



HEAD & NECK / NEURO / DENTAL POSTER PRESENTATIONS

P072 Incoherent intravoxel motion - a sequence of interest in the MR Imaging of Multiple Sclerosis in the spinal cord

Brian Johnson¹; Christine Heales²

¹Philips; ²University of Exeter

Introduction: Conventional MRI is a critical tool in Multiple Sclerosis (MS) for diagnosis and monitoring. Incoherent intravoxel motion (IVIM), an advanced MRI technique, assesses perfusion without contrast media. The aim of this study was to evaluate IVIM within the spinal cord of MS patients.

Method: Following ethical approval, 30 subjects (15 control, 15 with MS) were recruited and underwent 3 Tesla MR imaging. IVIM and anatomical sequences were performed. Processing included image co-registration, motion correction and spinal cord tissue segmentation for vertebral levels C2--C4. IVIM metrics for perfusion fraction (f), pseudo-diffusion coefficient (D*) and pure-diffusion coefficient (D) were calculated.

Results: Ratios were determined for each group for each IVIM metric in the spinal cord (SC), white matter (WM) and gray matter (GM). T-tests compared the control group ratios and MS group ratios for each metric.

SC:GM

f:Control 1.00(0.55-1.72), MS 0.95(0.53-1.99) p=0.204

D:Control 1.04(0.53-2.07), MS 1.03(0.52-5.22) p=0.955*

D:Control 1.02(0.50-2.16), MS 0.95(0.53-2.07) p=0.220

WM:GM

f:Control 0.99(0.80-1.08), MS 1.06(0.38-1.08) p=0.131

D:Control 1.00 (0.79-0.79), MS 1.05(0.39-1.90) p=0.256*

D:Control 0.99(0.81-0.81), MS 1.10(0.34-1.12) p=0.096

SC:WM

f:Control 1.01(0.93-1.24), MS 1.03(0.95-0.95) p=0.220

D:Control 1.00(0.93-1.24), MS 1.05(0.93-0.97) p=0.236*

D:Control 1.01(0.82-1.23), MS 1.03(0.93-0.94) p=0.237

Although not statistically significant, the perfusion fraction ratios for the control group compared with the MS group tended towards lower p-values; this is suggestive of changes in spinal cord perfusion for the MS group.

Discussion: In combination with the diffusion-weighted imaging, IVIM may be an additional biomarker sensitive to changes associated with MS in the cord. Further work is required to determine whether IVIM could replace contrast enhanced MRI for monitoring disease progression and treatment.

P073 Impact of gadopichol on decision making in patients with brain metastases: A post-hoc study

Gustavo Sarrig¹; Jens Fleckenstein²; Miriam Eckl²; Florian Stieler²; Martin Bendszus³; Leonard Schmeel¹; David Koch¹; Marco Essig⁴; Frederik Wenz⁵; Frank Giordano²

¹University Hospital Bonn; ²University Medical Center Mannheim; ³University Hospital Heidelberg; ⁴University of Manitoba; ⁵University Hospital Freiburg

Background: To evaluate the impact of contrast-enhanced MRI with gadopichol (EluciremT, Guerbet), a high relaxivity GBCA currently under review by EMA, on decision making and radiotherapy (RT) treatment planning of brain metastases (BM).

Method: In this post-hoc analysis of data from a phase IIb study, MR images of patients who underwent two separate contrast-enhanced MRIs with gadopichol and gadobenate dimeglumine at 0.1 mmol/kg, with ≥ 1 BM detected in any of both scans, were analyzed. For each MRI, treatment plans (stereotactic radiosurgery [SRS] or whole-brain radiotherapy [WBRT]) were determined, with the gross target volume (GTV) indicating the contrast-enhancing aspects of the tumor. Mean GTVs, normal tissue volumes receiving 12 Gy (V12), and the Dice similarity coefficient (DSC) were

obtained for the paired contours. The Spearman's rank (ρ) correlation was additionally calculated. Three blinded experts subjectively evaluated the contrast enhancement of each lesion.

Results: A total of 13 adult patients were analyzed. Gadopiclenol depicted additional BM as compared with gadobenate dimeglumine in 7 patients (54%). Treatment indication was changed in 2 patients (15%), from no treatment to SRS and from SRS to WBRT. The mean GTVs and V12 were comparable between gadopiclenol and gadobenate dimeglumine ($p=0.694$, $p=0.974$). The mean DSC was 0.70 ($\hat{A}\pm 0.14$, $\rho 0.82$). From a total of 36 answers, an improvement in enhancement was qualified in 21 (58.3%) with gadopiclenol, 8 (22.2%) with gadobenate dimeglumine, while no difference was obtained in 7 (19.4%) evaluations.

Conclusion: Gadopiclenol at 0.1 mmol/kg improved BM detection and characterization with impact on RT treatment decisions.

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P074 Improving the concordance with hippocampal sclerosis on MRI by increased reporting consistency of FDG PETCT in refractory temporal lobe epilepsy pre-surgical assessment

Alexander Alessi; Simon Hughes; Vijay Sawlani; Hayaka Amada; Mohamed El-Sayed

Queen Elizabeth Hospital Birmingham

Background: Medical treatment of epilepsy remains challenging. In temporal lobe epilepsy (TLE) refractory to medical therapy, magnetic resonance imaging (MRI) identification of hippocampal sclerosis (HS) is important. 18F fluoro-deoxy-glucose (FDG) positron emission tomography combined with computed tomography (PETCT) in preoperative selection of patients is increasing. The aim of the study was to improve consistency of reporting PETCT for medically refractory TLE. We investigated whether consistent reporting of PETCT gave improved concordance with HS on MRI.

Method: A retrospective single centre study was performed on 49 patients consecutively scanned with PETCT which had a blinded review. We defined 4 quality standards for PETCT ; simple reproducible consistent intensity display methodology is described (applicable to all types of acquisition and scanner - 5 x 95% saturation regional grey-matter activity). Lateral temporal lobe activity in 4 x regions was defined as mild, moderate , severe (with clinical pattern described). Comparison of original PETCT report, blinded study PETCT, original MRI report (with blinded review) was recorded.

Results: Abnormal MRI and abnormal PETCT concordance improved from 18/28 (64%) to 27/28 (96%). Abnormal MRI and normal PETCT discordance reduced from 10/28 (36%) scans to 1/28 (4%) scans. Normal MRI report and abnormal PETCT discordance increased from 5/21 (23.8%) to 13/21(61.9%) scans.

Conclusion: Consistent qualitative analysis of PETCT increased findings of abnormality in PETCT and concordance with MR findings. 1/49 had MR abnormality with undetectable FDG abnormality. This improved surgical confidence in PETCT, increased referrals and acceptance of PETCT in presurgical planning.

1. Casse, R., Rowe, C.C., Newton, M., Berlangieri, S.U., and Scott, A.M. (2002) Positron emission tomography and epilepsy. *Molecular imaging and biology.* 4(5), 338-351. 2. Kilpatrick, C. (1996) Neuroimaging in epilepsy surgery: a review. *Journal of clinical neuroscience.* 3(4), 305-309. 3. Rosenow, F. and Luders, H. (2001) Presurgical evaluation of epilepsy. *Brain: a journal of neurology.* 124(Pt 9),1683-1700.

P075 Identifying spontaneous, uncontrolled coughing events for fMRI of the human brain

Matthew Dimmock¹; Nabita Singh²; Michael Farrell²; Sharna Jamadar²; Aung Moe²; Stuart Mazzone³

¹Keele University; ²Monash University; ³University of Melbourne

Background: The use of functional magnetic resonance imaging (fMRI) to investigate spontaneous uncontrolled coughing (SUC) (Sigh et al., 2020) has not been previously investigated. The mapping of neural correlates of SUC requires the development of a new technique for detecting cough events. In this paper we report a novel cough detection algorithm, the COugh Finder in fMRI (COFF).

Method: The COFF algorithm was developed using a pilot dataset of four participants. Scanning was performed on a

Siemens Magnetom scanner with a 32-channel head coil to collect structural and functional data. A facemask was fitted to each participant which delivered six blocks of either nebulised capsaicin (to evoke a cough), or saline (as a control) in a randomised order. Participants used a button-box to indicate the precise times of cough events. The accuracy of the COFF algorithm for determining the presence of cough events was measured and also compared to the established framewise displacement (FD) technique.

Results: Typical fMRI scans in cough research acquire several thousand consecutive volumes, therefore a false positive rate (FPR) of 1/5000 was used to establish the threshold from the receiver operating characteristic curves. The FD (mm) and COFF thresholds were 4.4 and of 4.0, respectively. The ratios of the true positive rates to FPRs to were 1.78 and 80.0 for the FD and COFF techniques, respectively -- demonstrating a significant improvement.

Conclusion: This new algorithm can be applied to identify cough events which is particularly important when investigating the neural representation of SUC in the brain.

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P076 Necrotising otitis externa: Optimising the use of imaging for initial assessment, management and follow-up

Samuel Huthart; Nick Spencer

Mid Yorkshire Hospitals Trust

Background: Necrotizing otitis externa (NOE) is a rare complication of otitis externa, characterized by infection extending into the surrounding soft tissues and/or osseous structures. Radiological investigation is essential for prompt diagnosis and initial assessment, and may also be useful for monitoring disease activity. However, there is a lack of agreement among medical professionals regarding the optimal use of imaging, and capacity constraints for urgent imaging (e.g. Magnetic Resonance [MR] and nuclear medicine) in UK clinical practice, limits the use of advanced modalities in suspected NOE cases.

Purpose: This poster presents the results of a local education initiative and quality improvement project, aimed at ensuring consistent radiological investigation and improved patient outcomes. We have adopted a more standardized investigative approach, and we wish to share our findings and recommendations with a wider audience, along with a brief review of the literature.

Summary: We conducted a retrospective audit to examine the pattern of imaging in patients with NOE over a two-year period (2021-22). As per our local guidelines, Computed Tomography (CT) with or without MRI should be used to establish initial diagnosis, determine the extent of disease, and monitor progression at follow-up. Of the 17 patients initially diagnosed with NOE, 16 (94%) underwent a baseline CT scan, while only 2 (12%) had a baseline MRI. Additionally, 6 patients (35%) underwent follow-up CT scans, and only 2 (12%) had follow-up MRI. No patient underwent nuclear medicine-based imaging. Our findings demonstrate the lack of consensus and subsequent inconsistencies in imaging for NOE.

P077 fMRI Imaging the impact of cold-water immersion on brain function and emotion

Ruth Williamson¹; Ala Yankouskaya²; Heather Massey³

¹University Hospitals Dorset; ²Bournemouth University; ³Portsmouth University

Background: Emerging evidence supports mental and physical health benefits of cold-water immersion with the number of participants in outdoor swimming growing rapidly. The aim of the study was to use functional magnetic resonance imaging (fMRI) to demonstrate how mood changes after cold water immersion are associated with changes in brain connectivity.

Method: 33 healthy adults naïve to cold water swimming undertook a 5-minute cold water (20 degrees) cold water bath. Self-reported emotional state and brain connectivity were measured with a validated questionnaire and with functional magnetic resonance imaging (fMRI) before and after immersion. MRI Data was acquired at 3Tesla with MPRAGE anatomical and BOLD functional series. Analysis at subject level was followed with normalisation into the Montreal Neurological Institute space from which group level inferential statistics were performed. A robust brain parcellation approach and multivariate analyses of neuroimaging data were combined with self-reported behavioural measurements.

Results: Participants felt more active, alert, attentive, proud and inspired following immersion. The increase in positive affect was associated with changes in coupling between brain areas involved in attention control, emotion and self-regulation. The relationship between changes in functional connectivity and positive affect remained consistent across the participant group. A reduction in negative emotions did not show strong associations with changes in brain connectivity.

Conclusions: These results indicate that changes in interactions between large scale brain networks linked to positive affect can be demonstrated with fMRI. These changes may contribute to the reported positive improvements in mood following cold water immersion.

Yankouskaya, A et al (2023) Short-term head out whole body cold water immersion facilitates positive affect and increases interaction between large scale brain networks. *Biology* 12 (211) 1-20

P078 A critical review of the use of the PENTOCLO triple therapy medication regime for the management of stage III and/or refractory osteoradionecrosis of the jaw to improve quality of life

Lucy Koh

Lancashire Teaching Hospitals Foundation Trust

Background: Osteoradionecrosis of the jaw (ORNJ) is a debilitating late effect of head and neck radiotherapy. Incidence is 10%, however once diagnosed is difficult to treat. Severe cases can cause exposed bone, pathological fracture and oral fistulas. ORNJ is managed with regular follow up to achieve symptom control, if progression occurs other management options are explored, however there is no 'treatment protocol'. ORNJ is managed conservatively or surgically. Surgery is invasive and disfiguring with risk of poor healing in stage III and refractory ORNJ, therefore conservative management is usually employed, e.g., oral hygiene, antibiotics, sequestrectomy and analgesia. A triple therapy medication is showing promising results for ORNJ. Pentoxifylline (Vasodilator), Vitamin E (alpha tocopherol) and a new generation bisphosphonate, Clodronate (PENTOCLO). Published research demonstrated positive benefits, improving pain, increased oral nutrition and quality of life.

Methods: A systematic search and critical review of published literature was undertaken to ascertain benefits of using PENTOCLO for stage III/ refractory ORNJ by critically analysing the primary research and synthesising findings. Search/Key terms used: Pentoxifylline, Tocopherol, Clodronate, osteoradionecrosis, radiotherapy, head and neck cancer, mandible

Results: Data was analysed and synthesised using a 'narrative synthesis' (Ryan, 2013), a method that enabled arrangement of papers to be critiqued systematically. For stage III/refractory ORNJ, efficacy has demonstrated improved quality of life. Use of concurrent sequestrectomy where indicated demonstrated increased control of ORNJ whilst improving efficacy of PENTOCLO.

Conclusion: Off license prescribing of PENTOCLO is safe, well-tolerated and inexpensive for ORNJ and should be considered first line treatment.

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P079 The within-subjects reliability of fractional anisotropy (FA) in the cervical spinal cord of control participants

Hussein Al-shaari¹; Jonthan Fulford²; Christine Heales²; Marios Politis²

¹Exeter University and Najran University; ²Exeter University

Background: Diffusion tensor imaging(DTI) represents a promising technique for examining the cervical spinal cord (CSC) in vivo. Fractional anisotropy(FA) is a DTI metric which assesses directional characteristics of water proton diffusivity in tissues. It is affected by many factors including changes in water content and the presence of crossing fibres. Its values range from 0-1, where 0 reflects isotropic molecular water mobility and 1 anisotropic water diffusion.

Aim: The study purpose was to determine within-subjects reliability for measurements of FA in the healthy human cervical spinal cord.

Methods: A total of twenty healthy controls (10 male, mean age:33.93.5 years, 10 female mean age:47.514.4 years), with no family history of neurological disorders or contraindication(s) to MRI, were recruited over a two-month period. Each participant was scanned twice (3T MRI scanner - Siemens Prisma). Data were corrected for motion

artefact, then segmented and registered to a template. Metrics were then computed using Spinal Cord Toolbox(SCT). Single and average within-subject intra-class correlation coefficients(ICC) of FA were determined between the 2nd and 5th cervical vertebrae for the total WM and WM regions: dorsal column(DC), ventral column(VC) and lateral column(LC).

Results: FA showed poor to excellent within-subjects reliability. The single ICCs were 0.42, 0.43, 0.49, and 0.46 in WM, DC, VC and LC, respectively, and the average ICCs of FA were 0.59, 0.60, 0.66, and 0.63 in WM, DC, VC and LC, respectively.

Conclusion: Outcomes from this reliability study demonstrate that FA is a potentially useful quantitative biomarker in assessing CSC changes. However, reproducibility results indicate technical constraints.

P080 Within-subject variability evaluation, between two visits, for the mean diffusivity of the healthy cervical spinal cord

Hussein Al-shaari¹; Jonthan Fulford²; Christine Heales²; Marios Politis²

¹Exeter Universit and Najran University; ²Exeter University

Background: Diffusion tensor imaging(DTI) has been shown to be a promising technique for assessing the cervical spinal cord in vivo. It provides a broad indicator of tissue structure of axonal white matter. It is thought to be sensitive to evaluating damage within spinal cord tracts. It is therefore important to assess within-subject reliability.. Mean diffusivity(MD) is a DTI metric used to measure average diffusion independent of tissue orientation.

Aim: The purpose of this study was to determine the within-subject reliability of MD in the healthy human cervical spinal cord.

Methods: 20 healthy controls (10 male, mean age: 33.93.5 years, 10 female, mean age: 47.514.4 years) with no family history of neurological disorders or contraindication(s) to MRI were recruited over two months. Each participant was scanned using a 3T MRI scanner (Siemens, Prisma) on two different occasions. Data were corrected for motion artefacts, then segmented and registered to a template. Metrics were computed using Spinal Cord Toolbox(SCT). The within-subject coefficients of variation(CV) were measured between the 2nd and 5th cervical vertebra for the total white matter (WM), and sub-regions: dorsal column(DC), ventral column(VC), lateral column(LC)).

Results: MD showed relatively small variation with values for CV (group mean and range) of 4 (2-6), 4 (3-7), 9 (5-12) and 5 (3-7) in the WM, DC, VC, and LC ,respectively.

Conclusion: The CV provides useful information for future studies that intend to evaluate within-subject changes. The CV were different across SC regions and this regional variability should be considered when assessing MD in clinical patients.

P081

The reliability and measurement error of magnetization transfer imaging within the healthy cervical spinal cord

Hussein Al-shaari¹; Jonthan Fulford²; Christine Heales²; Marios Politis²

¹Exeter and Najran University; ²Exeter University

Background: Magnetization transfer imaging (MTI) is a quantitative approach that evaluates the interchange of bound and free water in tissue and generates a variable known as the magnetisation transfer ratio (MTR).

Aim: The purpose of this study was to evaluate the within-subject reliability and measurement error of the MTR measurement in the cervical spinal cord of healthy humans.

Methods: Over the course of two months, twenty healthy controls (10 males, mean age: 33.93.5 years, 10 females, mean age: 47.514.4 years) without a family history of neurological diseases or MRI contraindications were recruited. Each subject was scanned twice using typical MTI sequences on a 3T MRI scanner. Spinal Cord Toolbox (v5.3.0) was utilised for the post-processing of images. After segmenting and registering the data to the template, MTR was computed. Between the 2nd and 5th cervical vertebrae, the within-subject coefficients of variation (CV%), single and average within-subject intraclass correlation coefficients (ICC), and Bland-Altman (BA) plots were calculated for the total WM and for specific WM regions: dorsal column (DC), ventral column (VC), and lateral column (LC) (LC).

Results: MTR shown poor to excellent within-subjects reliability among the total WM, DC, VC, and LC with the

single/average ICC values of 0.03/0.06, 0.10/0.18, 0.39/0.75, and 0.001/0.002, while the CV% reported acceptable variation with values less than 10%. The (BA) plots demonstrated good intra-subject agreement between scan-rescan values.

Conclusion: This study suggests that clinical trials utilising the MTI approach are viable and illustrate that quantitative MTI may be used to track tissue changes in patients with degenerative WM.

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P082 Impact of planning target volume margins with different prescription isodose in gamma knife radiosurgery for brain metastasis: A phantom study

Emmanuel Fiagbedzi¹; Francis Hasford¹; Andrew Nisbet²; Samuel Nii Tagoe¹

¹University of Ghana; ²University College London

The impact of Planning target volume margins with the selection of different prescription isodose (PI) on plan quality has not been well evaluated during inverse planning on brain metastasis. A CT scan of the STEEV head anthropomorphic phantom was imported into the Leksell GAMMA PLAN Treatment Planning System. A target was centrally contoured together with organs at risk. A set of plans were made with Planning target volume margin of 0mm at five levels of PI from 50% to 70% at 5% increment. Identical plans were generated with four Planning target volume margins; 0.5mm, 1mm, 1.5mm and 2mm. Each plan was fine-tuned to ensure the same target coverage. The impact of the planning target volume margins on the quality metrics [S], [GI], V12, [PCI] and [Tt] was analyzed using a one-way ANOVA test. The selectivity, gradient index, V12, Paddicks index increases gradually with increasing PTV margin with prescription isodose but no significant difference with same PTV margin and different Prescription Isodose. The results revealed that the 2.0mm PTV margin had the highest mean value selectivity (M = 0.93), PCI (M = 0.92), GI (M = 2.50), V12 (M = 16.17) and treatment time (M = 118.32min). The 0.0mm PTV margin had the lowest value for all the indexes except for the treatment time (M=105.58min) which was a little higher compared to the 0.5mm PTV margin (M= 86.36min). PTV margins beyond the GTV(0mm) significantly impact plan quality indexes, normal brain sparing and should be avoided when treating brain metastasis on the Gamma Knife.

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P084 Phenytoin-induced calvarial hyperostosis: Bighead for a reason

Stavroula Theodorou¹; Daphne Theodorou²

¹University Hospital of Ioannina, Greece; ²General Hospital of Ioannina, Greece

Background: Although the effects of antiepileptic drug phenytoin on gingival growth have been studied, assessment of the effects on bone lags behind. With 1,5 million prescriptions/year, the adverse effects of phenytoin on bone need to be addressed because they can be seen more often affecting the burgeoning population of older persons and children.

Purpose: A 25-year-old woman with autism presented with skull injury after a fall. She had no focal neurologic deficits. The skull was enlarged and facial characteristics were coarse. Brain CT excluded subdural or subarachnoid haemorrhage/haematoma, bony injury, or hydrocephalus. Interestingly, there was massive expansion of the calvarium. The patient then reported long-term treatment with phenytoin for epilepsy. Prolonged administration of

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

Mekala Chandrasekaran¹; Rachel Barlow¹; Kilian Michel²; Laura Smith¹; Alexandros Papangelou¹; Nael Khater¹; Claire Birch¹

¹University Hospital Southampton NHS Foundation Trust; ²iRT Systems GmbH

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

Justin Cox; Katherine Haber

Barts and The London School of Medicine and Dentistry

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.