1. Boxwell, G. (2010). Neonatal intensive care nursing (2nd ed.). Oxon: Routledge.
2. Society and College of Radiographers. (2006). Healthcare associated infections (HCAIs): Practical guidance and advice. London: The Society of Radiographers.
3. World Health Organisation (WHO). (2017). First priorities: health care associated infections. http://www.who.int/patientsafety/implementation/apps/hai/en/.

P090 'Playing a part in the performance' of a child's X-ray procedure

Holly Saron[1]; Lucy Bray[1]; Bernie Carter[1]; Catherine Wilkinson[2]
[1]Edge Hill University; [2]Liverpool John Moores University

There is increasing evidence of children's engagement in health services. Less is known about children's experiences of X-ray procedures or the ways they communicate during the procedure. Data were generated through non-participant observations of children undergoing X-ray procedures. Children and their parents were invited after the procedure to take part in a semi-structured interview. Children, parents and radiographers played specific parts during the X-ray procedures and this influenced communication. Three different categories of communication were developed but are not presented as a hierarchy of the communication children preferred. The first category was communication where a child was involved; children's voices were sought with the expectation that they could influence what happened during the procedure. The second category was communication where a child was interrupted; children's voices were replaced because of the bigger roles adults played. The third category was communication where a child was ignored; children's voices were overlooked, silenced or not sought by adults. Children in these procedures had a small role and little power to influence what happened during their procedure. The findings have been discussed using dramaturgical metaphors of roles, scripts and front and backstage performances that unified the three developed categories and lead to the theorisation of a core category of 'Playing a Part in the Performance'. Children are able and value being engaged in meaningful communication during their X-ray. Different roles and interactions can close down or open up children's opportunity and ability to play an active role in their procedure.

ARTIFICIAL INTELLIGENCE / IMAGING TECHNOLOGIES

P091 A review of the current and future use of artificial intelligence (AI) in diagnostic radiology

Ghazn Khan[1]; John Howells[2]
[1]University of Manchester; [2]Lancashire Teaching Hospitals NHS Foundation Trust

Background: AI is on the forefront of health innovation, especially in radiology. The development of deep learning models such as convolutional networks has enabled programmers to design systems that are able to complete many radiological based tasks e.g. image analysis and segmentation.
Purpose: The aim of this poster is to; introduce AI and the underpinning principles and ideas, review the current AI developments taking place within chest and breast imaging , and understand the potential benefits, risks and limitations associated with the implementation of AI into clinical radiology.
Summary: We present a literature review of the different uses of AI within chest and breast imaging. Furthermore, we define the key terms of associated with AI; machine learning, deep learning and convolutional neural networks. We also illustrate the current issues surrounding AI and its application. Within chest imaging, AI programmes have been designed that detect diseases such as tuberculosis and pneumonia. In breast imaging, deep learning programmes have been developed that can aid in breast cancer screening and diagnosis. The main imitation surrounding AI research and development is the lack of number and quality of training datasets. It is important for radiologists to adapt and benefit from using AI; this is achieved through understanding and appreciating the theory and its application. Additionally, a standardised set of guidelines needs to be developed to validate and assess the effectiveness and safety of AI. The next step for advancement is the integration of AI systems into the clinical workflow.

P092 Evaluating the stability of PET radiomic features to expectation-maximization reconstruction iterations

Emad Alsyed[1]; Rhodri Smith[2]; Stephen Paisey[2]; Philip Whybra[1]; Emiliano Spezi[1]; Concetta Piazzese[1]; Christopher Marshall[2]
[1]School of Engineering, Cardiff University; [2]Wales Research & Diagnostic PET Imaging Centre

Background: Positron emission tomography (PET) imaging plays a fundamental role in the assessment of cancer[1]. The maximum likelihood expectation maximization (MLEM) algorithm is a common iterative image reconstruction approach used in clinical routine. Increasing the number of iterations can increase image sharpness. However, a trade-off exists between image sharpness and image noise [2]. Therefore, radiomic analysis may be affected as consequence of increasing the number of iterations [3].
Purpose: To evaluate the impact of the number of iterations upon stability of PET radiomic features.
Methods: A Mediso Nanoscan PET/CT was used to scan 8 mice, with 4T1 tumours, injected with 10.0 ± 2.0 MBq. Scans were reconstructed with five different numbers of iteration (1, 3, 6, 8, 10) and SPAARC (In-house developed tool built on Matlab[4]) was utilised to extract 138 radiomic features (bins=32) [5]. Coefficient of variation (COV) was calculated for each feature for each number of EM reconstruction iterations. Features were classified based on their COV values into four groups [6].

Results: Of the 138 radiomic features, 63 showed large variation (COV > 20%), 29 showed intermediate variation (10%-20%), 15 showed small variation (5%-10%) and 31 were found to be stable (COV < 5%). **Conclusions:** The number of iterations has the greatest impact on NGTDM features. This highlights the need for radiomics studies to utilise protocols with defined methods of reconstruction to ensure consistency. A model that makes use of features sensitive to EM reconstruction iterations may struggle to generalise.

1. M. E. Juweid and B. D. Cheson, "Positron-emission tomography and assessment of cancer therapy," N. Engl. J. Med., vol. 354, no. 5, pp. 496-507, 2006.
2. D. R. Gilland, B. M. W. Tsui, C. E. Metz, R. J. Jaszczak, and J. R. Perry, "An evaluation of maximum likelihood-expectation maximization reconstruction for SPECT by ROC analysis," J. Nucl. Med., vol. 33, no. 3, pp. 451-457, 1992.
3. G. J. R. Cook, M. Siddique, B. P. Taylor, C. Yip, S. Chicklore, and V. Goh, "Radiomics in PET : principles and applications," Neuroimage, pp. 269-276, 2014.
4. Sci Rep. 2019 Jul 4;9(1):9649. doi: 10.1038/s41598-019-46030-0. Assessing radiomic feature robustness to interpolation in 18F-FDG PET imaging. Whybra P, Parkinson C, Foley K, Staffurth J, Spezi E.
5. Zwanenburg, A., Leger, S., Vallières, M., Löck, S. & Initiative, for the I. B. S. Image biomarker standardisation initiative. arXiv:1612.07003 (2016)
6. I. Shiri, A. Rahmim, P. Ghaffarian, P. Geramifar, H. Abdollahi, and A. Bitarafan-Rajabi, "The impact of image reconstruction settings on 18F-FDG PET radiomic features: multi-scanner phantom and patient studies," Eur. Radiol., vol. 27, no. 11, pp. 4498-4509, 2017.

P093 Artificial intelligence in radiology – How medical students perceive it?

Upsana Topiwala[1]; Siddharth Thaker[2]; Rajesh Botchu[3]
[1]University of Birmingham Medical School; [2]Kettering General Hospital; [3]Royal Orthopaedic Hospital

There has been lot of hype and excitement of artificial intelligence (AI) in medical imaging. Potentially, AI will be an integral component of radiology in future. We performed a survey of medical students to ascertain the effect of AI perceived by them. A survey was created on survey monkey, sent to over 100 medical students in the UK and India and the results were analysed. The questions included role of AI in reporting X-rays, CT, MRI, and its effect on choosing specialty in future. Amongst medial students completed the survey, majority, 65 (65.66%) agreed that AI is going to play a crucial role in radiology and 29 (29.29%) were unsure about the impact of AI; whereas only 5 (5.05%) believed that AI will not impact radiology services in future. About of a quarter of respondents were of the opinion that AI will report x-rays, CT and MRI. Around 50% of respondents were equivocal with a view that AI might report studies. About half (46%) of the medical students felt that AI is crucial factor in deciding specialty, with 45% of the opinion that there will be less doctors in future. Based on the results, we feel that AI, inevitably, is going to be integral part of future hospitals and radiology services and should be embraced. Medical students should be primed of this, possibly by including into the curriculum.

P094 Using AI to reduce dose in CT thorax, abdomen & pelvis scans

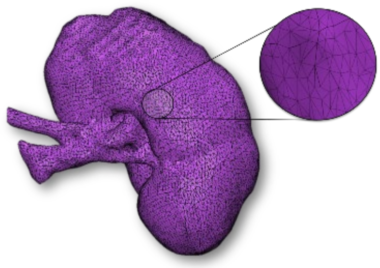
Christopher McLeavy; Rachel Gravell; Mohamed Chunara; Richard Hawkins
Leighton Hospital

Background: We know AI can streamline workflow and detect subtle lesions but did you know it can also reduce the dose of CT scans? Canon have developed a deep-learning algorithm called Advanced intelligent Clear-IQ Engine (AiCE) which they claim can provide 31% dose reductions in body imaging whilst still maintaining spatial resolution, "natural" appearing images and low contrast resolution. Unlike model-based iterative reconstruction, which took too long for use in everyday practice, AiCE uses supercomputers to ensure images are produced in a timely manner. Having recently purchased a Canon Aquilion One Genesis with AiCE we have been impressed with the image quality and put the dose reduction claims to the test on CT Thorax, Abdomen & Pelvis scans against our other scanners and the national Diagnostic Reference Limit (DRL) of 1000 mGy cm.
Method: The first 100 CT Thorax, Abdomen & Pelvis scans acquired using AiCE in September 2019 were selected. The Dose Length Product (DLP) for that scan was measured and the patient's most recent prior scan acquired on a different scanner.
Results: The mean DLP for scans performed using AiCE was 316.4 mGy cm (range 93.6 -- 998.7; n=100) whereas on all others the mean DLP was 719.2 mGy cm (range 117.6 -- 3006.5; n=58). The mean dose reduction was 51.3% (range 12.2 -- 82.0%) meaning scans were on average 68% less than the national DRL.
Conclusion: AiCE reconstruction can provide dose reductions of up to 82% and are on average 68% less than the national DRL.

P095 **3D Printing: A guide for trainees in the field of radiology – Everything you wanted to know, but were too afraid to ask!**

Philip Touska[1]; Nick Byrne[2]
[1]Guy's and St Thomas' NHS Foundation Trust; [2]King's College London

3D printing is an exciting technology that has multiple, rapidly-evolving applications in medicine. As many of these applications rely on imaging data from CT and MR scanning, professionals working in the field of radiology are uniquely placed to assist with and lead 3D printing projects. However, the process and terminology is often not well understood. This educational poster seeks to illustrate the rationale and basic processes behind 3D printing in medicine. In particular, it summarises the principle current applications of medical 3D printing pertaining to radiology and follows the steps required to create a 3D model from medical imaging data (typically encoded in Digital Imaging and Communications in Medicine (DICOM) format). The poster also describes different segmentation and printing techniques, facilitating an understanding of relevant terminology. Ultimately, we hope that the resource will prove useful to professionals and trainees working in all radiological disciplines and encourage engagement in collaborative projects.



Mitsouras D, Liacouras P, Imanzadeh A, Giannopoulos AA, Cai T, Kumamaru KK, George E, Wake N, Caterson EJ, Pomahac B, Ho VB, Grant GT, Rybicki FJ. Medical 3D Printing for the Radiologist. Radiographics. 2015 Nov-Dec;35(7):1965-88.
Marro A, Bandukwala T, Mak W. Three-Dimensional Printing and Medical Imaging: A Review of the Methods and Applications. Curr Probl Diagn Radiol. 2016 Jan-Feb;45(1):2-9.

P096 **Quantification assessment of bone healing: A feasibility study into the use of CT to assess the progression of fracture healing**

Patrice Burke
Nottingham University Hospitals NHS Trust

Background: Fractures are serious injuries, causing morbidity and mortality if not managed appropriately. There is no consensus about the optimum method for assessing fracture union, nor are there clear gold standards for parameters that confirm early fracture healing radiographically. The use of CT scans is recommended for assessment of fracture healing in trials, as they reveal healing markers much earlier than plain X-rays. To our knowledge, CT scanning has not been used for quantitative assessment of normal fracture healing progression, which is the aim of this work.

Method: Ten patients who had suffered a Weber Type B (ankle) fracture underwent ankle CT scan every two weeks for 13 weeks. Each patient's 7 scans were co-registered, and five ROIs along the fracture line were identified. In each region, trabecular bone, cortical bone and callus were segmented, and the variations of the contents over time were compared quantitatively, based on CT number. The 70 images were also presented blind in random order to two trained, experienced raters who scored them against agreed criteria.

Results: Quantitative assessment of the changes in CT number of the trabecular bone and callus regions showed evidence of healing; this was in good agreement with the scores of the raters (Cronbach's alpha scores of 0.804 and 0.874 for overall scores). (Further results to follow.)

Conclusion: This feasibility study shows the potential to use CT images to quantify the process of fracture healing. This could be used in the future to inform clinical management, but further research is warranted.

P097 **Voice recognition errors: Categorisation, frequency, and how to avoid them**

Mahdi Saleh; David Gendy; Priya Healey
The Royal Liverpool University Hospital

Background: Voice recognition technology has been used in radiology reporting as early as the 1980s. Initially, voice recognition aimed to reduce turnaround times and increase the efficiency of radiology reporting. However, it has been shown that reports formulated with voice recognition can have significantly higher levels of inaccuracy when compared to the more traditional method of dictation[1,2]. In an era where voice recognition is becoming part of everyday practice, the potential impact an error may have on the interpretation of a report can have significant consequences on patient management. Currently, there is a paucity of literature on the types of errors made, the circumstances in which they occur and a structured approach on how to avoid them.

Purpose: To classify the types of errors commonly made by radiologists, the circumstances in which they may potentially occur, and to develop a systematic approach that every radiologist can use to avoid making them.

Summary: This educational poster is based on 200 consecutive CT radiology reports divided equally between reports made during the day and during out of hours reporting. The data collected included the body part scanned, total number of errors per report, grade of reporting radiologist, and the length of the report. The data was then used to divide the errors into minor, moderate, and major categories. Based on the classification and data obtained, a systematic approach was designed to aid radiologists in reducing the chance of making an error when using voice recognition software.

1. Chang CA, Strahan R, Jolley D. (2011) Non-clinical errors using voice recognition dictation software for radiology reports: a retrospective audit. J Digit Imaging. 24(4):724-8.
2. Du Toit J, Hattingh R, Pitcher R. (2015) The accuracy of radiology speech recognition reports in a multilingual South African teaching hospital. BMC Med Imaging. 4;15:8.

P098 Stroke detection by scanning with low intensity radio frequencies

David Heatley; Mohamed Abdel-Maguid
University of Suffolk

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

1. The Stroke Association. (2018) State of the Nation – Stroke Statistics. stroke.org.uk.

DOSE OPTIMISATION AND MEASUREMENT

P099 Optimisation and implementation of size-specific pelvic CBCT

Megan Couper; Kirsty Farnan; Kirsty Muir
NHS Tayside

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

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

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

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

1. Department of Health (2017). *The Ionising Radiation (Medical Exposure) Regulations 2017.* London: The Stationery Office.
2. Wood, T.J., Moore, C.S., Saunderson, J.R. and Beavis, A.W. (2015). Validation of a technique for estimating organ doses for kilovoltage cone-beam CT of the prostate using the PCXMC 2.0 patient dose calculator. *Journal of Radiological Protection*. 35(1):153-63.

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

Gourav Kumar Jain[1]; Arun Chougule[2]; Rajni Verma[2]; Swati Kumari[1]
[1]Shalby Multi Speciality Hospital, Jaipur, India; [2]SMS Medical College and Hospital, Jaipur, India

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