quantitative measure of image quality in fluoroscopy

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The aim of this work is to develop a quantitative algorithm for the assessment of image quality in fluoroscopy as an alternative to the subjective Leeds Test Object TO-10. Current possible quantitative measurements such as Detective Quantum Efficiency and Modulation Transfer Function do not assess the effects of imaging processing, such as edge-enhancement and noise reduction, on the final displayed image. A standard statistical algorithm used to calculate the contrast needed to observe an object having area size (A) against background. The algorithm was developed to produce sets of Contrast-Detail and Threshold Contrast curves. Three flat panel fluoroscopy systems in our Cardiology were examined. Sequences of uniform fluoroscopy images, obtained using 1 mm of copper as an attenuator, were acquired and then analysed remotely. For each system curves were generated for (a) different dose rates at the detector, (b) different settings of magnification, & (c) different levels of edge-enhancement. For one system different levels of noise reduction were examined. Areas under contrast-detail and threshold-contrast curves reflect changes in dose rate at the detector. The algorithm is sensitive to changes in applied edge-enhancement and noise reduction. Both sets of curves for each system exhibit characteristic spatial frequency responses. This new efficient and objective algorithm measures fluoroscopic image quality using the standard Threshold Detection Index. It tracks quality changes that depend not only on input dose rate, but also the level of image processing applied. It only requires the acquisition of a few seconds of fluoroscopy to produce images for remote analysis.

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Poster Session : P19

Hippocampal volumetrics in the diagnosis of temporal lobe epilepsy

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Most people with epilepsy control their seizures by using anti-epileptic drugs. However, one third of these patients suffer from a severe kind, resistant to medication, refractory epilepsy. These patients may be considered for surgical resection, where a portion of brain tissue involved in seizure onset is removed. In the most common form of epilepsy, temporal lobe epilepsy (TLE), structures such as the hippocampus are often found to be involved. An indicator that the hippocampus may be related to the seizure onset is the presence of mesial temporal sclerosis (mTS), which is noted by a loss of internal architecture, reduced hippocampal volume and hyperintensity on T2 weighted MRI. It has also been shown in the literature that mTS supported by hippocampal volumetry can indicate a better

postoperative outcome for patients. This project evaluates the use of software packages to produce volumetric estimates of these TL structures. These estimates were obtained for patients whose radiological reports indicate the presence and/or suspicion of mTS and a normal cohort. A comparison between Freesurfer and more specific hippocampal volumetric software packages was made. A database of normal MRI scans was compiled, this is age and gender matched for robust comparison and to reduce systematic error associated with comparing volumetric data. It was found that the software packages showed good agreement with radiological reports by indicating a reduced hippocampal volume. It is hoped that this work and further validation of volumetric approaches will be integrated into the presurgical workup with the aim of improving postoperative prognosis.

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Poster Session : P20

Dose equilibrium and CTDI quality assurance in CT and the implications for the effective dose estimation in patients

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Effective dose is a single parameter meant to reflect the relative risk from exposure to ionizing radiation. It reflects the risk of detrimental biologic effects from a non- uniform, partial-body exposure in terms of a whole-body exposure1. In this study we applied the American Association of Physicists in Medicine (AAPM)2 dose equilibrium (DEq) method and the CTDI method to estimate organ dose and effective dose values and retrospectively correct the annual effective patient dose for a random sample of twenty patients. The results showed that the effective dose summed across the affected organs was underestimated by CTDI between 26 % and 31% when compared to the DEq estimate. This updated data set reflected that the effective dose to patients was up to 6 mSv greater than previously estimated through CTDI. 1. Rodrigo Canellas, Subba Digumarthy, Azadeh Tabari, Alexi Otrakji, Shaunagh McDermott, Efren J. Flores, Mannudeep Kalra. 2018. Radiation dose reduction in chest dual-energy computed tomography: effect on image quality and diagnostic information. Radiologia Brasileira 51:6, 377-384 2. AAPM. Report of AAPM Task Group 111: The Future of CT Dosimetry: Comprehensive Methodology for the Evaluation of Radiation Dose in X-Ray Computed Tomography. AAPM Report No. 111. City Park: American Association of Physicist in Medicine; 2010.

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Poster Session : P21

Retrospective Shielding Measurements in a Radiographic X-ray Department

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Retrospective Shielding Measurements in a Radiographic X-ray Department Undertaking a series of Barrier Measurements for Lead Shielding Verification purposes using a Mobile X-ray tube/Ionisation chamber brought to light many practical issues. As a result of these practical issues, it became evident that a protocol would need to be drafted to better suit our positioning difficulties and logistical issues. Whilst positioning of X-ray tube in line with ionisation chamber via the medium of lead glass was relatively straightforward, positioning of X-ray tube and Ionisation Chamber through other barriers proved more difficult in relation to vertical and horizontal positioning whereby no visual cues were available to confirm that the X-ray beam and ionisation chamber were correctly aligned. Also, the distance between the X-ray tube and the Ionisation Chamber would have a knock-on effect on certain parameters. Situations resulted with no output recorded on the measurement device, which may have been either as a result of barrier thickness or positioning accuracy. Whichever was the case, either of these situations may have been attempted to be rectified by reducing the X-ray tube/Ionisation chamber distances, making the collimation bigger or a combination of both. Trade off in collimation size needed to be considered, whereby although broad beam is desirable for the above reasons, it is also necessary to ensure that the collimation is coned to the barrier of interest only and not including other barriers.

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Poster Session : P22

Global head SAR assessment of MRI-induced temperature change

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Purpose: Underestimation of SAR (Specific Absorption Rate) in MRI poses potential risks to patients and in particular individuals with compromised thermoregulation. EU standards imposes a head SAR limit of 3.2 W/kg as SAR effects are negligible at up to 3 W/kg. We developed a phantom and protocol where heating due the RF pulse is measured and verified against scanner displayed SAR.

Methods and materials: The spherical 3-Litre phantom comprised of agar (60 g/L), NaCl (10 g/L) and CuSO4 (1 g/L) dissolved in distilled hot water. T1 properties of the phantom were determined at room temperature using a STIR sequence. The phantom was manufactured to achieve thermal equilibrium. A baseline image is acquired using a 2D fast gradient echo. SAR loading is generated with a clinical 3D FLAIR sequence followed by a repeat 2D fast gradient echo. Our phantom is nonperfused, and the period of heating is relatively short. Thus, physiological and conduction effects are ignored. Temperature maps were generated using Proton Resonance Frequency Shift (PRF) thermometry. Global SAR was estimated by averaging temperature changes over the whole phantom and compared to the scanner's SAR display. The procedure was repeated for five independent scanners.

Results: In the format scanner model/scanner readout [W/Kg]/ our calculation [W/Kg]/ error [%]: GE 1.5T Signa Explorer/0.42/0.41/2.3, Siemens 1.5T Symphony/1.88/1.90/1.0, Philips 3T Achieva/1.52/1.52/0, GE 1.5T Signa Explorer /0.56/0.55/1, Siemens 1.5T Magnetom 1.5/1.49/1.2 We have found that our SAR estimates are in good agreement with the MRI scanner displayed data.

Conclusion: We have developed a phantom that can independently verify MRI SAR.

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