

DRAFT CONFERENCE PROCEEDINGS



INVITED PRESENTATIONS

Hutchinson Lecture

Prof Patrick Brannan

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41 years ago, I stepped into radiography under the immense stewardship of one of radiography's gurus Ms. Sybil Stockley. Since that time, Radiography has taken me across 5 continents and had an immeasurable influence on my family and me and we are eternally grateful. For a very large part of that journey, I have been involved in research to the point where through observations of incredible individuals and personal experience I have identified 6 maxims I feel are important to make change: change that is not necessarily measured by numbers of publications, invited book chapters or Facebook posts, but instead by the effect we have on people. This is not a blueprint for everyone; but rather a rambling through anecdotes culminating in conclusions that were important to me and maybe of some value to others.

Artificial Intelligence in Medical Imaging: Diagnosis and Beyond

Prof Jing Cai

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Artificial Intelligence (AI) is evolving rapidly and promises to transform the field of medical imaging and diagnosis in an unprecedented way. The tremendous possibilities that AI can bring to precision medicine have triggered a flood of activities in the field. Particularly, with the support of big data and accelerated computation, deep learning is taking off with tremendous algorithmic innovations and powerful neural

network models. AI technology has great promises in improving medical imaging diagnosis from early detection to precise assessment. It can aid radiologists in reaching unbiased consensus imaging, update practitioners, reduce professional costs, and improve quality assurance in clinical trials and patient care. Given the promising learning tools and massive computational resources that are becoming readily available, AI will dramatically change the landscape of medical diagnosis research and practice soon. This presentation will give a glance of some recent advances in AI for precision diagnosis, together with some thoughts generated and lessons learnt from related research.

Pancreatic Cancer Research from the Perspective of the RTT

Dr Aileen Duffton

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Pancreatic cancer has the lowest one-year survival of any cancer in the UK. This illustrates the poor outlook suffered by patients and recognises it as a cancer of unmet need that requires further investigation. Pancreatic cancer is a global problem and according to worldwide cancer statistics, it is the 7th top cause of cancer death. This presentation will cover a general background of ongoing pancreatic research to first highlight the bigger picture, before focussing on the current landscape of radiotherapy (RT) research for pancreatic cancer. This will be from a RTT perspective and will include a detailed case study of building a research career that investigates the many challenges of treating these patients. RT challenges include abdominal motion that causes many uncertainties throughout the full RT pathway and impacts image quality at each stage. Topics to be discussed will be accuracy and precision of treatment planning and delivery, acquisition of high-quality images with image guided-RT (IGRT), dealing with dose-limiting organs at risk, and determining response using advanced functional imaging protocols. The discussed issues require multi-disciplinary strategies to overcome them.

Optimizing CT Protocols: Advanced Dose Reduction and Contrast Media Strategies for Personalized Patient Care – Today's Innovations and Tomorrow's Horizons

Mr Euthimios Tim Agadakos

International Society of Radiographers and Radiological Technologists, London, United Kingdom

The rapid advancement of Computed Tomography (CT) imaging technology offers unprecedented opportunities to enhance diagnostic precision and patient safety. However, it also imposes a significant responsibility on radiographers and medical imaging professionals to stay abreast of evolving best practices for dose optimization, contrast media (CM) administration, and the integration of emerging technologies. This presentation seeks to provide a holistic overview of current innovations and future directions in CT imaging, focusing on personalized patient care.

Scope: The scope of this presentation encompasses a detailed examination of dose optimization techniques and CM administration strategies within the context of current and forthcoming CT technology. It addresses the critical balance between ensuring diagnostic efficacy and minimizing patient exposure to ionizing radiation and contrast media-related risks. Furthermore, the presentation extends into the promising potential of emerging technologies, including artificial intelligence (AI) and dual-energy CT, illustrating their role in refining and personalizing diagnostic protocols.

Aim: The primary aim of this presentation is to equip radiographers and imaging professionals with a deep understanding of the principles and practical applications of dose optimization and safe CM administration in CT imaging. It endeavors to provide a comprehensive overview of the methodologies and technological innovations that can be employed to tailor imaging protocols to individual patient profiles, thereby enhancing both the safety and efficacy of diagnostic procedures. Additionally, the presentation aims to foster a forward-looking perspective among attendees, encouraging the adoption of emerging technologies and practices that promise to redefine the standards of patient-centered care in medical imaging.

1. **Diagnostic Reference Levels (DRLs) and Dose Optimization:** Participants will explore the concept of DRLs, their establishment, and utilization as a cornerstone for dose optimization. The session will highlight the importance of DRLs in monitoring and improving radiation safety, underscoring the need for regular updates and adherence to best practices.
2. **Contrast Media Administration Strategies:** This section delves into strategies for minimizing iodine dose in contrast-enhanced CT imaging. By reviewing recent advancements and case studies, attendees will learn about reducing CM-related risks without compromising diagnostic quality, emphasizing patient-specific considerations in CM protocol selection.
3. **Emerging Technologies in CT Imaging:** The presentation will introduce participants to cutting-edge technologies reshaping CT imaging. Focus areas include dual-energy CT, iterative reconstruction algorithms, and the integration of AI and ML in optimizing imaging protocols. This segment aims to demonstrate how these technologies can support personalized care and dose optimization.
4. **Future Directions in CT Imaging:** Looking ahead, the presentation will discuss the potential of novel developments, such as photon-counting CT and iodine-free contrast agents, to further enhance patient safety and diagnostic accuracy. Attendees will gain insights into how ongoing research and technological advancements are poised to influence the future of CT imaging.

Particle therapy -from protons to carbons and neutrons

Dr Hirokazu Makishima

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Particle therapy, from proton beam therapy (PBT) to heavier ions as in carbon ion radiotherapy (C-ion RT), and thermal/exothermal neutrons also known as neutron capture therapy or boron neutron capture therapy (BNCT) possess distinct characteristics compared to photons both physically and biologically, providing a cure to the incurable. Chordomas have become a manageable disease eliminating the risk of dissemination; liver cancer patients with vascular invasion now can still have hope in their prognosis; locally recurrent rectal cancer patients can now sit up straight whilst controlling their disease; even glioblastomas may be cured. While the list can go on for quite a bit and the benefits of particle therapy over conventional photon radiotherapy are overwhelming, it is equally important to understand its limits and shortcomings. This will lead not only to a safer treatment but also to maximize the impact of particle therapy.

The concept of PBT or using charged particles as a form of cancer treatment has been around since the mid-1940s which is not so later than the discovery of X-ray by Roentgen in 1895. Clinical application started in 1954, but without CT scanners, only selected disease sites were applicable. It was not until the 80s when the University of Tsukuba started treatment that it became full-fledged with CT-based range calculations and respiratory gating. The biggest advantage of PBT over photon RT is the distinctive dose distribution known as the Bragg Peak. Due to this physical characteristic, it became possible to treat tumours that reside within radiosensitive risk organs. While early models only had fixed

beam ports resembling ports for basic physics experiments, current facilities possess rotating gantries, enabling more versatile treatments with less patient stress. Alongside with biological characteristics being rather close to high energy photons making it possible to use photon experience and knowledge, the use of PBT has expanded exponentially these 20 years with over 300,000 patients treated at over 100 facilities across the globe.

C-ion RT is another form of particle therapy, just using carbon ions instead of protons. The difference is in a slightly but noticeable better dose distribution and different biological characteristics. C-ion beams being a high linear energy transfer (LET) beam, it possesses a higher “biological effect” compared to low LET beams such as photons and protons. While physical and biological benefits are clear, due to the higher installation costs, the number of C-ion facilities is still small with 14 globally, half of it in Japan. But with newer technology, C-ion RT has become not only more precise and safer but even cheaper, opening doors to a more widespread implementation with 5 more facilities under construction.

BNCT is something totally different from other particle therapy that use charged particle beams. While the actual cell damage is done by alpha particles and lithium ions, which obviously has a very high LET, the delivery of it is done using drugs and low-energy neutrons to excite it. Non-radioactive boron-10 in the form of p-boronophenylalanine (BPA) or sodium borocaptate, captures low energy neutrons and leads to the production of an alpha particle and a recoiling lithium-7. Both particles have a very short path with the longer alpha particle being 10 μm . By concentrating the boron distribution to tumour cells, theoretically, it can selectively kill tumour cells only. With nuclear reactors being the sole efficient source of low neutrons, such as thermal and exo-thermal neutrons, it was very challenging to implement this potentially game-changing technology, though that has now been overcome with new accelerator-based neutron sources.

While all these new technologies have shed hope to those without, it does come with difficulties and shortcomings yet to be addressed. One of the most critical factors of charged particles is the range. While the bragg peak enables us to realise the distinctive dose distribution, it brings in another parameter or uncertainty leading to new errors. Another challenge for C-ion RT is the biological model. While multiple models exist, it is not “cobalt Gray equivalent” dose, presenting a challenge in clinical application, and moreover alignment between different models. BNCT being the newest of the three has even more challenges from drug delivery to dose estimation, even dose calculation of neutron flux itself is still under development.

Understanding not just the strong potential of particle therapy but also its shortcomings is critical in providing these cutting-edge treatments safely and efficiently. Therefore continuous education of all staff in the facility is key to the success of particle therapy.

Application of Artificial Intelligence in Neck Ultrasound in the Era of Precision Medicine

Prof Michael Tin Cheung Ying

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The importance of artificial intelligence (AI) in medical healthcare is increasingly becoming apparent. There is a rapid growth of scientific research in medical AI in the past years, from 1,623 studies in 2012 to 29,947 studies in 2021, and many of these studies are related to radiology. By 2023, the FDA has approved 700 AI healthcare algorithms and 527 (75.3%) are in radiology. In AI-empowered radiology, the application of AI in ultrasound imaging is emerging which includes ultrasound of liver, breast, thyroid gland, lymph node, etc. Ultrasound is commonly used for the evaluation of head and neck masses. In

patients with thyroid nodules, ultrasound is used for the differentiation of benign and malignant nodules, and guiding fine-needle aspiration. Ultrasound is also a common imaging modality to assess neck lymph nodes in head and neck cancer patients. Various AI-empowered and computer-assisted diagnostic tools for ultrasound examination of thyroid nodules are available. AI-based algorithms for lymph node segmentation and classification in ultrasound images are emerging. They help clinicians improve diagnostic accuracy and guide patient management. In this talk, different AI-empowered diagnostic tools for thyroid and lymph node ultrasound imaging will be introduced and discussed.

AI in Paediatric Radiology

Dr Curtise K. C. Ng

Curtin University, Perth, Australia

Use of AI has become popular in radiology for improving service efficiency and quality. Currently, there are 366 United States (US) Food and Drug Administration (FDA)-approved radiology AI products for potential use in routine clinical practice. Apparently, some of these products would be useful for its subspecialty, paediatric radiology to address the long-standing problem of paediatric radiologist shortage as well as other issues such as radiation risk, and sedation and anaesthesia use. However, great differences exist between adult and paediatric radiology because of age-dependant changes of anatomy and physiology leading to variations of image acquisition settings and diagnostic processes. Hence, AI products suitable for paediatric radiology have been developed. The purpose of this keynote presentation is to explore current opportunities, challenges and way forward for clinical use of AI in paediatric radiology.

As yet, 13 commercial AI products have been approved by FDA for paediatric radiology use, i.e. 3.6% of the total number of FDA-approved radiology AI products. Around a quarter of these (3 out of 13) are developed for computer aided detection / diagnosis of fractures and dental diseases such as caries and calculi based on general and dental x-ray images. Although FDA has determined the other 10 products as medical image management and processing systems (MIMPS), about half (6) can assist paediatric radiologists in making diagnoses faster through automatic segmentation and quantification of body structures such as urinary bladder, hip, cardiac chamber, brain, liver, and jawbone in pelvis and hip ultrasound, cardiac, brain and liver magnetic resonance imaging (MRI), and dental x-ray, respectively. Hence, the majority of these products can address the paediatric radiologist shortage issue to some extent by increasing clinician efficiency and productivity while the others (except one designed for lumbar spine surgical outcome prediction) would be useful to alleviate the traditional burdens of paediatric radiology such as x-ray and computed tomography radiation dose, and sedation and anaesthesia use in MRI due to long examination time.

Nonetheless, the application areas of these existing FDA-approved products appear limited and only cover certain types of paediatric examinations and diseases. According to recent literature reviews, there are lots of potential AI applications for improving paediatric radiology service efficiency and quality such as image translation, quality assessment, acquisition setting selection and labelling for routing, billing and hanging protocol management, robotic assistance in guidewire insertion, computer assisted triage and notification, natural language processing for highlighting significant findings in reports, literature search / expert seeking for diagnosis support, trainee education and chatbot for responding to patient questions but none of them have become commercially available. Also, more than one-third (5) of the FDA-approved paediatric radiology products do not have any disclosures of their performance evaluation details, e.g. number of clinical cases and readers involved, patient demographics, etc., and only two have been involved in the American College of Radiology Transparent-

AI program with their model training and evaluation arrangements disclosed in more detail. For those products which have their model evaluation information, it is concerning that some of their evaluation approaches seem not appropriate or robust. For example, the aforementioned bladder segmentation and quantification product has only been evaluated based on 122 ultrasound cases of adult patients (age range: 18-90 years) despite a lack of generalisability being a well-known problem of AI.

Although mixed results are noted in previous studies about applying adult radiology AI products to children, clinical centres are encouraged to evaluate feasibility of using adult radiology AI products in their own paediatric radiology practice when such AI applications unavailable for this subspecialty. This is because even for products intended for paediatric radiology use, the clinical centres should conduct their own evaluation to ensure these products being safe and effective for their patients to avoid any potential medico-legal issues. Given that the paediatric radiology AI is an underdeveloped area which has potentials to address its long-standing issues including the clinician shortage, radiation, and sedation and anaesthesia burdens, more financial incentives and research grants from governments and other funding bodies should be provided to manufacturers, researchers and clinicians for the paediatric radiology AI product development, evaluation and adoption. Otherwise, potential advantages of AI cannot be widely realised in paediatric clinical practice, subsequently, affecting this vulnerable patient group and resulting in health equity issue.

Radiographers Role in Quality and Safety in Diagnostic Radiology and Nuclear Medicine: IAEA Vision

Dr Olivier Pellet

International Atomic Energy Agency, Vienna, Austria

This presentation investigates the pivotal role of radiographers in upholding quality and safety standards for patients undergoing diagnostic radiology and nuclear medicine procedures, from the perspective of the International Atomic Energy Agency (IAEA). It delves into the effective implementation of Quality Management Systems (QMS) and underscores the indispensable contributions of radiographers within these frameworks. Emphasizing their significance, the discussion highlights how radiographers optimize imaging techniques, mitigate radiation exposure, and elevate overall patient care standards. Furthermore, the speaker will shed light on the IAEA's proactive measures and endeavors aimed at advancing quality and safety protocols in these medical disciplines. Specifically, attention will be drawn to IAEA's clinical audit programs such as QUAADRIL (Quality Assurance Audit for Diagnostic Radiology Improvement and Learning) and QUANUM (Quality Management Audits in Nuclear Medicine Practices), designed to enhance professional practices and ensure optimal patient outcomes.

Enhancing Patient Experience in CT Imaging

Mr Mike Wing Tak Lai

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Cardiac CT is the most complicated procedure for CT imaging and Paediatric cardiac CT is even more challenging due to the nature of the patients who may not able to obey the command and keep still during the whole examination procedure. Several challenges for Paediatric cardiac CT includes: The timing of blood flow may be different significantly for patients even with similar body size; wide range of pathology and congenital anomalies for paediatrics and most important of all is the size and body weight of the patient may pose a limitation on the rate and dose of contrast that can be delivered during the

cardiac CT examination. In 2019, Hong Kong Children's Hospital commenced the CT services for Paediatric cardiac patients. Through the collaboration of Radiographers and Radiologists, we have developed a set of protocols to optimize the radiation dose, contrast dose and examination routines for our Paediatric patients with different body size and clinical conditions. This presentation aims at providing a holistic approach for Paediatric CT imaging with an in house developed theory to optimize the contrast injection rate and dosage as well as optimizing the use of kVp for imaging to achieve maximum contrast enhancement with reduction of radiation dosage to the patient.

Applications of Radiomics for Next-Generation Oncologic Management – Current Trend, Challenges and Future Prospects

Dr Edmond Sai Kit Lam

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The rapid advancements of AI and computational technologies have tremendously driven the soaring demand for personalized medicine, particularly in the field of oncology. The contemporary “-Omics” era encompasses genomics, proteomics, metabolomics, etc., which have made dominant and immense impacts on personalized healthcare delivery for the past couple decades, while an aborning concept of radiomics has been introduced since a decade ago, which involves a high-throughput extraction of quantitative, standardized, and voxel-based imaging features, including but not limited to tissue morphology, first-order statistics and spatial-related heterogeneity/texture, from radiographic images. Neoplasms are intrinsically heterogeneous and contain multiple sub-clusters of cancer subpopulations; therefore, imaging textures representing clusters of adjacent imaging voxels can be grouped together to derive metrics for tumor subpopulations or habitats that are more representative and objective in reflecting intra-tumoral heterogeneity.

Over the past decade, mounting evidence has demonstrated the superiority of radiomics over conventional qualitative radiologic, histopathologic and clinical attributes from virtual biopsy, cancer staging, cancer histological classification, cancer prognostication, disease differentiation (e.g., pseudo-progression vs cancer recurrence), radiation-induced toxicity prediction, identification of patients who may be reluctant to neo-adjuvant chemotherapy and immunotherapy, etc. Furthermore, the term “delta-radiomics” has emerged as to reflect the dynamic temporal changes in radiomic features, that may capture treatment response or cancer progression patterns that would otherwise not be measurable using current practice. The predictive power of delta-radiomics has been demonstrated to outperform radiomic features from static images. Apart from this, a growing amount of research has illustrated certain radiomic features have been highly correlated with existing genomic markers along with expression of various microRNA signature associated with tumor response to treatment perturbations, cancer metastatic spread, and prognosis; integrating both radiomics and genomics have paved the way toward the nascent area of “radio-genomics” within the community. Moreover, there are also growing number of research on sub-regional radiomics, reporting that peri-tumoral radiomics yielded a greater predictive power than tumor-core radiomics in identifying at-risk patients of post-treatment cancer metastases. There are lot more exciting and innovative radiomics research in the current body of literature. Without doubt, radiomics offers immense and tantalizing potential to serve as a supplementary technique to the existing methods, and to revolutionize cancer management toward personalized oncologic care delivery.

Notwithstanding, there exist several caveats of radiomics, which if addressed, will gain further confidence and trust from clinical practitioners towards model bench-to bedside translation. Key stumbling blocks include the lack of standardized radiomic workflow and clear reporting of study

methodologies, radiomic feature reproducibility across image acquisition protocols or scanner vendors, tumor delineation, etc., lack of large-cohort data for effective model development and external cohort for model external validation (partly due to the practical concern of patient privacy protection), the common circumstances of highly imbalanced data in the field of oncology, challenges in maximizing the harvest of complementary predictive features between various -omics data and/or radiomics features from different imaging modalities/sequences; whether or not the model is explainable, whether or not the accuracy of the radiomic predictors can be generalized to tumors in extreme sizes, recurrent lesions, patients with multiple metastasis, etc.

To this end, the research community has been inventing solutions to the above challenges. For instance, several guidelines for standardized radiomic features extraction, checklists for reporting in radiomics study, radiomic quality scores for assessing the study design of radiomics research. Besides, several radiomic feature reproducibility assessment approaches have been developed and advocated recently for safeguarding model generalizability in unseen populations. Also, an emerging strategy called federated learning, which aims to get rid of the concern of patient privacy disclosure during model development, has been reported in recent years. Various data imbalanced adjustment frameworks as well as sophisticated techniques for multi-omics / multi-view fusion have been developed and reported in the literature.

To conclude, radiomics is playing an influential role as part of next-generation oncologic management. Although it is still in its infant stage in history, tremendous and concerted efforts have been constantly made to revolutionize the role of radiomics in personalized oncology. The developmental pathway and potential of genomics can be an analogy to those of radiomics, with a confident hope that radiomics can eventually assist in routine clinical decision-making in oncology, and it is highly anticipated that the synergistic power of radio-genomics will ultimately generate game-changing impacts in the long run. Nevertheless, it is highly imperative to first create clinical awareness of the concepts of radiomics, hence driving further translational research and clinical trials. Like any other inventions, maturity comes with time, experience, and creativity from eminence worldwide. Global solidarity is the key to success!

The Changing landscape of Medical Imaging: are we ready?

Prof Jenny Sim

Monash University, Melbourne, Australia

Radiographers serving in the frontline in Medical Imaging have remained unchallenged for decades. Our role is reinforced again with the recent Covid-19 pandemic, where radiographers were at the forefront; assuming a critical role in the early detection, monitoring and clinical management of the disease. However, the rapid advancement of technology has now seen Medical Imaging creeping into other allied health care services. With the changing landscape of Medical Imaging, where are radiographers in the shifting topography of technological advancement? How should we respond to this wave of changes confronting our profession? This presentation explores the challenges and examines how radiographers, rooted in the practice of personalised care, can prepare to meet these technology disruptions and continue to be the champions and advocates for our patients.

Current Status of Personalized Care in Radiotherapy

Dr Yat Man Tsang

Princess Margaret Cancer Centre, Toronto, Canada

There have been constant changes and progressive developments in the technology used for the planning and delivery of radiotherapy, especially with the utilisation of artificial intelligence (AI) and telemedicine in cancer diagnosis/treatments/outcomes. Advancements in medical technology and a growing understanding of individual patient characteristics have facilitated a paradigm shift towards personalized care in radiotherapy. With the ever-increasing complexity of the radiotherapy patient pathway and limited healthcare resources, we, as healthcare professionals within radiation oncology, are obliged to respond to these ongoing advances efficiently through various resource optimization initiatives with a patient-centered personalised care focus. The radiotherapy workflows and models of care should be continuously evolved with an emphasis on high-quality communications/interactions between patients and clinicians/radiation therapists, in order to support the consistent engagement of patients and their families at each stage of their cancer care journey. Against this background, this presentation will include the following:

- Complexity of radiation therapy pathways and the importance of patient-centered personalised care
- Current landscape of personalized approaches in radiotherapy, encompassing the integration of advanced imaging modalities and patient-specific factors
- Existing challenges on radiation therapy resources and workforce supply
- Examples of innovative model of care such as case expert model and radiation therapist advanced practice with the focus personalised care in radiotherapy
- A glimpse into the future – how should we move forward as a multi-professional group for patient-centered personalised care optimisation.

HEROCARE: Advancing Paediatric Radiotherapy and Education through Innovative Care Models

Dr Shara Wee-ye Lee

The Hong Kong Polytechnic University, Hong Kong, Hong Kong

Background: The need for innovative paediatric cancer care models that minimise the reliance on anaesthesia and sedation during treatment has never been more critical. The HEROCARE (Holistic Empowerment in Radiation Oncology) project, developed at the Hong Kong Polytechnic University, pioneers an advanced framework that emphasises personalised preparations and experiential learning for patients, undergraduate radiography students and healthcare providers, particularly radiation therapists.

Objective: This presentation outlines the transformative impact of the HEROCARE model in paediatric radiotherapy, detailing its dual benefits in enhancing treatment efficacy and educational outcomes. It highlights the model's role in fostering empathy and compassion among practitioners, crucial for patient-centred care.

Methods: The HEROCARE model integrates immersive simulations and interdisciplinary workshops to prepare children and their carers for the radiotherapy course, significantly reducing the need for sedation/anaesthesia. This model serves as a practical training ground for radiation therapy students and practising therapists, emphasising hands-on engagement, empathetic patient and carer interactions. This model, incorporating real-world clinical scenarios into education, enhances students' professional skills, communication abilities, and emotional intelligence.

Results: The implementation of HEROCARE has led to remarkable improvements in treatment outcomes, including a substantial reduction in sedation/anaesthesia use, shorter treatment times, and increased patient comfort and compliance. Simultaneously, the project enriches the training of future radiation therapists by providing them with comprehensive insights into patient-centred approaches

and interdisciplinary collaboration. Feedback from participants indicates enhanced understanding of the emotional and physical needs of paediatric patients, better communication with children and families, and greater confidence in managing complex clinical situations without sedation.

Extension Beyond Paediatric Care: Building on its success in paediatric settings, the HEROCARE framework is proposed as a model for continuing professional development in radiation therapy. The model's adaptability for advanced practice professionals helps in refining their skills in empathetic patient care, complex decision-making, and collaborative practice. This initiative not only exemplifies the integration of service and education but also sets a visionary standard for developing cancer treatment protocols that are both effective and compassionate.

Conclusion: The HEROCARE project not only revolutionises paediatric radiotherapy by improving clinical outcomes and reducing dependency on sedation/anaesthesia but also significantly advances radiation therapy education. By bridging the gap between clinical practice and academic training, HEROCARE cultivates a new generation of radiation therapists who are not only technically proficient but also deeply empathetic and patient-focused. This model promises to redefine professional standards in cancer care, underscoring the critical role of empathy and compassion in the therapeutic disciplines.

Future Directions: With the proven success of the HEROCARE model in paediatric oncology, future initiatives will aim to expand its application across other demographics and medical specialties. This includes adapting the model for adult patients and integrating it into broader oncology and radiology training programmes to enhance the scope and impact of this pioneering approach.

Application of AI in Radiotherapy

Prof Q. Jackie Wu
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The deployment of artificial intelligence (AI) technologies will have a great impact for the radiation therapy field. At the frontline of patient care, therapists will have a significant role in assuring safe and effective clinical implementation of AI-based tools. A major part of clinical AI applications will focus on facilitating and enhancing healthcare practice, via automation. This may raise concerns on responsibility and decision boundaries of patient care. Another challenge related to the AI application in clinic is the "black boxes" perception. It may be difficult to understand why or how the algorithm performs, due to the complexity of these AI algorithms. This talk will provide an overall review of major areas that AI technologies are being launched in clinics, including segmentation, treatment planning, treatment decision support, and treatment plan QA etc. Additionally, this talk will also address some relevant topics such as ethics in developing and deploying AI tools in clinic, etc.

The connectomics revolution: Utilizing Resting State fMRI and DTI to personalize the treatment of neurological and psychocognitive disorders

Dr Jacky Yeung
Yale University School of Medicine, New Haven, USA

Background: Connectomics has been instrumental in advancing our understanding of the intricate neural networks that underpin neurological and psychiatric conditions. Resting state functional magnetic resonance imaging (rs-fMRI) and diffusion tensor imaging (DTI) are critical imaging modalities that provide insights into the brain's functional and structural connectivity without the need for active patient participation.

Purpose: This presentation is designed to showcase the pivotal role of rs-fMRI and DTI in the burgeoning field of personalized functional imaging. It will highlight how these techniques can redefine the practice of radiological technologists by integrating connectomic insights into personalized patient care.

Methods: The presentation will discuss the protocols for employing rs-fMRI and DTI in a clinical environment, including data collection, analysis, and interpretation strategies. It will illustrate the connectome's relevance in various neurological conditions and the ways in which these imaging techniques can contribute to the development of individualized treatment plans.

Results: Employing rs-fMRI and DTI for connectomic analysis has yielded promising results in pinpointing neurological disease biomarkers, deciphering psychiatric disorder pathways, and crafting tailored therapeutic interventions. These imaging modalities offer a refined perspective on brain disorders, shifting the diagnostic paradigm from a general to a more patient-centered approach.

Conclusion: The integration of connectomics with personalized functional imaging marks a significant advancement in the field of medical imaging. Rs-fMRI and DTI not only enhance our visualization of brain networks but also support a transition toward treatments aimed at the underlying mechanisms of disease. Embracing these techniques is crucial for the progression of personalized medicine and the enhancement of patient care outcomes.

Implications: The keynote will delve into the implications of these technologies for radiological technologists, stressing the necessity for a transition to a connectome-based imaging model. Additionally, it will touch upon the educational and skill development needed for practitioners to adeptly adopt and apply these sophisticated imaging techniques in a personalized healthcare setting.

AI Image Analysis and Quantification

Dr Tian Li

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Artificial Intelligence (AI) has revolutionized various fields of healthcare, including medical imaging, by enabling advanced image analysis and quantification techniques. This presentation delves into the current landscape and future prospects of AI application in segmentation, image registration, and the derivation of image biomarkers in radiography and radiological technology. Segmentation, the process of partitioning an image into meaningful regions, plays a pivotal role in medical image analysis. AI-driven segmentation algorithms, such as deep learning-based approaches, have demonstrated remarkable performance in accurately delineating anatomical structures and pathological regions from medical images. These techniques hold promise for improving diagnostic accuracy, treatment planning, and patient outcomes. Image registration, the alignment of multiple images to a common coordinate system, is essential for various medical imaging tasks, including image fusion, motion correction, and treatment planning. AI-based registration methods leverage machine learning algorithms to achieve robust and accurate image alignment, even in the presence of complex deformations and anatomical variations. These advancements facilitate the integration of multi-modal imaging data and enhance clinical decision-making. The derivation of image biomarkers, quantitative measures extracted from medical images, is crucial for disease characterization, treatment response assessment, and prognostic evaluation. AI-enabled image analysis techniques enable the extraction of sophisticated biomarkers from medical images, providing clinicians with valuable insights into disease progression and therapeutic efficacy. Moreover, AI-based predictive models leverage image-derived biomarkers to forecast patient outcomes and guide personalized treatment strategies. This presentation will explore the current state-of-the-art in AI-driven image analysis and quantification and discuss the challenges and opportunities in translating these technologies into clinical practice. In conclusion, AI holds tremendous potential to

revolutionize image analysis and quantification in radiography and radiological technology, offering unprecedented opportunities for enhancing diagnostic accuracy, improving patient care, and advancing research in the field. By embracing AI-driven approaches, radiographers and radiological technologists can leverage the power of technology to optimize healthcare delivery and improve outcomes for patients worldwide.

Nuclear Medicine: The Beauty of Theranostics

Mr Donny Tung Tung Tsoi

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The field of Nuclear Medicine had witnessed significant advancement in the past two decades, particularly within the area of theranostics. Basically, the term “Theranostics” is a fusion of two words – “Diagnostics” and “Therapeutics”. The backbone concept behind is “we see what we treat, and then we treat what we see”. The principle involves the use of a pharmaceutical ligand, either of the same molecular structure or an analogue, to serve either as a diagnostic or therapeutic agent based on the choice and nature of the labelling radioisotope. This presentation will mainly cover three cutting-edge and innovative topics within the field of Nuclear Medicine: theranostics for prostatic carcinoma (PCa), neuroendocrine tumor (NET) and hepatocellular carcinoma (HCC). We will explore the basic concept and applications for these diseases by discussing the currently common used radio-isotopes for disease evaluation and therapy. Furthermore, we will discuss how to tailor make the pre-treatment imaging regime in order to personalize the treatment delivery and its potential impact on patient outcome.

Theranostics for Prostatic Carcinoma: We will assess how to utilize the positron emission tomography/computed tomography (PET/CT) imaging with injection of 18F-Prostate Specific Membrane Antigen (PSMA) inhibitor to reveal the PSMA overexpression of PCa. By replacing the radioisotope with Lutetium-177 (177Lu), the beta emission of 177Lu-PSMA enables the delivery of internal radiation to the pathology while sparing the surrounding normal tissue.

Theranostics for Neuroendocrine Tumor: We will discuss various Gallium-68 (68Ga) labeled DOTA peptides (such as 68Ga-DOTATOC and 68Ga-DOTATATE) as somatostatin analogues to reveal the somatostatin receptor (SSTR) expression of NET. Additionally, we will review the treatment efficacy of 177Lu-DOTATATE in radionuclide therapy.

Theranostics for Hepatocellular Carcinoma: We will explore the application of Technetium-99m labeled Macroaggregated Albumin (99mTc-MAA) as a surrogate radiotracer in SPECT/CT for planning Yttrium-90 (90Y) microsphere radioembolization treatment in HCC patient. Instead of using physical parameters from CT or MRI as part of conventional 90Y-microsphere radioembolization treatment protocol, which is based on a recommended fixed dose of 120Gy, we will delve into the significance of pre-treatment Dual Tracer PET/CT using 11C-Acetate and 18F-Fluorodeoxyglucose, in evaluation of HCC cellular differentiation based on cytokinetic properties and radiosensitivities of HCC, which aids in tailoring the dosage prescription of 90Y-microsphere for individual patient.

Conclusion: The field of Nuclear Medicine has experienced a remarkable blossoming in the area of theranostics. By combing diagnostics and therapeutics into a single modality, it enables more individualized treatment management and provides improved patient outcome. This presentation has provided an overview of the concept and applications of theranostics in Nuclear Medicine with various novel radioisotopes.

Child-sizing Imaging and Interventions – Making challenges fun!

Dr Kin Fen Kevin Fung

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“Children are not small adults” – Many assumptions that we apply when performing imaging and interventions in adults do not hold true when applied in children. Children are more susceptible to the deleterious effect of radiation when compared to adult, especially in terms of cancer-risk associated with radiation. While the average radiation dose involved in medical imaging is significantly lower than that in radiation therapy, it is important for us to adopt the “As Low As Reasonably Appropriate” (ALARA) principle. When performing medical imaging with ionizing radiation, we need to use appropriate strategies to limit the radiation dose. Also, we need to consider alternative radiation-free imaging modalities, such as ultrasound and magnetic resonance imaging (MRI). MRI is the preferred imaging modality for many childhood conditions, given its high soft tissue contrast resolution and lack of ionizing radiation. The trade-off for performing MR scans is the relatively long scan time, during which the child would have to stay still and motionless. Motion artifacts result in poor image quality and potentially non-interpretable scans.

In order to keep young children still for MR scans, sedation or anaesthesia services are often required. While sedation is relatively safe in experienced hands, the risk to the patient is higher than that of non-sedated MRI because of the possibility of adverse reactions to medications, cardiovascular or respiratory events, as well as growing concerns regarding potential adverse neurocognitive effects associated with exposure to anaesthetic medications early in life. In addition, anaesthesia service is a scarce resource in most hospitals and often creates a bottleneck effect in examination scheduling, i.e. MR scans with sedation often have longer wait times than non-sedated MR studies.

Depending on the age of the child, various non-sedative strategies can be used to reduce need for sedation or anaesthesia. To run a successful non-sedated MR program, it involves collaborative teamwork between radiologist, MR technologists, referring clinical team, anaesthesiologists, play specialists and, most important, the child and his/her parent. This multidisciplinary team effort ensures proper patient selection, MR scan protocoling and creation of a child-friendly environment. For baby aged less than 6 months, “feed-and-sleep” can be used to reduce the need of pharmacological sedation. With this technique, we make use of patients' daily feed and natural sleep pattern to let the baby fall asleep before start scanning. The parents would be briefed beforehand on when to feed the patient and the scan would be scheduled to fit with the feed schedule. The infant would be wrapped tightly in a pneumatic blanket to ensure comfort and minimise movement. The MR scanning room ambient light would be dimmed and “quieter” MR sequences would be selected to avoid waking the patient up.

Older children from 3 to 6 years old can avoid pharmacological sedation with the “Mock Scan MRI” programme, which was created in collaboration with play specialists. The mock scanner simulates the MRI experience including the noises the scanner makes. Selected patients are individually invited to a mock scan, during which education and training are provided to the child and parents. At the same time, the compliance level of the child is also assessed.

In addition to Mock MRI scan, MR-compatible video goggles can be worn by the child during scanning to provide audiovisual distraction. In our hospital, we provide a selection of movies for the child to select before he/she hops on the scanner. If the child is nervous, the parent and/or child play specialist may also be invited to accompany the child into the scanning room.

Finally, interventional Radiology (IR) has revolutionised the management of childhood diseases. With its minimally invasive nature, image-guided interventions are now the standard of care for many

procedures which are traditionally delivered by paediatric surgeons, including vascular access, tumour biopsies and enteric access. Moving into the realm of interventional oncology, IR also has a growing role to play in management of locoregional tumour control through thermal ablative therapies and chemo-embolisation.

Exploring the Impact of Immersive Virtual Reality Learning on Interprofessional Learning

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Introduction: Interprofessional education (IPE) is a core component of health care education, fostering collaboration and improve health outcomes. Studies has demonstrated that IPE had built the confidence of the students and affirmed the significance of the nursing roles within the health care team. Education focusing on interprofessional communication and teamwork skills is pivotal to preparing health professional students to manage complex clinical situation effectively.

Using an immersive virtual reality (IVR) game may allow the students to experience the dynamic challenges of complex care management and effective communication of the investigation results among health professionals. Growing evidence suggests that gamification augments engagement and is an effective learning strategy. Research has shown higher perceived competence, motivation, and achievements in gamification, when compared to conventional textbook learning tasks. However, whether the IVR contributes to recognising team-based practice and identifying professional roles remained unexplored.

Aim: The study aims to explore the impact of IVR game on interprofessional learning.

Method: A one-group cross-sectional survey design was used. Radiography (RAD) and nursing (NUR) students in their third year of undergraduate programme participating in the IVR game as part of the learning activity in their course were recruited to complete an anonymous questionnaire to evaluate their interprofessional team experience. The Attitudes Towards Various Aspects of Team Learning (ATL) questionnaire comprised of four subscales: the overall satisfaction with team experience, team impact on quality of learning and clinical reasoning ability, and attitudes towards professional development. It consists of 15 items rated on a 5-point Likert scale (1 indicated strongly disagree and 5 indicated strongly agree). A conceptual model is used to examine the causal relationship between the overall satisfaction with VR experience and the other three constructs of ATL. The analysis was performed using Partial Least Squares Structural Equation Modeling (PLS-SEM). To ensure greater stability in estimating standard errors and p-values, a bootstrapping approach with 5,000 subsamples was employed. All statistical tests were two-tailed and variables were considered significant at $p < 0.05$.

Results: A total of 259 students participated (RAD: $n = 68$, NUR: $n=191$), with an average age range of 20-21 (85 male, 174 female). A significantly higher proportion of female in Nursing than in Radiography was shown (74.9% vs 45.6%, $\chi^2 = 19.500$, $p < 0.005$). No significant difference was found in terms of prior experience with playing online game (85% had prior online game experience).

Assessment of the measurement model showed there was a significant relationship between the overall satisfaction with the VR experience and the three constructs. Among them, the overall satisfaction with the VR experience had a higher impact to the professional development ($\beta=0.796$, $p < 0.001$), followed by the team impact on quality of learning ($\beta=0.768$, $p < 0.001$) and the team impact on clinical reasoning ability ($\beta=0.729$, $p < 0.001$). Results showed that the value of Q2 for professional development, team impact on quality of learning and team impact on critical reasoning ability were 0.489, 0.461 and 0.439,

respectively, which indicated that there was medium predictive relevance. The effect sizes in the model, in term of f^2 , to the professional development, team impact on quality of learning and team impact on clinical reasoning ability were 1.734, 1.441 and 1.134, respectively (criterion: large effect size ≥ 0.35)[10]. Moreover, all the items' factor loadings were significant and greater than 0.703 for all of the constructs, and the Cronbach's alpha (ranged from 0.872 to 0.951, criterion ≥ 0.6) and the composite reliability (ranged from 0.918 to 0.951, criterion ≥ 0.7). All constructs indicated good convergent validity (ranged from 0.797 to 0.860). While it has satisfactory discriminant validity (≤ 0.90) except the team impact on quality of learning (0.970), factor loadings within the same constructs had higher values than other variables indicating no discriminant issues.

Conclusion: This study suggests that healthcare students were satisfied with the IVR game and the experience can enhance interprofessional learning.

ORAL PRESENTATIONS

Mental Health Burden and its Associated Factors Among Radiation Therapists Working in Singapore - A National Study

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There has been an emphasis on mental health and its importance among healthcare workers in recent years. Radiation Therapists work in an oncological setting, where there is high stress due to cancer burden inflicted by patients and caregivers. The study was to assess the mental health strain and burden among radiation therapists working in Singapore. A nation-wide survey was conducted between March to June 2023. Eligible participants were identified and invited to participate in the survey. The three-part survey was carried out via an online platform and take about 20 minutes to complete. Participation is voluntary, responses are anonymous and no incentive will be offered for participation. Study protocol is approved by the Institutional Review Board. Seventy-five of the 174 eligible radiation therapists responded to the study. 80% work in restructured hospitals whereas 20% in the private. 88% of them work 5 days / week and 33.3% work in more than one section of the radiation therapy center in a work week. Chi-square test analyses were used to identify the mental health strains and their associated factors. There is not significant difference ($p=0.796$) in either gender feeling emotionally exhausted due to work. Employed in either restructured or private hospitals has no significant ($p=0.614$) in feeling burned out. 44% felt that being in direct contact with people at work is too stressful. However, there is a statistical significant difference ($p=0.045$) in the different marital status towards how they felt things were going their way. Our findings show that it is not statistically significant that radiation therapists experience major mental health strains associated with work or work / patients-related. Nevertheless, mitigation strategies can be introduced by providing avenues to seek mental health training in promoting better mental health.

Testicular two-dimensional shear wave elastography (2D-SWE): establishment of normal reference values and discrimination from orchitis in patients presenting with acute scrotal pain.

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Background: Ultrasound is the primary scrotal imaging modality utilising B-mode with colour, pulsed-wave and power Doppler. Rarely, Urologists routinely palpate testes to subjectively assess stiffness during the clinical examination. Ultrasound offers shear-wave elastography (SWE) capability which is able to provide an automatic quantitative measure of tissue stiffness.

Aim: To establish normal testicular elasticity reference values using two-dimensional shear wave elastography (2D-SWE) to allow discrimination from pathology, specifically orchitis in patients presenting with acute scrotal pain.

Materials and Methods: Patients referred for scrotal ultrasonography for investigation of scrotal pain or discomfort. Sonographic evaluation of the 599 testes included B-Mode, colour and pulsed wave (PW) Doppler, testicular volume, peak systolic velocity (PSV), and the median SWE.

Results: In asymptomatic testes the median volume, PSV and SWE were 14.7 cc (IQR 11.1 – 18.0 cc), 6.3 cm/s (IQR 5 – 8.3 cm/s) and 2.6 kPa (IQR 2.2 – 3.1 kPa) respectively. In patients with extra-testicular scrotal findings, the median volume, PSV and SWE were 14.9 cc (IQR 10.5 – 18.5 cc), 7.2 cm/s (IQR 4.9 – 8.3 cm/s) and 3.1 kPa (IQR 2.3 – 4.1 kPa) respectively. In patients with orchitis the median testicular volume, PSV and SWE were 19.9 cc (IQR 11.7 – 25.3 cc), 14.55 cm/s (IQR 8.63 - 21.10) and 7.0 kPa (IQR 4.3 – 8.3) respectively. These values were age and side independent. Conclusion: Normal adult testes have an elasticity of 2.6 kPa (IQR 2.2 – 3.1 kPa). A threshold cut off value of 3.5 kPa will rule in testicular pathology with an accuracy, specificity, sensitivity and AUC of 0.92, 0.99, 0.11 and 0.92, therefore caution is required in the presence of extra-testicular inflammatory findings where there were a wider range of obtained SWE measurements.

Shaping patient care in Geriatric Radiation Oncology: Through the lens of an Advanced Practice Radiation Therapist

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Background: Singapore's ageing population necessitates heightened focus on complex health issues, particularly cancer. With a projected 53% increase in cancer cases by 2030, of which 70% will affect the elderly. Geriatric Oncology is pivotal in meeting this demographic's unique needs. Over 60% of cancer patients will require radiation therapy. Elderly patients exhibit specific challenges, including reduced treatment tolerance, increased comorbidities, and social support requirements, which complicate their care. Highlighting the need to advance geriatric radiation therapy services, Advanced Practice Radiation therapists (APRT) can provide personal care to address the rising demands of the ageing population.

Role expansion and Development: Our initiative is grounded in utilising the Advanced Practice Registered Technologist (Radiation Therapy) Competency Profile provided by the Canadian Association of Medical Radiation Technologies. This framework serves as the basis for our role expansion and development efforts. We have identified the feasibility of extending roles and the corresponding educational prerequisites. In the domain of clinical competencies, our experiential journey involves

implementing established clinical geriatric assessment tools to evaluate elderly patients undergoing radiation treatment and elucidate the clinical rationale that informs treatment decisions and underscores the importance of collaboration with multidisciplinary teams to ensure personalized, patient-centred care. Technical competencies: The use of geriatric tools enhances radiation treatment for this vulnerable population, aligning with geriatric assessment clinical practice guidelines. In the realm of professional competencies, we address the development of geriatric APRT in education, research, and leadership domains.

Conclusion: Our aim is to illuminate the evolving landscape of geriatric radiation oncology through the journey of an APRT. This transformation marked by challenges and opportunities, includes comprehensive patient care, geriatric assessment tools, and multidisciplinary collaboration. By embracing this initiative, APRT can have a profound impact on improving outcomes and enhancing the quality of life for geriatric oncology patients.

The practical experience of performing cardiac MRI (CMR) for patients with Cardiac Implantable Electronic Device (CIED) using WB LGE (Wideband Late Gadolinium Enhancement) sequence

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MRI conditional Cardiac Implantable Electronic Devices have become more common nowadays, which allowing patients with these devices to undergo MRI examinations safely with appropriate programming and monitoring during the procedures. CIED is no longer a contraindication or safety concern for MRI examinations. However, patients with heart disease after CIED implantation are usually not able to undergo CMR because of the susceptibility and off-resonance artefacts caused by CIED and its leads. The artefacts are substantial and obscure the heart which makes CMR almost not interpretable, especially late gadolinium enhancement. WB LGE sequence is introduced by Siemens to reduce the susceptibility and off-resonance artefacts caused by the device. NUH installed the sequence in June 2023. CMR scans were performed on 2 patients with CIED. Quality of the CMR images produced was satisfactory. In conclusion, performing CMR for patients with CIED is challenging because of device related artefacts. With WB LGE sequence, we can produce diagnostic quality CMR images by reducing the artefacts caused by the device.

Application of Subtraction Iodine Mapping in the Immediate Liver Tumour Ablation CT Scan – Initial Experience Report

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Purpose: To share our initial experience and benefits of the iodine mapping application in the post-liver radiofrequency ablation CT scan compared to conventional post-contrast CT liver image reconstruction.

Methodology: The SGH hybrid angiography-CT System (installed 2021), comprises the Genesis edition CT system and Alphenix Sky+ angiography system. The CT scanner gives 640 slices per rotation, with a maximum of 16cm field coverage. Iodine mapping in the post-liver ablation is routinely performed on the post-ablation contrast-enhanced CT. This subtraction technique involves taking two scan volumes

and subtracting the images to highlight the differential contrast uptake in the liver parenchyma. Color-coded maps of iodine distribution within the liver parenchyma are then generated to demonstrate enhancement and washout to facilitate interpretation.

We plan to showcase the application of the iodine map technique in liver tumor ablation to through a small retrospective case series.

Result: Through a series of 5 cases, we plan to demonstrate how iodine mapping from subtraction CT imaging after liver tumor ablation facilitates the detection of any non-ablated residual tumors and bleeding which is the most dreaded acute complication. In particular, how it is an improvement from conventional post-contrast CT image reconstructions. In addition, we will show pitfalls in imaging to prevent misinterpretation of iodine mapping subtraction CT.

Summary: Our initial experience in the application of iodine mapping for immediate post-liver ablation scans demonstrates that it is a useful adjunct for the interpretation of post-liver ablation CT to provide more early and accurate detection of residual tumors and complications.

Current State of Radiographic Patient Shielding in the United States

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Background: The American Association of Physicists in Medicine (AAPM) proposed the elimination of routine patient fetal and gonadal shielding during x-ray-based diagnostic medical imaging in April 2019. This change was met with considerable confusion and consternation in the United States. The American Society of Radiologic Technologists (ASRT) Patient Shielding Task Force developed educational materials to assist radiologic technologists in appropriately implementing this change in patient shielding. After more than a year of developing and disseminating these resources, the Task Force seeks quantifiable information on current shielding practices and perceptions of the front-line imaging professionals who have been directly implementing this change in clinical practice.

Methods: In February 2024, a 30-item online survey will be administered to members of the ASRT currently performing radiographic procedures in the United States. Survey questions are designed to investigate the current state of patient shielding as reported by responding ASRT members and to identify needed educational resources to assist clinical practitioners and patients in understanding the rationale behind this proposed change.

Results: While survey results are pending, we will collect and analyze data demonstrating the diversity of current practice and the perceptions of radiologic technologists regarding these recent changes. Analyses of the survey responses will inform the Task Force of the depth and breadth of this change's impact. They will aid in the further development of educational resources for both patients and technologists.

Conclusion: The proposed elimination of routine fetal and gonadal shielding during x-ray-based medical imaging impacted a fundamental tenet of radiation protection in medical imaging practice. Strategic change management is critical for the effective implementation of any significant change. The ASRT Patient Shielding Task Force continues to evaluate current practices and develop practical educational resources.

Computed Tomography Imaging Radiomics in the Diagnosis of Gastric Cancer under Iterative Reconstruction Algorithm

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Purpose: This study aimed to explore the application value of computed tomography (CT) imaging radiomics based on iterative reconstruction algorithm in the diagnosis of gastric cancer. **Methods:** An iterative model was established, the actually measured values were adopted to repeatedly trim the hypothetical image and to control the noise level of each pixel value. When the ideal standard was reached, the optimized image can be obtained. 80 patients who were pathological diagnosed with gastric cancer were selected as research objects. The images obtained were optimized by an iterative reconstruction algorithm. The generated data were randomly rolled into a training group and a verification group, and the training group was verified.

Results: The area under the curve (AUC), sensitivity, and specificity of the training group were 0.992, 97%, and 100%, respectively; while those in the verification group were 0.961, 93%, and 99%, respectively. Statistical analysis of the best features of the selected images showed that the AUC, sensitivity, and specificity of total energy were 0.698, 82%, and 73%, respectively; those at the 90th percentile were 0.751, 76%, and 78%, respectively; those for the average absolute deviation were 0.985, 90%, and 96%, respectively; and those of kurtosis were 0.743, 78%, and 81%, respectively.

Conclusion: The iterative reconstruction algorithm eliminated the noise in the image to the greatest extent, optimized the quality of the image, and promoted the better development of CT imaging radiomics in clinical early diagnosis and treatment of gastric cancer.

Assessment of Stroke Onset Time Based on DINOv2 Visual Features

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Background: Currently, the thrombolytic treatment for acute ischemic stroke (AIS) strictly depends on the time since stroke onset (TSS) being less than 4.5 hours. However, some patients are excluded from thrombolytic treatment due to uncertain TSS. Clinically, diffusion-weighted imaging (DWI) and fluid-attenuated inversion recovery (FLAIR) mismatch are commonly used to roughly determine TSS.

Methods: In this paper, we propose a method based on DINOv2 to classify the TSS as less than or more than 4.5 hours. We conducted model training and external testing using case data from two hospitals. These hospitals respectively included 226 and 85 cases of TSS less than 4.5 hours, along with an equal number of cases with TSS greater than 4.5 hours. Firstly, we utilized DINOv2 for automatic segmentation of lesions and extraction of visual features from DWI and FLAIR images. Then, the visual features of the lesion area were input into four different machine learning models. Finally, a conclusion on whether the patient's onset time is more or less than 4.5 hours is reached through a weighted voting method.

Results: The results from the external test set show that in lesion segmentation from DWI and FLAIR images, the Dice coefficients were as high as 0.872 and 0.823, respectively. In the judgment of TSS less than 4.5 hours, our approach achieved an accuracy of 0.865, sensitivity of 0.843, and specificity of 0.902.

Conclusion: The assessment of TSS based on DINOv2 visual features demonstrates excellent performance. The results of this approach significantly surpass those of human doctors using the DWI-FLAIR mismatch method. Moreover, it achieves a fully automated process for rapid and efficient handling. This approach is expected to play a key role in treatment decision-making for patients with unknown TSS.

Signal Power Estimation and its Novel Applications in Radiology as two birds with one stone

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Background/Purpose: In radiology, MTF and SNR (or CNR) are known as established methods for evaluating the quality of phantom images. However, due to their complexity caused by multiple procedures involved in measuring of multiple ROI statistics such as mean, variance, etc., this study proposes a simplified signal power estimation method calculated directly from a pair of observed images. Then, in this research, MTF* and SNR* utilizing this proposed method are introduced as novel applications.

Methods: First, two observed phantom images are prepared by using the same imaging condition. Then, a signal power of the image is estimated from a covariance of a pair of the observed images using the following equation. $V(\mathbf{x}) = \text{Cov}(\mathbf{y}_1, \mathbf{y}_2)$ where $V(\cdot)$ and $\text{Cov}(\cdot)$ denote a variance and a covariance of \cdot respectively. Here, \mathbf{x} is a signal image vector, and \mathbf{y}_1 and \mathbf{y}_2 are observed image vectors obtained under the same imaging conditions, where \mathbf{y} is constructed from the signal vector \mathbf{x} summated the additive noise vector \mathbf{n} , namely $\mathbf{y} = \mathbf{x} + \mathbf{n}$. Finally, MTF* and SNR* are calculated using the estimated signal power $V(\mathbf{x})$. The proposed methods are then compared with the conventional methods.

Results: While a direct comparison between conventional SNR and SNR* proved difficult due to differences in definition, both methods showed similar trends. On the other hand, the conventional MTF by Droege's method and the MTF* were almost in agreement with two significant figures as expected.

Conclusion: This investigation proposed simplified method for estimating signal power derived from the covariance of a pair of observed images. And this proposed method produced novel applications termed MTF* and SNR*, and has an more practical than the conventional method in terms of simplified procedure as two birds with one stone.

"Digital Twin" Intelligent Management of Large Medical Equipment Based On Internet of Things Platform

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Background: The implementation of China's Healthy China strategy and the development of new medical infrastructure have led to the widespread deployment of various medical equipment across all levels of healthcare institutions. These instruments serve critical functions such as health checkups, disease screening, diagnosis, treatment, and therapeutic evaluation, forming the essential backbone for a hospital's normal operation. Nevertheless, the challenge persists in transitioning from Breakdown Maintenance to Prejudgment due to the vast and diverse array of medical equipment.

Method: Utilizing Internet of Things (IoT) digital twin technology, a comprehensive evaluation management system for large medical equipment is established. The system parses operational logs to fully reconstruct the dynamic usage patterns of the equipment. Standard data interfaces are interconnected with existing information systems to create a real, objective, automated, and normalized platform for analyzing equipment operation, usage, quality control, and efficiency data. This platform facilitates equipment monitoring, early warning, quality control management, and decision-making applications.

Result: Real-time remote monitoring of equipment operating status is achieved 24/7, providing immediate awareness of current equipment states such as shutdown, standby, and downtime. This enhances the quality and efficiency of equipment operation and maintenance. Different levels of risk warnings are pushed, guiding biomedical engineers to take timely and effective measures. Predictive estimation of the lifespan of core components enables proactive, foresighted equipment maintenance management, effectively controlling maintenance costs. Real-time remote monitoring of core parameters allows for efficient intelligent inspections, enhancing maintenance efficiency and reducing downtime.

Conclusion: The system enables real-time remote monitoring of medical equipment, achieving dynamic and refined management. It enhances operational quality, efficiency, and decision-making capabilities by integrating IoT and cloud platforms into the management and early warning system for major medical equipment in large hospitals.

Residual/recurrent nasopharyngeal carcinoma and nasopharyngeal lymphoma: Dual-parameters differentiation based on apparent diffusion coefficient and standardized uptake value of 18F-FDG PET/MRI

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Objectives: To evaluate the multi-parametric diagnostic performance with apparent diffusion coefficient (ADC), standardized uptake value (SUV) and the relative SUV (rSUV) of hybrid ¹⁸F-fluoro-2-deoxy-D-glucose positron emission tomography/magnetic resonance image (¹⁸F-FDG PET/MRI) to differentiate residual/recurrent nasopharyngeal carcinoma (RNPC) and nasopharyngeal lymphoma (NPL).

Materials and methods: One hundred and sixty-three patients, including PNPCs ($n = 86$), RNPCs ($n = 53$) and PNPLs ($n = 24$), were recruited in this study. The peak standardized uptake value (SUV_{peak}), maximum (SUV_{max}), and mean (SUV_{mean}) were obtained by workstation, and relative SUV_{peak} ($rSUV_{peak}$), SUV_{max} ($rSUV_{max}$) and SUV_{mean} ($rSUV_{mean}$) were obtained by standardization of the contralateral normal-appearing lateral pterygoid muscle. The minimum apparent diffusion coefficient (ADC_{min}) and mean ADC (ADC_{mean}) were obtained by ROIs measurement. Bivariate logistic regression was used to determine the best logistic regression model for classification. The area under the curve (AUC) was used to evaluate the diagnostic performance.

Results: RNPCs showed significantly lower SUV_{mean} , $rSUV_{peak}$, $rSUV_{max}$ and $rSUV_{mean}$ than that of NPLs. The ADC_{mean} of PNPL was significantly lower than that of RNPC. The joint model with ADC_{mean} and $rSUV_{mean}$ achieved the higher AUC, which was 0.92, and the sensitivity and specificity were 88.7% and 91.7%, respectively.

Conclusion: The combination of ADC_{mean} and $rSUV_{mean}$ allowed reliable differentiation between RNPC and NPL.

Coronary CT Angiography Applications with photon-counting CT

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The first photon-counting computed tomography (PCCT) was installed in Hong Kong in December 2023. I would like to discuss the background and clinical uses of quantum technology in PCCT for coronary angiography. The photon-counting detector is a new, advanced technology that uses detectors that discriminate the energy of individual photons in the x-ray beam and convert the detected individual photons into electric signals. By comparison with traditional CT (energy-integrating detector CT, EID-CT), it offers multiple advantages over standard energy-integrating detectors, including uniform photon weighting across multiple x-ray energies. 10 clinical cases of the patients were compared using PCCT and EID-CT, regarding the image quality of proximal, middle, and distal vessels, calcified plaque, stents, non-calcified plaque, and artefacts of pericardial calcification. The coronary stents and calcified plaque can be assessed by the special features of true-lumen that allow for calcium removal based on material decomposition. The ultra-high-resolution scanning protocol has advantages in demonstrating the instant lumen of coronary arteries. Mono-energetic images improve the diagnostic value of cardiac CT angiography. This new technology promises to overcome the blooming artefacts of heavy calcified coronary plaques or beam-hardening artefacts in patients with coronary stents. PCCT enables improved image quality and diagnostic confidence for coronary CT angiography examinations in comparison to EID-CT.

Optimization of Radiation Dose for Fluoroscopic Micturating Cystourethrogram in Sitting Positioning Style

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Micturating cystourethrogram (MCU) is a common fluoroscopy exam to evaluate the anatomy and abnormalities of the lower urinary tract for paediatric patients. During MCU exam, a sitting approach could enhance patient comfort during the micturating phase, apart from the routine supine and standing positioning styles. Prior to adopting sitting MCU in our centre, a radiation dose study was conducted to optimize the protocol of automatic exposure rate control (AERC) system, aiming to maintain adequate diagnostic information while minimizing the radiation dose to our patients. Phantom in-vivo radiation measurements were performed using different combinations of cells in the AERC system for the sitting positioning style. Results showed that the use of central measuring field cell in AECR system resulted in over 70% radiation dose reduction compared to full measuring field by excluding the long radiological path length of femurs and thighs when simulating patient in a sitting posture. Thus, the optimized selection of central measure field cell is recommended for MCU in sitting approach to achieve radiation dose reduction with adequate image quality for diagnosis.

Reducing Respiratory Motion Artifacts in Gadoxetate-Enhanced MRI: Assessing Assisted Breath-Holding Effectiveness

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Purpose: This study evaluates the effectiveness of the assisted breath-holding technique in improving image quality by reducing motion artifacts associated with gadoxetate-enhancement during the transient arterial phase compared to the conventional breathing approach in liver MRI.

Methods: We performed a comprehensive analysis of liver MRI scans from 261 consecutive patients subjected to gadoxetate-enhanced MRI. Our focus was on evaluating motion artifact severity during the arterial phase, categorizing the cases into two groups: assisted breath-holding (130/261 cases) and traditional breathing (131/261 cases). Two independent, blinded readers rigorously assessed image quality using a 5-point scale.

Results: A pronounced and statistically significant enhancement in arterial phase image quality scores was observed in patients employing the assisted breath-holding method as compared to the traditional approach ($p = 0.006$). The incidence of moderate and severe respiratory artifacts during the arterial phase notably decreased from 17.557% to 4.615% following the implementation of the assisted breath-holding technique ($\chi^2 = 11.065$, $p = 0.001$).

Conclusion: The utilization of the assisted breath-holding method led to a substantial enhancement in the image quality during the arterial phase of gadoxetate-enhanced liver MRI scans.

Framework to Improve Access to Radiotherapy Services for Cancer Patients in Gauteng Province, South Africa: A Study Protocol

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Background / Purpose: Access to radiotherapy cancer care is a challenge in many low- and middle-income countries, including South Africa. This study aims to develop a comprehensive strategic framework to improve access to radiotherapy for cancer patients in the region.

Methods: A mixed-methods approach will be employed to address five objectives: conducting a systematic review of current access to radiotherapy in sub-Saharan Africa, collecting quantitative data on patient clinical cancer journeys, assessing socio-economic indicators, and assessing radiotherapy quality indicators and their impact on patient outcomes. Quantitative data will be analyzed using IBM SPSS software, while qualitative data will be analyzed using ATLAS.ti version 23 through thematic content analysis. Ethical considerations will be observed.

Results: The study will use data from 400 patient files at two public radiotherapy facilities to provide insights into radiotherapy access and its impact on patient outcomes. The results will be analyzed and presented to contribute to the development of the strategic framework.

Conclusion(s): The proposed research has the potential to significantly improve access to radiotherapy services in Gauteng Province. The developed framework will be valuable for policymakers, healthcare providers, and stakeholders in planning and implementing interventions to address identified barriers. Enhanced access to radiotherapy services will lead to timely treatment and improved outcomes for

Evaluation of dose calculation in Direct Density algorithm reconstruction images using dual energy CT for Radiotherapy

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Background: Computed tomography (CT) is used in the simulation and treatment planning process. The dose calculation is based on the HU-ED calibration curve, which varies with tube voltages. A single HU-

ED curve of standard 120 kV is used for dose calculation. However, Direct Density algorithm can reconstruct images from different tube voltages, regardless of the HU-ED calibration curve. This study aims to evaluate the radiation doses between the standard kV and the Direct Density reconstruction images.

Methods: The image acquisition and data collection followed the machine protocol. Electron density phantom was scanned with Brain, Head and Neck, Breast, Abdomen and Pelvis protocol, the scanning was performed for all the tube voltages including 70, 80, 100, 120 and 140 kV. HU-ED curves from standard kV and Direct Density reconstruction were created in the treatment planning system. After that, the homogeneous phantom (Solid water phantom) and heterogeneous phantom were scanned using Thorax and Head and neck protocol. The radiation doses between the standard kV images (120 kV) and the Direct Density reconstruction images in different tube voltages including 80, 100, 120, and 140 kV were compared.

Results: The results showed that the dose calculation did not show the difference between the standard kV and the Direct Density reconstruction for all the tube voltage in homogeneous and heterogeneous phantom at $p\text{-value} < 0.05$.

Conclusion: The difference in the radiation dose was less than 1%, indicating that images obtained from Direct Density reconstruction can be used to calculate radiation doses in clinical practice. Moreover, the patient dose can be reduced by selecting lower energy levels in the simulation process.

A RESEARCH PROPOSAL CONCERNING SONOGRAPHIC FINDINGS AMONG PREGNANT WOMEN PRESENTING WITH PER-VAGINAL BLEEDING AT HEALTH FACILITIES IN ARUSHA REGION.

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Background: Vaginal bleeding has been noticed as the major problem experienced by pregnant women associated with consequences like abortions, preterm birth, low birth weight, intrauterine fetal deaths, intrauterine growth retardation and anemia in pregnant in East Africa. According to the records obtained, the study will provide the percentage (after data collection) of pregnant women returned to hospital for attendance to the antenatal care services complaining of Per-vaginal bleeding before their next recommended date of attendance.

Methodology: The purpose of the study is to determine the sonographic findings in pregnant women presenting with Per-vaginal bleeding referred for obstetric ultrasound scan at health facilities. The study is non-interventional, cross section, descriptive, and quantitative. The study will involve potential participants and it will be conducted for a certain period of time from health facilities in the region. An informed consent will be obtained from the participants before collecting data and confidentiality will be assured and maintained throughout the study.

Results: Majority of the respondents reported history of use of contraceptives, history of miscarriage, history of caesarian section and presence of vaginal infection alongside Per Vaginal bleeding. The major sonographic findings among pregnant women with vaginal bleeding are normal sonographic findings in threatened abortion but some seen with uterine fibroids, placenta Previa, incomplete abortion, molar pregnancy, inevitable abortion and vasa Previa.

Conclusions: Vaginal bleeding is common among pregnant women in the first trimester and threatened abortion is the major cause of vaginal bleeding among pregnant women. Any pregnant woman presenting with vaginal bleeding should have an early and timely ultrasound scan.

The cost of perfection: An investigation into the unnecessary rejection of clinically acceptable lateral wrist imaging.

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Introduction: This study illustrates image rejection rates of the lateral wrist x-ray projection at a large, public teaching hospital. Rejected images were evaluated to determine the number of images where image repeat was required based on the clinical indication. This study highlights the difference in subjective image-repeat decision-making skills existing between radiologists, experienced radiographers and junior radiographers.

Methods: A retrospective review was conducted of all rejected lateral wrist x-ray images by a panel of 3 radiologists, 3 experienced radiographers and 6 junior radiographers. This review aimed to determine if rejected imaging met the consideration of the clinical indication and assumed appropriate acquisition of an orthogonal projection. A compliment of images that had not been rejected were included in the review.

Results: The review demonstrated 85.8% of rejected images were deemed to meet clinical requirements according to radiologists. The experienced radiographers agreed with radiologists regarding 75.3% of images. Junior radiographers agreed with radiologists in 34.2% of cases. Junior radiographers were three times more likely to seek repeat imaging than the radiologists and experienced radiographers.

Conclusion: This review demonstrated a lateral wrist projection reject rate of 38.7% with unnecessary repeats according to clinical indications in 85.8% of cases. The review of experienced radiographers was comparable to radiologists, however, difference in decision making skills was evident in the junior radiographers. This highlights an alarming trend, should similar results be demonstrated at other health services. Inclusion of clinical reasoning for imaging and the need for repeat imaging is recommended for radiography training programs.

High Complaints on Radiology Examination Request: The Efficiency of an In-house RIS Solution

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Background/Purpose: The current manual process of requesting radiological examinations using paper forms has resulted in significant inefficiencies, data errors, and frequent complaints from customers. This has not only led to delays in the application process but also impacted patients who require urgent treatment. The information from the forms needs to be entered into the Radiology Information System (RIS) by staff, resulting in further delays and errors. Outdated computer hardware and problems with the RIS also aggravate the situation.

Methods: To address these problems, an in-house developed system that covers the entire process from examination request to reporting has been proposed.

Results: The system has been found to be effective in eliminating various issues, including delays, errors, and customer complaints. The use of the system has reached 100%, and standardization has been achieved throughout the organization. The system has also resulted in significant cost savings of USD

1,794,126.82, primarily due to reduced maintenance costs. Moreover, the system has led to a more efficient work system, reduction in customer complaints, time savings, cost savings of consumables, and reduction in procedural steps.

Conclusion: Overall, the in-house RIS has provided an effective, standardized, and cost-saving solution for radiology examination requests.

The value of T1p mapping in preoperatively predicting the status of ER, PR, HER-2 and Ki-67 in breast cancer

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Purpose: to explore the value of T1p mapping in preoperatively predicting the status of ER, PR, HER-2 and Ki-67 in patients with breast cancer

Method: 26 biopsy proved breast cancer patients were prospectively enrolled in this study. They all received preoperative clinical routine breast MRI and T1 p mapping sequence. Patients were grouped into ER, PR, Her-2 and Ki-67 negative (n=5, 5, 20, 13, respectively) and positive groups (n=21, 21, 6, 13, respectively) with reference to pathological results. ROIs were drawn by two radiologists along the edge of the tumor at three largest slices on T1p mapping images, and avoiding artifacts, blood vessels, necrosis, etc. Calculate the average value of two measurements as a final absolute T1p value of the lesion. Independent t test, ROC curves, analysis were used for statistical analyses.

Results: Patients with ER positive status had significantly lower T1p value than negative group (P<0.01). ROC curve showed that T1p presented AUCs of 0.867 in predicting ER status. Patients with PR positive status also had significantly lower T1p value than negative group (P=0.01). ROC curve showed that T1p presented AUCs of 0.79 in predicting PR status. Patients with Her-2 positive status had significantly higher T1p value than negative group (P=0.04). ROC curve showed that T1p presented AUCs of 0.77 in predicting Her-2 status. Patients with Ki-67 positive status showed significantly higher T1p value than negative group (P=0.02). ROC curve showed that T1p presented AUCs of 0.75 in predicting Ki-67 status.

Conclusion: T1p Mapping has the potential for preoperative evaluation of ER, PR, HER-2, and Ki-67 status, which may give additional information to guide individualized therapeutic strategy in breast cancer.

Deep Learning Reconstructed Reduced Field-of-View Diffusion Weighted Imaging in Rectal Cancer: Comparison of Image Quality

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Purpose: To compare the image quality (IQ) and apparent diffusion coefficient (ADC) values between deep learning reconstructed reduced field-of-view diffusion weighted imaging (DLR-rDWI) and original rDWI (noDLR-rDWI) in the context of rectal cancer.

Methods: 42 patients undergoing rectal MRI with DLR-rDWI in a 3.0 T MRI scanner were enrolled. The signal-to-noise ratio (SNR) and contrast-to-noise ratio (CNR) of lesions in both DLR-rDWI and noDLR-rDWI were calculated. ADC values were measured on the normal rectal wall and the central slice of the tumor in two DWI sequences. Subjective analysis of two DWI sequences was performed using a Likert scale with scores ranging from 1 to 4. The interobserver variability for objective indexes (SNR, CNR and

ADC) and subjective indexes was assessed using the intraclass correlation coefficient (ICC) and weighted kappa statistics.

Results: The overall agreement of objective and subjective indexes was good. The SNR_{lesion} and CNR_{lesion} of DLR-rDWI were all higher than those of noDLR-rDWI ($P < 0.001$). The scores of sharpness, noise and total IQ were higher for DLR-rDWI than noDLR-rDWI ($P < 0.01$). There was no significant difference in lesion conspicuity ($P=0.157$). The ADC value of lesions was significantly lower than normal rectal wall in each DWI sequence (DLR-rDWI: 0.97 ± 0.21 vs. 1.79 ± 0.47 , $P < 0.001$; noDLR-rDWI: 0.99 ± 0.23 vs. 1.77 ± 0.42 , $P < 0.001$). There was no significant difference between two DWI sequences in $ADC_{normal\ rectal\ wall}$ ($P=0.517$) or ADC_{lesion} ($P=0.087$).

Conclusion: DLR-rDWI had better IQ compared to conventional rDWI and the utilization of DLR had no impact on ADC measurement. Therefore, DLR-rDWI could be considered for inclusion in routine rectal MRI protocols.

Metabolic Analysis of Ongoing Neuropsychiatric Symptoms Post SARS-COV-2 Through Magnetic Resonance Spectroscopy

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Background: Previous research has established that SARS-COV-2 infection not only leads to acute systemic damage but also results in persistent symptoms, collectively known as "long-term COVID." Our research aims to verify whether the sustained presence of neuro-psychiatric symptoms after SARS-COV-2 infection is linked to changes in the metabolite GABA and/or an imbalance in excitatory-inhibitory (E/I) function.

Methods: Using Magnetic Resonance Spectroscopy (MRS) techniques, we investigated the levels of metabolites (GABA and Glx) and the excitatory-inhibitory balance (E/I) in the rACC and dACC brain regions, examining differences between two groups. Anxiety and depression states were assessed in all participants (37 in the infection group, 44 in the control group).

Results: In the rACC brain region, the study revealed higher GABA levels ($p=0.004$) and depression scores ($p=0.001$) in the COVID-19 infection group compared to the control group. The previously established excitatory-inhibitory balance (E/I) was disrupted ($p=0.056$, $r=0.317$). Additionally, depression scores and GABA concentration in the COVID-19 infection group showed a positive correlation ($p=0.026$, $r=0.366$), and Glx/GABA exhibited a negative correlation ($p=0.019$, $r=-0.384$).

Conclusion: The precise pathological mechanisms of "long-term COVID" remain incompletely understood. Our study suggests that in patients post COVID-19 infection, elevated GABA levels beyond normal may trigger a range of neuro-psychiatric symptoms and emotional changes by disrupting the excitatory-inhibitory balance. The implicated physiological processes include the activation of the transporter protein TSPO and the initiation of long neural circuits within the brain.

Developing Patterns of Network Controllability in first episode drug-naïve schizophrenia patients

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Purpose: Schizophrenia typically manifests in late adolescence or early adulthood, making early-stage patient studies crucial for untainted insights into brain function, free from antipsychotic medication effects. Prior research, while identifying functional deficits through regional and network abnormalities, has paid limited attention to network controllability. This study delves into controllability—a measure of the brain network's ability to transition between states, particularly modal controllability, which is associated with significant brain state changes. The aim is to uncover network controllability deficits in early schizophrenia, isolated from medication influences.

Methods: The study involved 135 first-episode, drug-naïve schizophrenia patients (ages 16-30) and 119 matched healthy controls. Resting-state fMRI data were collected using a 3-T GE scanner, with DPAS software for data preprocessing and functional connectivity analysis. Regional modal controllability was assessed using Linear Mixed-Effects Models (Controllability - Category + Gender + Age + Edu + Category*Gender + Category*Age + Category*Edu), and inter-group comparisons focused on these controllability measures and their age-related changes.

Results: Significant differences in regional modal controllability were found in the left inferior parietal gyrus between schizophrenia patients and healthy controls ($p=0.02$). Schizophrenia patients showed a decrease in regional modal controllability with age, in contrast to an increase in controls. The comparison of age-related changes in regional modal controllability showed a significant difference between diagnostic groups ($p=0.009$).

Conclusion: Early-stage schizophrenia is characterized by abnormal network development patterns, notably decreased regional modal controllability in the left inferior parietal gyrus. This study highlights the importance of examining brain network dynamics in early schizophrenia without the confounding effects of medication.

Does Correction factor based T10 atlas help to achieve quick and improved K^{trans} computation? a feasibility study

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Introduction: The ultrafast dynamic contrast-enhanced magnetic resonance imaging (DCE-MRI) used for Pharmacokinetic (PK) analysis is an effective method to predict benign and malignant tumor. Attempts have been made to achieve an accurate K^{trans} by correcting T_{10} , a major factor that influence K^{trans} computation.

Purpose: The purpose of this study to develop a correction factor atlas database at every spatial-location (x,y coordinate) in both side of the mMR breast coil cuff space to improve T_{10} homogeneity in the reference method using multiple tube phantom by SW based automation.

Method: Both multiple tube phantoms (61 tubes in each phantom) and patient's studies were acquired on simultaneous PET/MRI Biograph mMR system (Siemens, Erlangen, Germany) by using 4 channel mMR breast coil. Each spatial location correction factors (2916 each side, total 4392 correction factors) derived from multiple tube phantom were assign to an inhouse developed software (Radvista, version 3.2.95) that compute K^{trans} in few seconds. A retrospective analysis of DCE-MRI data acquired for 60 seconds of 146 patients with mean age of 50 years (24-80 years) having 178 enhancing histologically proved breast lesions forms the material of the study.

Results: Corrected and non-corrected ROC curve analysis revealed a mean K^{trans} , v_e value of 1.52 min^{-1} , 0.44 & 1.16 min^{-1} , 0.34 respectively. The sensitivity, specificity and overall accuracy of K^{trans} for non-corrected data were 89.06%, 74.00% and 84.83% respectively and for corrected data it was 89.84%,

86.00%, and 88.76% respectively. The AUC of corrected data was improved to 0.927 (95% CI 0.878 to 0.960) from 0.893 (95% CI 0.839 to 0.935) for non-corrected data.

Conclusion: Spatially normalized T_{10} values derived from correction factor based T_{10} atlas in a reference method can provide a quick estimation of K^{trans} with improved diagnostic accuracy.

Prevalence of workplace-related burnout among diagnostic radiographers at selected public and private radiography departments in the Eastern Cape, South Africa

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Background/Purpose: Constant profession advances, a broad scope of practice, and the work setting contribute to occupational stress which increases radiographers' risk of workplace-related burnout. This can have negative consequences for radiographers' social and psychological wellness, patient safety, and service delivery. The prevalence of workplace-related burnout among diagnostic radiographers is not well-researched in South Africa. Thus, this study aimed to contribute to this knowledge gap.

Methods: An exploratory-descriptive, cross-sectional survey design was used. Diagnostic radiographers (n=29/35; 82.86%), at two research sites, participated. Data collection was through an electronic self-reporting questionnaire based on the burnout assessment scale (BAT). Data analysis was done as prescribed for the BAT scale: distribution frequencies, proportions and norm-referencing to determine the categorisation of scores as very high, high, average, and low.

Results: There was a high prevalence of the core symptoms of workplace-related burnout (44.83%), while the secondary symptoms prevalence was average (48.28%). Three core burnout symptoms contributed to the high burnout score: exhaustion (55.17%), mental distance (37.93%), and emotional impairment (48.28%). The overall cognitive impairment score was average, with the majority of participants scoring low and average (58.62%). Headaches (17.24%) and muscle pain (44.83%) were the most frequently experienced psychosomatic complaints. While a tendency to worry (37.93%), feeling stressed (37.93%), and being disturbed by noise and crowds (34.48%) were the most prevalent psychological complaints identified.

Conclusions: The prevalence of workplace-related burnout was high. Participants demonstrated exhaustion and mental distance, but the lower cognitive impairment score indicates a sense of organisational commitment. Strategies need to be considered to promote workplace wellbeing to mitigate the development of burnout. Workplace-related wellness and wellbeing strategies would be beneficial as the participants noted work stress as their primary stressor.

Water-excitation improves the image quality of diffusion-weighted MR imaging in esophageal cancer: Comparison with spectral attenuated inversion recovery diffusion-weighted imaging

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Purpose: To determine whether water-excitation (WE) in diffusion-weighted imaging (DWI) can improve the image quality in patients with esophageal cancer compared with standard spectral attenuated inversion recovery (SPAIR).

Materials and methods: Twenty-two patients Clinically diagnosed with esophageal cancer were enrolled in this study. For each patient, both WE-DWI and SPAIR-DWI were performed using a 3T MR scanner. Two radiologists independently assessed the overall image quality, homogeneity of fat suppression, lesion conspicuity and artifacts of two sequences by using a four-point scale. The quantitative apparent diffusion coefficient (ADC) value, signal-to-noise ratio (SNR) and contrast-to-noise ratio (CNR) were also measured and calculated on the largest slice of the tumor. The interobserver agreement was evaluated using a weighted Kappa test and the respective intraclass correlation coefficient (ICC). Comparisons of the quantitative and qualitative parameters were performed using the paired t-test and the Wilcoxon signed rank test.

Results: The interobserver agreement between two independent radiologists was good for qualitative assessments (weighted kappa value 0.626-0.760) and quantitative evaluations (ICC : 0.768-0.968). The overall image quality, homogeneity of fat suppression and lesion conspicuity of WE-DWI were all significantly higher than those of SPAIR-DWI (all $p < 0.001$). There was no significant difference in artifacts scores between the two sequences ($p = 0.093$). The SNR and CNR were all higher in SPAIR-DWI than those in WE-DWI (all $p < 0.05$). There was no significant difference between WE-DWI and SPAIR-DWI with regard to mean ADCs of the tumor ($p = 0.101$)

Conclusion: Diffusion-weighted imaging with water-excitation is a clinically useful technique to improve the image quality for the purpose of evaluating lesions in patients with esophageal cancer.

A Comparative Analysis of Transcranial Doppler and Magnetic Resonance Imaging for Stroke Detection in Pediatric Patients with Sickle Cell Disease

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Background/Purpose: Sickle cell disease (SCD) poses a significant risk of stroke in pediatric patients, with estimates indicating an 11% likelihood of stroke occurrence before the age of 20. Early detection is crucial for timely intervention and prevention of recurrent stroke. This study aims to compare the efficacy of transcranial Doppler (TCD) and magnetic resonance imaging (MRI) in identifying stroke risk in pediatric SCD patients.

Methods: A retrospective analysis was conducted on TCD reports containing the keyword 'sickle cell disease' from January 2014 to August 2019 at the Royal Children's Hospital, Melbourne. Inclusion criteria encompassed children aged 0 to 18 years with subsequent MRI examinations within 12 months. TCD and MRI protocols, including criteria for TCD according to the Stroke Prevention in Sickle Cell Anemia (STOP) protocol, were employed.

Results: The study comprised 12 pediatric patients (median age 8.5), with 16 TCD-MRI paired examinations. TCD demonstrated 100% sensitivity and 51% specificity in stroke detection. MRI revealed abnormalities in cases with conditional TCD results and identified incidental findings. False-positive results were attributed to TCD limitations.

Conclusion(s): TCD emerges as a sensitive screening tool for identifying stroke risk in pediatric SCD patients. However, its limitations necessitate cautious interpretation. MRI, while providing more detailed information, should be reserved for cases with inconclusive TCD results, neurological symptoms, or the need for further investigation. Early detection using TCD allows for prompt intervention, reducing the impact of neurological deficits in SCD children.

The application of magnetic resonance MAGIC technique in preoperative grading of brain gliomas

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Objective: The research aimed to utilize the Magnetic Resonance Image Compilation (MAGIC) technique, featuring multi-contrast one-stop relaxation quantification technology, for the preoperative grading of brain gliomas. The objective was to ascertain the capability of MAGIC in distinguishing between high-grade glioma (HGG) and low-grade glioma (LGG) based on quantitative MRI parameters.

Materials and Methods: A retrospective analysis was performed on 22 cases with confirmed glioma diagnosis through surgical pathology. The cohort included 13 cases (59.10%) of HGG and 9 cases (40.90%) of LGG. All patients underwent MRI scans pre- and post-contrast enhancement using the MAGIC technique. This allowed for the measurement of quantitative T1 (qT1) and T2 (qT2) values both within the tumor parenchyma and in a 1 cm perimeter surrounding the tumor, facilitated by automatically generated T1 and T2 maps.

Results: The study found a marked difference in post-enhancement qT1 values between HGG (688.44 ± 143.79) and LGG (1189.37 ± 592.37), with a statistically significant P-value below 0.05. Additionally, a significant contrast was observed in the percentage change of T1 values post-enhancement between HGG (127 ± 68)% and LGG (58 ± 63)%, again with a significant P-value. The other measured parameters within the tumor core and its perimeter did not exhibit statistically significant differences. The diagnostic accuracy, as determined by the area under the Receiver Operating Characteristic (ROC) curve, was 0.786 for both post-enhancement qT1 values and the percentage change in T1 values, with respective sensitivity and specificity values based on optimal thresholds.

Conclusion: The MAGIC technique's post-enhancement qT1 values and the percentage change in T1 values after enhancement present reliable metrics for differentiating HGG from LGG. These quantitative imaging biomarkers offer valuable contributions to the preoperative grading of gliomas, potentially guiding clinical decision-making.

Patients' Health Literacy for Radiological Procedures and Examinations

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Background: Health literacy is crucial in healthcare as it influences an individual's ability to make well-informed health decisions, resulting in better health management and outcomes. Limited health literacy has been linked to poor health outcomes, such as increased mortality risk, morbidity, and complications. This presentation will provide an overview of an integrative review that investigated patients' knowledge and understanding of a scheduled radiological procedure and the barriers that inhibit good health literacy in radiology patients.

Methods: A systematic search was conducted using the electronic databases: Medline, EMBASE, and CINAHL. The keywords used were "health literacy", "patient knowledge", "before", "radiolog*", and "exam*". The review included literature that investigated patient knowledge regarding radiological examinations such as general radiography, computed tomography, mammography, and interventional or fluoroscopy, written in English and published between January 2013 and May 2023.

Results: A total of 1,728 studies were initially identified from Medline, EMBASE, and CINAHL. Fifty-one of which met the criteria for this review and were eligible. Four key themes regarding patient knowledge

before their appointment were distinguished: 1) Patient preparation awareness; 2) General knowledge and information received; 3) Radiation exposure estimation; 4) Risk perception.

Conclusions: There is a significant gap in patients' knowledge about their scheduled radiological appointments in general. Certain barriers exist which hinder patients from effectively acquiring satisfactory knowledge. This included their passive approach to health decisions and low education level. Patients heavily rely on healthcare professionals, especially their referring physician, to provide them with the necessary information.

Coexisting Management and Professional Skills in Radiology Technologists

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Background and Purpose: In the past, the development of professional skills by medical practitioners has greatly benefited patients. Currently, management skills, which should be developed in balance with professional skills, seem to have been neglected. The increasing imbalance between these two skills has rendered communication between healthcare professionals and patients, and among healthcare professionals increasingly difficult. This study was conducted to clarify the current status of management and professional skills among radiology technologists and to explore solutions to the imbalance problem.

Methods: This literature review examines previous studies, focusing on the views of the various authors regarding management skills. The subsequent interview survey included a total of 17 participants with professional training in radiology working at seven medical institutions nationwide (seven department heads and nine subordinates, and one former director of the Japan Radiological Technologists Association, who was added to supplement the analysis).

Results: Management skill enhancement requires learning, teaching, and mentoring. Some universities and other educational institutions have focused on the importance of management skills and are making efforts to focus on collaborative education of many professions. However, some staff members have reacted negatively to progressive initiatives such as "reassignment to other departments," including open communities with diversity. Clarification of the reasons for such negative reactions is the subject of this study.

Conclusions: A demonstrated need exists to enhance professional skills in radiology. Radiology technologists are not AI; they are flesh-and-blood people in the workplace, and workplaces require management skills. Professional skills can be augmented with management skills. However, it is not possible to augment management skills with professional skills.

Findings of energy spectrum CT in anterior talofibular ligament injury of ankle joint

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Objective: To evaluate the diagnostic value of energy spectrum CT in structural injury of anterior talofibular ligament using MRI as reference standard.

Methods : 50 patients with ankle injury were scanned by DECT and MRI. The articular surface was analyzed. CT and MRI images were independently evaluated by two diagnostic physicians. Using MRI as the reference standard, the diagnostic ability of energy spectrum CT and MRI was compared. The

consistency of MR And CT conclusions was evaluated. Energy spectrum CT adopts virtual decalcification technology. 80keVCT value and mixed keV value were used in MRI.

Results: The 80keVCT value, mixed keV value and Rho value of EDCT before the tear of talofibular ligament were significantly lower than that of intact ligament. The optimal critical value was 80keV and CT value was 65HU. The mixed keV value was 64.5. There was no difference in diagnosis between MRI and DECT.

Conclusion: DECT is accurate and reliable in the diagnosis of anterior talofibular ligament tear.

A preliminary study of deep learning-based compressed sensing accelerated mDIXON for segmented coronary adipose tissue evaluation in patients with suspected coronary artery disease

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Background: The secretion of dysfunctional PCAT is positively correlated with coronary artery stenosis, degree of calcification, and plaque progression. It is important to develop novel clinical diagnostic tools for coronary heart disease based on PCAT assessment. Homsy et al. introduced and validated coronary magnetic resonance angiography (MRA), based on the three-dimensional (3D)-modified Dixon (mDIXON) technique, for epicardial adipose tissue quantification. Therefore, the present study was to use non-contrast-enhanced compressed sensing artificial intelligence framework 3D mDIXON coronary MRA for PCAT [quantification](#) in patients with suspected CAD. It also evaluated segmented PCAT's relationship with coronary plaque characteristics and stenosis severity.

Methods: The study protocol was approved by the institutional ethics committee of the hospital. We included 35 symptomatic patients with CAD (111 arteries with plaque, 169 without plaque) (Figure 1). All the subjects underwent CMR on a 3T clinical MR scanner to evaluate segmented PCAT volume and fat-fraction of 8 coronary segments. We manually traced the segmented PCAT volume, and calculated the fat fraction of the segmented PCAT by formula: only fat images (F)/F + only water images (W). We compared the segmented PCAT volume and fat-fraction across 8 coronary segments with different plaque types and degrees of stenosis defined with CCTA and explored the relationship between them.

Results: The coronary segments with plaques had a higher segmented PCAT volume and fat-fraction than those without plaques. Meanwhile, segmented PCAT volume around mixed plaques was larger than non-calcified or calcified plaques ($p = 0.014$ and $p < 0.001$) (Figure 3). There was a moderate correlation between the segmented PCAT volume and plaque type ($r = 0.493$, $p < 0.001$). The fat-fraction had similar results ($r = 0.480$, $p < 0.001$).

Conclusion: The non-contrast-enhanced, whole-heart coronary MRA framework with CSAI is able to measure segmented PCAT volume and fat-fraction. The segmented PCAT volume is more significantly associated with the coronary plaque characters than fat-fraction.

Multisequence MRI-based nomogram for prediction of human epidermal growth factor receptor 2 expression in breast cancer

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Purpose: Accurate identification of human epidermal growth factor receptor 2 (HER2) expression has a clinical significance for the diagnosis and therapy in breast cancer (BC). This study was aimed at developing a nomogram based on multi-sequence MRI (msMRI) radiomics signatures (RSs) and imaging characteristics to predict HER2 expression in BC.

Methods: 206 consecutive women diagnosed with invasive BC were retrospectively enrolled and randomly divided into a training set (n = 144) and validation set (n = 62). Tumor segmentation and feature extraction were performed on dynamic contrast-enhanced (DCE) MRI, T2-weighted imaging (T2WI), and apparent diffusion coefficient (ADC) map. Radiomics models were constructed using RSs, and radiomics score (Rad-score) was calculated. Rad-score and significant clinical-imaging characteristics were included in the multivariate analysis to establish the nomogram. The performance was mainly evaluated via the area under the curve (AUC) of receiver operating characteristic (ROC).

Results: Edema types on T2WI (OR = 4.480, $P = 0.008$), enhancement type (OR = 7.550, $P = 0.002$), and Rad-score (OR = 5.906, $P < 0.001$) were independent risk predictors for HER2 expression. Radiomics model based on msMRI (AUCs of 0.936 and 0.880 in the training and validation sets, respectively) was superior to those based on one sequence or dual sequences. With the combination of edema and enhancement types, the nomogram achieved the highest performance in the training set (AUC: 0.940) and validation set (AUC: 0.893).

Conclusion: Multisequence MRI-based nomogram could effectively predict the HER2 expression in BC.

A Case Study: Maxillofacial MRI of a Fetal with a Complaint of Narrowing of the Upper Alveolar Process

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Purpose: Tooth buds anomalies coincide with genetic disorders, and prenatal identification may contribute to a more accurate diagnosis. And fetal cleft lip and palate (CLP) is a common congenital facial malformation, which not only affects the appearance of children but also causes malnutrition in children with the difficulty of sucking milk. The purpose of the presentation was to improve the feasibility of fetal magnetic resonance imaging in visualizing intrauterine tooth buds alignment, CLP conditions and image quality.

Method: A 29-year-old pregnant woman was referred to our institution with an ultrasound report of a narrow upper alveolar process. We used 3.0T MRI Steady-State-Free-Precession (bSSFP) and Single-Shot Fast Spin-Echo (SS-FSE) sequences to examine this fetus for tooth bud abnormalities and CLP. Sagittal scanning is performed with the fetus swallowing amniotic fluid so that the tongue and palate are separated to better show the continuity of the hard and soft palate. The oblique axial position is scanned along the sagittal superior alveolar process to show the development of the tooth buds.

Result: Compared to the SS-FSE sequence, bSSFP sequence improves the SNR and contrast, and better shows the alignment of the tooth buds as well as the palate. It was finally confirmed that the fetus had a narrow upper alveolar eminence for abnormal tooth buds alignment (deciduous central incisor teeth, lateral incisor teeth and cusp incisors) and that there was no CLP.

Conclusion: The use of the bSSFP sequence to better shows fetal maxillofacial structures in the presence of amniotic fluid swallowing, also improves diagnostic accuracy and the diagnosis of associated syndromes.

ASSESSING THE DIAGNOSTIC REFERENCE LEVELS OF HEAD CT SCAN at GAROUA REGIONAL MEDICAL IMAGING CENTER

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Introduction: Diagnostic Reference Levels (DRLs) are benchmarks used in medical imaging to optimize radiation doses while maintaining diagnostic image quality. They have emerged as a critical tool in this endeavor, serving as benchmarks to ensure that radiation doses from CT scans are kept within acceptable limits without compromising diagnostic efficacy. This study focuses on establishing DRLs for head CT scans at the Garoua Regional Hospital.

Methods: A cross sectional study was performed from January to December 2022. Our sample included adult patients who have Head CT examination. Some variable parameters considered are: The patient age, sex, CT indications, the DLP, the CT DIvol, the voltage, rotation time and slice thickness. The DRL for each type of indication was defined as the 75th percentile of its PDL and CT DIvol

Results: 621 CT scan were analyzed revealing a male predominance (52.5%) and diverse indications, with strokes and traumas accounting for 27.2%. The mean age of patients was 42 ± 7 years (18 - 99 years), 37.8% were between 18 to 29 years old. The Dose distributions, specifically CT DIvol and DLP, are detailed for different protocols including strokes, non-vascular cases, sinus examinations, and angiography: 692 ± 243 mGy·cm, 669 ± 152 mGy·cm, 78 ± 23 mGy·cm, 320 ± 82 mGy·cm. The study highlights the prevalence of stroke and trauma protocols, emphasizing the need for tailored imaging approaches for diverse neurological conditions. Comparative analyses with international practices in Uganda and Ireland reveal variations in radiation dose metrics across locations and devices.

Conclusion: The findings underscore the importance of optimizing radiation doses while maintaining diagnostic efficacy. The study not only contributes to regional DRLs but also provides a foundation for enhancing patient safety, refining imaging practices, and promoting dose optimization strategies in head CT scans.

Evaluation of the usefulness of Vacuum-lock device for patient immobilization during lower extremity percutaneous transluminal angioplasty

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During Percutaneous trans-luminal angioplasty, the patient's uncooperative movements cause delays in the procedure time, and unnecessary radiation exposure. Therefore, in this study, we attempted to investigate the usefulness of the vacuum-lock device, which is usually used in radiation therapy, by applying it to interventional radiology patients. Three experimental groups were set up for this study. First, an Optical stimulated luminescence dosimeter was used on pig feet to determine the radiation exposure dose that changes when the vacuum-lock device is applied. Second, for patients who received the procedure on both legs, the vacuum-lock device was applied only to one side and NOT to the other side. Afterwards, the captured images were compared. Third, in the case of a patient who received the procedure on only one leg, the vacuum-lock device was applied before percutaneous transluminal angioplasty, and the device was removed after ballooning was completed. We compared the images before and after applying the device. When vacuum-lock device was applied, the average core dose increased by 0.24 mSv compared to the case without it, and the surface dose increased by 0.29 mSv.

As a result of examining the difference in radiation exposure due to the application of vacuum-lock device, it was found that there was no significant difference in the deep dose and shallow dose that the patient received due to the application of the vacuum-lock device. A study was conducted on 20 patients to prove the hypothesis that the patient's movements would be inhibited by applying the Vacuum-Lock Device. As a result, 14 of the 20 patients studied showed differences before and after applying the Vacuum-Lock Device. It was found that there was a significant effect on movement inhibition.

Dosimetric comparison between two techniques (VMAT & Hybrid) used in ring-based and c-armed linear accelerators with hypo-fractionated scheme in Synchronous Bilateral Breast Cancer (SBBC) radiotherapy

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Purpose: The purpose of this retrospective study was to evaluate the dosimetric performances in using Volumetric Modulated Arc Therapy (VMAT) in a ring-based linear accelerator (HAL-VMAT) and a c-armed linear accelerator (TB-VMAT, H-IMRT) and Hybrid-Intensity Modulated Radiation Therapy (H-IMRT) technique in a c-armed linear accelerator for the treatment of Synchronous Bilateral Breast Cancer (SBBC).

Methods: Ten previously treated patients with Grade I to III SBBC were replanned with HAL-VMAT, TB-VMAT and H-IMRT. A hypo-fractionated dose regimen of 40.05Gy in 15 fractions was prescribed to the Planning Target Volume (PTV) for all generated treatment plans. Plan quality such as target coverage, Conformity Index, Homogeneity Index, dose and dose volumes to Organs-at-Risks (OARs) and delivery efficiency were evaluated and compared among the three techniques.

Results: Both HAL-VMAT and TB-VMAT plans showed statistical significance in PTV coverage when compared with H-IMRT plans and V_{100} in HAL-VMAT, TB-VMAT and H-IMRT were 97%, 97% and 95%, respectively ($p < 0.05$). Although comparable target coverage was achieved in VMAT plans, HAL-VMAT showed lower doses to Mean Heart Dose (MHD), V5 of Left Anterior Descending Artery (LAD) and Right Lung (RL) when compared with TB-VMAT (MHD = 4.3Gy vs 5Gy, $p = 0.005$; LAD V5 = 63% vs 71%, $p = 0.047$; RL V5 = 63% vs 65%, $p = 0.007$). Moreover, HAL-VMAT delivered with the shortest average Beam-On Time (BOT) among the three techniques (HAL-VMAT : 2.42 minutes, TB-VMAT : 3.41 minutes, H-IMRT: 3.25 minutes, $p = 0.005$).

Conclusions: Using VMAT technique in treatment with a ring-based linear accelerator attained its superiority in dosimetric performances by demonstrating its sufficiency in target coverage, significant reduction of low dose volume for LAD and lungs, and efficiency in treatment delivery.

Cancer outcomes of head and neck cancer predicted by multi approaches using machine learning approaches

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Background: Head and neck cancer (HNC) has been causing several thousands of deaths annually in Hong Kong. Accurate cancer prognosis can allow physicians to design a personalized treatment to lower

the mortality rate. Significant breakthroughs in Artificial Intelligence (AI) technology have opened a lot of opportunities in the development of cancer prognosis. Traditionally, it has to be done with the consideration of TNM staging and biopsy is required. With the advancement in computer technology, invasive procedures can be skipped with the application of radiomics. Recent research has successfully demonstrated that the use of radiomics and machine learning could indeed achieve an accurate result in cancer prognosis prediction.

Method: In our research, we adopt multiple machine learning approaches, that include Random Forests, deep learning technique, Gradient Boosting and clinical factors for evaluation of cancer outcomes. The clinical data were download from TCIA image database. We use 3D slicer and program developed by the research team to extract multi factors.

Result: The performance of these machine learning approaches can vary depending on the quality and size of the dataset, the choice of features, and the specific problem being addressed. The proposed model will be evaluated under the receiver operating characteristic (ROC) curve to understand its sensitivity, specificity and accuracy.

Conclusion: The Multi-approaches method offer a promising avenue for predicting cancer outcomes in head and neck cancer, and ongoing research in this field continues to improve the accuracy and reliability of these predictions.

Assessment of variable helical pitch scan protocol for preoperative evaluation of transcatheter aortic valve implantation with automated software tool

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Objective: To evaluate variable helical pitch (VHP) protocol for pre-intervention evaluation of transcatheter aortic valve implantation (TAVI).

Methods: 60 patients (M/F 39/21, Mean age 59 ± 13 years) with aortic valvular disease who underwent CT scan for preoperative assessment of TAVI were randomly divided into two groups. Group A, performed VHP scan mode with ECG-gated scans for chest area by non-ECG-gated abdominal scans. Contrast agent: kg * 1.0 ml, flow rate 4.0 ml /s. Group B used conventional two injections protocol to scan retrospectively ECG-gated CTA of the aortic root and heart (Contrast agent: kg * 0.7 ml, flow rate 4.5ml / s) and non-ECG-gated CTA of the aorta / iliac artery / femoral artery respectively (Contrast agent: kg * 1.1 ml, flow rate 3.0 ml / s). Statistical analysis was performed on the image quality, radiation dose, software measurement report, and contrast agent usage of the two sets of data.

Results: There was no statistically significant difference ($P > 0.05$) in the CT values of the thoracic aorta, abdominal aorta, coronary artery, and iliac artery between the two sets of images. After post-processing analysis using 3mensio software, both sets of scanning data were able to evaluate the patient's peripheral vascular access, sinus height, degree of coronary artery stenosis, and measure the diameter of the ascending aorta, aortic root, and aortic ring. In terms of patient radiation dose, Group A ($DLP = 706.4 \pm 49.1$) showed a significant decrease compared to Group B ($DLP = 923.8 \pm 56.6$) ($P < 0.001$). The usage of the two groups of contrast agents was statistically significant ($P < 0.001$).

Conclusion: The "one-stop" scan using the VHP protocol for preoperative TAVI evaluation can significantly reduce the radiation dose and contrast agent consumption without affecting the image quality and measurement data, which show great potential value in clinical routine for TAVI preoperative evaluation.

BENEFITS OF TEST-BOLUS TECHNIQUE FOR CTPA IN COVID-19 PATIENTS WITH SUSPECTED PULMONARY EMBOLISM

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Background / Purpose: This study aimed to investigate the effectiveness of the test-bolus technique application for Computed Tomography Pulmonary Angiography (CTPA) in COVID-19 patients by analyzing contrast media volume and radiation dose reduction, and image quality.

Methods: This is a retrospective study of 32 CTPA images from Hospital Al-Sultan Abdullah (HASA) (Group A) and University Malaya Medical Centre (Group B) with clinical suspicion for PE from 1st February 2021 to 1st May 2021. Group A (N=16) received test-bolus technique (35ml of 370mg/l at 5ml/s) and Group B (N=16) received bolus-tracking technique (50ml of 370mg/l at 5ml/s) and were scanned by 128-slice Siemens Somatom Definition AS (Siemens Healthcare, Forchheim, Germany) CT scan machine. For analysis, subjective image quality was done by two board-certified radiologists independently (both 7 years' experience) using a 5-point Likert's scale at an axial image at the level of the pulmonary artery. Objective image quality analysis was done by measuring contrast enhancement at the MPA, RPA, LPA, left upper and lower lobe PA, apical segment artery and vein, basal segment artery and vein. The CTDI_{vol}, dose-length product (DLP) and Effective dose (E) were measured. The volume of contrast media was recorded.

Results: Group A mean contrast volume was (38.13ml ± 2.5ml) compared to Group B (56.25ml ± 8.85ml), ($P < 0.005$), leading to a 32.21% contrast reduction ($p = 0.000$). 8.8% of dose increase in mean CTDI_{vol} in group A (16.45mGy ± 3.43mGy) compared to group B (15mGy ± 2.8mGy) ($p = 0.200$). For mean DLP and effective dose, the dose increase was 9.2% in group A (204.38mGy cm ± 47.42mGy cm), (3.27mSv ± 0.76 mSv) compared to group B (185.56mGy cm ± 16.97mGy cm), (2.97mSv ± 0.27mSv), with $p = 0.152$ each.

Conclusion(s): This study proved that the test-bolus technique application is effective in reducing contrast media volume usage for CTPA in COVID-19 patients with suspected PE.

The Evolution of Healthcare Cybersecurity and The Safeguarding of Patient Data in The Modern Age of Medicine

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Background/Purpose: Modern medicine is rife with the use of information technology (IT). Beginning with the introduction of hospital information systems around 1970, digital imaging modalities like computed tomography and magnetic resonance imaging in the 1970s and 1980s, Picture Archiving and Communication Systems and softcopy reading in the 1980s and 1990s, to the electronic sharing of

clinical information across regions, nations, or even globally today. The hospital has become a crucial tool for speedy, effective, and affordable communication. However, the expanding use of IT and the Internet in hospitals has also generated new issues, and one area that has grown in importance for hospitals is cybersecurity. To comprehend this challenge, it is crucial to undertake a thorough examination and meticulous study of its evolutionary journey. The evolution of healthcare cybersecurity reflects the changing landscape of healthcare delivery and technology, as well as the growing threats and challenges posed by cyberattacks.

Methods: A review of literature on the subject was conducted across Google, Google Scholar, journal articles, radiography and radiology websites as well as the Information and Telecommunication Union website. Words like the evolution of cybersecurity, cyberattacks in hospitals, cybersecurity in radiology, vulnerability, radiography, radiology, and medical imaging were used in the search.

Results: The health industry suffers some of the highest volume of cyberattacks and there are whispers of a lot to come. Combine these trends with the breach damage cost surpassing all other industries and a thunderous warning of a devastating cyberattack approaching the sector.

Conclusion: Healthcare organizations need to adopt proactive and comprehensive strategies to safeguard their data, such as implementing robust policies, standards, and protocols, conducting regular risk assessments and audits, educating and training staff and patients, and collaborating with other stakeholders.

Comparative study of image quality between T2-weighted FRFSE and PROPELLER based on respiratory patterns of abdominal MRI

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Purpose: To evaluate and analyze the image quality of the T2W propeller technique according to breathing patterns by comparing and analyzing the propeller / blade techniques during abdominal MRI examinations.

Subjects and Methods: A total of 238 patients (141 males:97 females) undergoing abdominal MRI examinations were analyzed. The equipment was GETM Signa Hdx 1.5T, the coil was 12ch Body Array, and Axial T2W FRFSE (Fast Recovery FSE) and Axial T2W PROPELLER examination techniques were performed. The groups were divided into 4 groups (A: more than 18 breaths, B: 13~17 breaths, C: less than 12 breaths, D: inconsistent breathing) according to breathing patterns. The images were quantitatively evaluated using SNR, CNR, and NRQA (non-referenced quality assessment), and qualitatively evaluated by two abdominal radiologists using a 5-point Likert scale. The results were statistically analyzed using R-Studio 4.3.1.

Results: In both quantitative evaluation (SNR, CNR, BRISQUE) and qualitative evaluation, the quality of Axial T2W FRFSE images in groups B and C was better ($p < 0.001^*$), and Axial T2W PROPELLER images in groups A and D were better ($p < 0.05^*$). However, there was no significant difference in SNR of group A among quantitative evaluation items and Ghost Artifact of group C among qualitative evaluation items.

Conclusion: In abdominal MRI examinations, the PROPELLER technique showed differences in image quality depending on the breathing method. It was found that the image quality of the PROPELLER technique was better only when the breathing rate was not fast or consistent for more than 18 breaths. Therefore, it is effective to use the PROPELLER technique appropriately according to the patient's breathing method during abdominal MRI examination.

Clinical Significance and Application Value of MRU in Patients with Iodine Contrast Allergy

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Purpose: This study aims to investigate the clinical significance and application value of performing Magnetic Resonance Urography (MRU) in patients with iodine contrast agent allergy, particularly those suspected of renal stones and bladder tumors.

Methods: A total of 30 patients with a history of iodine contrast agent allergy and concurrent urological disorders were selected for MRU examinations after thorough bowel preparation. Patients underwent bowel preparation one hour before the examination, consuming 1500 mL of water. Within the last hour, they drank 1200 mL of water within ten minutes, followed by retaining urine. Upon entering the examination room, the remaining 300 mL of water was consumed to ensure optimal distension of both kidneys, ureters, and the bladder. MRU examinations were conducted using T2W-TSE-Cor-BH, MR-Urogram, and MRU-3D sequences. Post-scan image processing and reconstruction involved saving 3D MRU images every 24 degrees in both coronal and sagittal planes. Diagnostic accuracy for conditions such as renal stones, hydronephrosis, ureteral stones, ureteral dilation or constriction, bladder stones, and bladder tumors was determined based on image descriptions and diagnostic reports.

Results: Of the 28 patients with examination requirements and adequate bowel preparation, MRU images demonstrated clear visualization of bilateral ureters, renal hydronephrosis, stone obstructions, and bladder conditions. Two patients with inadequate urethral preparation showed relatively clear visualization of bilateral ureters, renal hydronephrosis, stone presence, and bladder conditions.

Conclusion: In cases where patients have a history of iodine contrast agent allergy and are unsuitable for contrast-enhanced examinations such as IVP or CTU, MRU provides a non-invasive, precise, and intuitive alternative. Therefore, MRU examinations hold significant clinical relevance and application value for patients with iodine contrast agent allergy, particularly those suspected of renal stones and bladder tumors, emphasizing the necessity of conducting MRU examinations in such scenarios.

Motion scout trigger technique improves the quality of 3.0T MRI images of the fetal brain

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Purpose: Single-shot fast spin-echo (SSFSE) is the premier imaging and diagnostic sequence for fetal brain magnetic resonance imaging (MRI). This sequence is affected by maternal respiratory motion, and the repeated excitation of protons at some levels of the fetal brain partially leads to a high probability of cross talk artifact, which affects the image quality, especially at 3 Tesla. In this paper, we will explore the application of motion scout trigger technology to reduce cross talk artifact in SSFSE images and improve image quality.

Methods: 43 cases of fetal brain MRI scans were performed in pregnant women using SSFSE and motion scout trigger SSFSE scans in free breathing state, respectively to obtain axial brain images of the same fetus. Using self-control and paired t-test to compare the signal-to-noise ratio (SNR) and contrast-to-

noise ratio (CNR) uniformity of fetal white matter, and then evaluate the difference in image quality between the two groups.

Results: The SNR of free-breathing SSFSE and motion scout trigger SSFSE images were 99.93 ± 36.16 and 120.18 ± 44.58 ($P < 0.05$), and the CNR uniformity was 32.67 ± 21.07 and 7.00 ± 6.69 ($P < 0.05$), respectively. All differences were statistically significant.

Conclusion: Motion scout trigger SSFSE can significantly improve the signal-to-noise ratio of fetal brain MRI images and effectively reduce cross talk artifact. Therefore, it can clearly display the fetal brain structure and provide more effective information for diagnosis.

Dosimetric difference of urinary bladder and rectum in patients undergoing intracavitary brachytherapy for cervical cancer under Sedation and General anesthesia. A Case at Bugando Cancer Center and Ocean Road Cancer Institute

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Background: High-Dose-Rate Intracavitary Brachytherapy (HDR-ICBT) is a commonly employed treatment modality for cervical cancer, delivering a high dose of radiation directly to the tumour site while minimising exposure to the surrounding healthy tissues. Anaesthesia administration during HDR-ICBT varies, with some centre's using Sedation (CS) and others employing General Anaesthesia (GA). Despite the widespread use of these techniques their potential impact on dosimetric outcomes, particularly in urinary bladder and rectum, remains an area of interest and investigation. This study aimed to determine the dosimetric difference in the urinary bladder and rectum doses among cervical cancer patients undergoing HDR-ICBT under CS and GA. The research was conducted at Bugando Cancer Center (BCC) and Ocean Road Cancer Institute (ORCI) to compare the dosimetric outcomes between the two techniques (anaesthesia or sedation).

Methods: A total of 273 patients who underwent HDR-ICBT for cervical cancer were included in the study. Patients was divided into two groups based on the technique used during the procedure: 143 patients received GA, 130 patients received CS. Dosimetric parameters of urinary bladder and rectum doses were collected retrospectively and analysed using descriptive statistics and the independent samples t-test.

Results: The findings demonstrated a statistically significant dosimetric difference in the mean urinary bladder dose between patients treated under GA and CS ($p < 0.001$). Patients under GA received lower mean urinary bladder dose compared to those under CS. However, no statistically significant difference was observed in mean rectum dose between the two groups ($p = 0.689$).

Conclusion: Our study reveals that the choice of technique affects the urinary bladder dose during HDR-ICBT for cervical cancer. Patients receiving GA had a lower mean urinary bladder dose compared to those under CS. These findings emphasize the importance of considering anesthesia techniques during treatment to optimize dosimetric outcomes and patient safety in HDR-ICBT. Further investigations are warranted to validate and expand upon these results. Collaboration between radiation oncologists and anaesthesia team is crucial to enhance treatment efficacy and minimize side effects during HDR-ICBT for cervical cancer.

Mobility of radiological technologists within the Asia Pacific: a comparative study between Japan and Australia

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Background: Facilitating international mobility among radiological technologists (RTs) has the potential to enhance clinical practice of individual practitioners, their host countries and their country of origin when they return home. The key to maximizing the benefits and managing drawbacks of such mobility lies in international cooperation and information exchange. This study investigated the licensing/registration systems for RTs to explore the possibility of promoting transnational movement for qualified RTs to practice within the Asia Pacific region.

Methods: Ten countries/regions in the Asia Pacific region were selected based on two primary types of licensing/registration systems: single and multiple registration. Invitations were extended to presidents of professional societies or board members from national registration bodies. Participants completed an initial questionnaire, followed by semi-structured interviews online. Data was analysed using thematic analysis. This presentation focuses on Japan and Australia, comparing the similarities and differences of a single and multiple registration respectively.

Results: In Japan, diagnostic imaging, radiation therapy, and nuclear medicine operate under a single license, while Australia requires separate registration for each of the three specialisations. In Japan, a diploma is the minimum education requirement, whereas Australia requires a bachelor's degree. Both countries offer licensing/registration pathways determined through individual assessments. Language was recognized as one of the main barriers in the mobility of RTs between the two countries.

Conclusions: The unrestricted movement of RTs between Japan and Australia is presently limited. Our ongoing analysis of the systems in the remaining countries/regions aims to inform and identify potential pathways for RTs to practice within the Asia-Pacific region. With appropriate policies and strategies in place, a well-established international movement has the potential to mitigate workforce shortages, enhance patient safety, and foster mutual development in clinical practice.

The novel phantom-less quantitative computed tomography for different CT machine systems: Bone mineral density quality assurance evaluation

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Background/Purpose: Quality assurance (QA) study is a significant research for bone mineral densitometry (BMD). Especially for quantitative computed tomography (QCT), such study was clinical practical as QCT bone density measurements were generally executed on different CT machines. This QA study aimed to evaluate quality parameters includes accuracy and precision of vBMD measurements by a novel phantom-less QCT (PL-QCT) on different CT machines. European spine phantom (ESP) was used as measurement reference in this study.

Methods: 10 CT machines and 100 patients were enrolled. For each CT machine, the ESP was scanned independently 10 times with repositioning under 120kV. CT data of 10 patients scanned on the same CT machine in the same day under 120kV were randomly selected for PL-QCT BMD calibration. An automatic algorithm was used for calibration region of interest (ROI) placement on soft tissues (muscle and fat) in PL-QCT software. ESP reference values by manufacturer were used as standard for BMD measurements evaluation.

Results: For all CT machines, the average of ten repeated ESP L1-3 vBMD measurements did not exceed $\pm 5\text{mg}/\text{cm}^3$ in comparison with ESP reference value. Only one CT machine failed to satisfy the $\pm 5\text{mg}/\text{cm}^3$ threshold for L3 segment. The linear regression of the three vBMD measurements for each CT scanner yielded a median SEE of $1.44\text{ mg}/\text{cm}^3$, with a range from 1.37 to $2.28\text{ mg}/\text{cm}^3$. The mean and range of the coefficients of variation measured by all CT scanners was approximately 0.12% (0.11 - 0.14%).

Conclusions: The deviations of BMD results on different CT machines are within the acceptable range. This novel PL-QCT was a reliable and applicable osteoporosis evaluation device, combining its benefits on retrospective screening, it could be a QCT technique worth promoting.

Quantitative Susceptibility Mapping for Distinguishing Progression from Treatment Response: Added Value to 3D Pseudo-continuous Arterial Spin Labelling Perfusion.

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Purpose: To assess the diagnostic value of quantitative susceptibility mapping(QSM), 3D pseudo-continuous arterial spin labeling(3D-PCASL) imaging and diffusion-weighted imaging(DWI) in distinguishing true progression(TP) from treatment response(TR).

Methods: 45 patients with glioblastoma(GBM) who showed newly appearing enhancing lesions after treatment were enrolled. All underwent examination including conventional MRI, QSM, 3D-PcASL and DWI sequences. Longitudinal MRI for 6 months follow-up or repeat surgery were used to define the diagnosis. We calculated the proportion of hemorrhagic foci for the enhancing-lesions (proQSM) on magnitude image and corresponding average magnetic susceptibility value(SUS) on QSM image. The maximum cerebral blood flow (CBFmax) obtained from ASL and minimum ADC value(ADCmin) generated from DWI were measured by placing 3–5 circular ROIs, receiver-operating characteristic(ROC) analyses were conducted to evaluate diagnostic performance.

Results: 28 patients were finally diagnosed with TP, and 17 patients were diagnosed with TR. The proQSM in the TP was significantly lower than in the TR(0.060 vs. 0.270 ; $p < 0.001$), The rCBFmax were significantly higher in TP(2.180 vs. 1.265 ; $p < 0.001$), and the rADCmin in the TP was lower than TR (1.229 vs. 1.432 ; $p < 0.05$), with the area under the ROC curve (AUCs) of 0.891 , 0.854 and 0.662 , respectively. Combining the two parameters with the highest diagnostic efficiency (proQSM_rCBF parameter), AUC can reach 0.952 , the sensitivity can reach 88.9% , and the specificity can reach 93.3% . Besides, there was a close negative correlation between proQSM and rCBFmax($r_s = -0.492$; $p = 0.004$).

Conclusion: QSM can be used as an imaging biomarker for distinguishing TP and TR. Combining the QSM and ASL can improve diagnostic performance.

Assessment Of Image Quality & Radiation Dose in Chest CT by Varying kVp, mAs & Pitch on 128 DSCT (Somatom Definition Flash, Siemens Healthcare) by Using PBU-60 Whole Body Phantom Kyoto Kagaku Ltd., Japan

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Introduction: Image quality is initially associated with increased patient radiation dose. Several methods were continuously evolved to mitigate effects. Dose reduction strategies used by radiologists and technologists in the daily performance of CT examinations include modifying scanning protocols and manipulating scanning parameters such as mAs, kVp, and pitch.

Aim: The present study aims to study parameters that may be used to achieve maximum image quality with a reasonable radiation dose.

Material and Method: The Study was Done on a Whole-Body Phantom PBU 60 from Kagaku Kyoto Ltd. on 128 SLICE DSCT SOMATOM Definition Flash (Siemens Health Care) in Nehru Hospital, PGIMER, Chandigarh and Imaging, PGIMER, Chandigarh. The scans were obtained from the apex of the lung to the lower section of the posterior costophrenic angle by varying mAs (100mAs, 150mAs, 200mAs, 250mAs, and 300 mAs), kVp (70kVp, 80kVp, 100kVp, 120kVp and 140kVp) and pitch (0.5, 0.8, and 1.0). **Results:** A total of 75 scans were acquired at acquisition 128 x 0.6mm by varying kVp, mAs and pitch and reconstructed to 10 mm and 1 mm for Multi Planner Reconstruction by using SAFIRE Excel by using medium Smooth Kernel (I30f Medium Smooth) for evaluating the Noise, Standard deviation, SNR and CNR. The radiation dose protocols were recorded for all examinations, including volume CT Dose Index (CTDIvol.) and Dose Length Product (DLP), provided automatically by scanner.

Conclusion: The phantom study shows that CTDIvol and DLP directly and significantly relate to mAs and kVp. CTDIvol and DLP vary pitch to 0.5, 0.8, and 1.0. SNR and CNR have no significant change ((p-value

>0.05)) by varying Pitch 0.5, 0.8 and 1.0. Dose reduction and Image quality play an important role in Computed Tomography. It is essential to maintain accuracy and reproducibility of Diagnosis and patient care delivery.

Altered reward circuit in adolescents with non-suicidal self-injury: a study on subcortical volume and lateralization index

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Purpose: This study aims to examine the structural characteristics of the reward circuit in adolescents with non-suicidal self-injury (NSSI), focusing on subcortical volume and lateralization index (LI). The objective is to shed light on the underlying mechanisms of NSSI within the reward circuits and provide structural evidence supporting its occurrence.

Methods: A total of 50 adolescents with first-episode NSSI and 33 healthy controls (HC) were enrolled. Clinical characteristics included the Self-Rating Anxiety Scale (SAS), Beck Scale for Suicidal Ideation (BSI), Brief Assessment of Cognition in Schizophrenia (BACS), and Ottawa Self-Injury Inventory (OSI). Subcortical volume segmentation was performed using Freesurfer software. LI quantified differences in left and right subcortical volume. Statistical analysis of clinical features, subcortical volume, and LI was

performed using analysis of covariance, Wilcoxon rank-sum test, and independent sample t-tests. Pearson or Spearman correlation was used to explore relationships between subcortical volume or LI and clinical characteristics.

Results: The NSSI group had higher SAS scores compared to the HC group. BACS scores in the NSSI group were lower than in the HC group. Compared to the HC group, the NSSI group exhibited reduced volume in the left accumbens, along with an increased LI of the accumbens. In the NSSI group, left accumbens volume was positively correlated with BACS scores, and LI of the accumbens was negatively correlated with BACS scores.

Conclusion: This study discovered a decrease in the volume of the left accumbens in adolescents with NSSI, providing structural evidence that supports the involvement of reward circuits in NSSI among adolescents. The observed alterations in subcortical volume and LI suggest a potential vulnerability in the left hemisphere among adolescents with NSSI.

Simultaneous Estimation of Bone Morphology and Fat Fraction Using General-purpose Magnetic Resonance Imaging

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Background / Purpose: Intravertebral fat degeneration may be a potential risk factor for bone fractures. Previously, measurements of vertebral morphological changes and fat fraction have been performed separately. However, separate measurements can lead to positioning errors, and with regard to X-ray examinations, an added factor of radiation exposure also exists. Our developed method allows for the simultaneous evaluation of bone morphology and fat fraction using magnetic resonance imaging (MRI), addressing the concerns mentioned above.

Methods: All examinations were performed on a 1.5 T MRI system. To obtain a bone image, multi-echo images with in-phase (i.e., echo time [TE], comprising 4 TE, ranged from 4.6–18.4 ms) were acquired. We generated a bone image by applying an inversion process to the sum of the four images. Additionally, by setting the initial TE of the multi-echo image to the opposed phase (i.e., TE, 2.3 ms), the fat fraction was calculated on a pixel-by-pixel basis. Furthermore, a field map was used to correct the inhomogeneity of the magnetic field within the in-plane using MATLAB 2023b.

Results: Images that enabled the evaluation of bone morphology similar to X-ray computed tomography were obtained from MRI. Using the in-phase images from multi-echo MRI also made it possible to evaluate trabecular bone. Additionally, opposed-phase images were used to calculate fat fraction images. By incorporating the field map into the analysis, obtaining a more accurate image of the fat fraction was possible without magnetic field inhomogeneity.

Conclusion: This method can be completed in a single imaging session, with minimal burden on the participant and no positional displacement, in a clinically useful manner.

Comparison of iodine quantification results accuracy between 3 different dual-energy CT systems: a phantom study

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Introduction: Dual-energy CT seems to be acquiring significant attention in the field of medical imaging. Iodine mapping, specifically, has emerged as a valuable application, enabling the quantification of contrast agent concentration throughout the images. CT users lack robust criteria to assess the accuracy of iodine maps generated by various CT systems. This study seeks to compare the performances of iodine quantification on 3 recent CT systems employing different emission-based technologies, positioned in our hospital.

Methods: A specific home-made phantom was used for this study, with 12 known concentrations of iodinated contrast agent: from 0.4 to 50.0 mgI/mL. Three different dual-energy scanners were tested: one employing dual-source technology and two systems equipped with Fast kilovolt-peak switching solution from two different manufacturers. Helical scans were performed for each system following specific spectral acquisition protocols. Eight acquisitions were performed for each concentration (mgI/mL) on each CT system, resulting in 24 measurements for each concentration and CT. Mean measured values were compared to the known concentrations, and the absolute quantification error (AQE) and the relative percentage error (RPE) were used to compare the performances of each CT.

Results: The obtained measurements' accuracy varied depending on the studied model but not on the acquisition mode. The quantification was more precise at high concentrations (≥ 5.0 mgI/mL). The accuracy of measured values at low concentrations (< 4.0 mgI/mL) varied considerably from one device to another.

Conclusions: We identified variability in the results accuracy depending on the CT model, with sometimes significant deviation. Therefore, a comprehensive evaluation of the performances of all CT systems may be necessary before routinely conducting iodine mapping. The radiographer role is to be attentive to the performances of imaging systems, especially when dealing with quantitative data such as iodine-quantification.

Optimizing Imaging Practices for ECMO-Supported Patients: Experiential Insights from Interdisciplinary Collaboration in Intensive Care

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Background/Purpose: The utilization of ECMO (Extracorporeal Membrane Oxygenation) has surged in intensive care units, particularly amid the COVID-19 pandemic, presenting unique challenges for imaging services. This work aims to optimize practices and consolidate solutions based on experiential insights to address the complexities associated with ECMO patient care and imaging procedures.

Methods: Drawing from experiential knowledge and interdisciplinary collaboration, this retrospective analysis explores adaptations in patient handling and imaging protocol for individuals undergoing ECMO support. Insights were derived from multidisciplinary discussions and feedback, focusing on ECMO-specific considerations and scan acquisition nuances.

Results: Collaborative efforts between imaging and intensive care teams identified crucial adjustments in patient management to mitigate risks effectively. Furthermore, insights into ECMO configurations and their implications on imaging procedures contributed to a reduction in non-diagnostic scans, thereby enhancing patient care, albeit persistent challenges.

Conclusion: Through experiential learning and interdisciplinary collaboration, practices can be optimized to minimize non-diagnostic scans and associated risks in ECMO-supported patients. Continual refinement of protocols based on experiential insights is essential for improving patient outcomes in this complex clinical setting.

Personalised motion management for Stereotactic Ablative Radiation Therapy to the Lung

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Background/Purpose: SABR is a mainstay treatment option for stage 1 lung cancer. Our service has offered lung SABR treatment for 10 years. Standardly, these patients are treated in free breathing, with breathing motion accounted for in treatment planning, via Internal Target Volume concept. For targets in lower lobes though, significant breathing motion could lead to larger target volumes and increased dose to surrounding healthy tissue. An alternative motion management approach is deep inspiration breath-hold (DIBH). In 2023, the service initiated a pilot study on Lung SABR in DIBH and undertook a retrospective audit assessing the reliability of target position in repeated breath-hold.

Method: The audit assessed the residual inter-breath-hold target repositioning variability for the first eight patients by analysing intra-fractional imaging (IFI) CBCT taken during treatment delivery in repeated breath-hold. From this data, the patient with the most variability was analysed further. Each of the four fractions were re-created in the treatment planning system, applying the residual positioning error from the respective IFI CBCT and a sum plan of these four plans was created to compare dose statistics to the original plan.

Results: This patient's overall largest errors were 0.76cm in longitudinal, 0.31cm lateral and 0.26cm vertical directions, all still within the planning target volume. The patient's setup was discussed within a multidisciplinary team. A plan review was performed by applying the daily residual errors to a "plan per fraction" and then summed to a final "treated plan" - all dose statistics were comparable to the original plan.

Conclusion: Lessons were learned from this complex patient and hence implemented. The re-calculation of this patient's plan with target position "as treated daily" provided reassurance that the Lung SABR in DIBH technique is a valuable alternative to SABR in free breathing.

Analyzing the Impact of BMI on Breast Cancer Setup Errors in Prone Position Radiation Therapy: A Comparison of Manual and Automated Image Matching

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In radiation therapy, the precision of patient positioning is crucial, particularly when using the prone position to minimize exposure to organs at risk (OAR). This investigation explores the effect of Body Mass Index (BMI) on setup errors in prone positioning, emphasizing the distinction between manual and automated image matching techniques. Data from 27 patients with normal weight and 88 overweight patients, treated from February to November 2023 with the VARIAN iX Linear Accelerator and assessed through weekly On-Board Imaging (OBI), were analyzed. Both manual and automated matching

methods were utilized to evaluate setup error (Laterolateral(X axis), Craniocaudal (Y axis), Anteroposterior (Z axis), Yaw)deviations, correlating these with the patients' BMI. The analysis demonstrated that in automated matching, patients with a higher BMI showed mean displacement values of 0.192 ± 0.2296 cm ($P<0.05$) in the X axis and 0.118 ± 0.3590 degree ($P<0.05$) in the Yaw axis, significantly higher than those with a normal BMI. Manual matching reinforced this finding, with a notable increase in displacement for higher BMI patients in the X axis, averaging 0.344 ± 0.2828 cm ($P<0.05$). These results reveal that patients with higher BMI face greater challenges in maintaining precise positioning during prone radiation therapy, potentially affecting treatment precision. This study shows the necessity for customized positioning strategies in prone radiation therapy for patients with higher BMI. By addressing these positioning challenges, it is possible to improve treatment precision and ensure more effective radiation therapy outcomes.

Thoracic bone density measured by automatic phantom-less quantitative computed tomography was a valuable opportunistic osteoporosis diagnosis tool during chest scan

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Background/Purpose: Routine physical exams often use a chest computed tomography (CT) scan to screen pulmonary nodules, generally it only includes thoracic vertebrae. Phantom-less quantitative computed tomography (PL-QCT) has advantage on retrospective bone mineral density (BMD) assessment, especially for chest CT scan. This study aimed to evaluate the performance of different single vertebrae and different thoracic vertebrae combinations in predicting osteoporosis or osteopenia.

Methods: 246 patients (mean age of 55.97 ± 14.91 ; 48% female) who underwent the whole abdominal computed tomography (CT) were involved in this retrospective study. The BMD of lower thoracic and lumbar vertebrae were measured by PL-QCT. Diagnostic performance measures and the receiver operating characteristic (ROC) curves for diagnosing osteoporosis and osteopenia were calculated. Average of L1 and L2 BMD was used as diagnosis standard value of osteoporosis and osteopenia.

Results: A total of 1230 vertebrae were measured for BMD via this PL-QCT system. The BMD of lower thoracic vertebrae decreased successively from T10 to L2. And the BMD of lower thoracic and lumbar vertebrae are highly correlated. To distinguish osteoporosis from non-osteoporosis (osteopenia + normal), the maximal area under the receiver operating characteristic curve (AUC) was 0.951 (BMD average of T10, T11 and T12). At the optimal threshold of 107.85 mg/cc, the specificity was 94.7% at the combination of the entire 3 lower thoracic vertebrae (BMD average of T10, T11 and T12).

Conclusions: During chest CT scan, BMD of lower thoracic measured by automatic PL-QCT could be a valuable opportunistic osteoporosis diagnosis tool as it has similar performance in comparison with its lumbar counterpart.

According to the use of bismuth shield during mammography examination A Study on the Change of Dose in Facial Area

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Introduction: As a way to screen for breast cancer. A mammogram will be performed. and the use of pressure methods and shields that reduce the thickness of the subject to reduce unnecessary doses. This study was conducted to compare the doses of bismuth shield before and after applying to acrylic to see if it helped reduce the amount of exposure. It is the contact surface of the face.

Method: Dosimeters were installed in three areas of the acrylic surface of the mammography surface, and the radiation dose was measured before & after the bismuth shield was applied. Mammography conditions were measured by filter MO, 28KV/100mAs, and 28KV/100mA based on 4 cm thickness during medical lateral slope (MLO). The mean result was analyzed with SPSS Ver. 28, and if the P-value was less than 0.05, it was judged to be significant.

Result: Average value before applying the bismuth shield to the first point of 2.566uGy, Second point 10.89uGy, And Third point 3.859uGy. MLO photography was measured as 3.859uGy. Second point 9.998uGy, And Third point 47.27uGy before application. After applying the bismuth shield, The mean values after applying CC First point 69.66nGy, Second point 199nGy, Third point 212.66nGy. After applying MLO, It was measured as First point 61.33nGy, Second point 134.33nGy, And Third point 208.33nGy. In mammography CC, The mean dose change decreased by 97.22%. In MLO photography, The mean dose change decreased by 99.34%

Conclusion: Based on this study, It is thought that if applied to actual patients, exposure to the lens and thyroid, Which are sensitive to radiation, can be reduced, contributing to public health & health improvement

Initial clinical experience using a 6-dimensional (6D) positioning system with surface and thermal guidance for setup and intra-fraction motion management of partial-breast radiotherapy patients.

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Background: Surface-guided radiotherapy (SGRT) involves patient surface-tracking to reproduce setup and manage patient motion. Considering superficial location of breast tissues and primarily border-based 3D-conformal radiotherapy (3D-CRT) technique, we explored usage of a 6-dimensional (6D) positioning system with surface and thermal guidance for breast radiotherapy. Current utilisation of this 6D-system is restricted to stereotactic treatments requiring non-coplanar beams. This work aims to investigate the potential of an integrated surface-guided system for patient setup and intra-fraction motion management in partial-breast radiotherapy.

Methods: Data of six patients indicated for partial-breast 3D-CRT on FAST-Forward protocol between July to September 2023 were analysed. Daily setup using surface-based automatic positioning on 6D-

system preceded verification of field borders on skin. Daily imaging constitutes of Day 1 orthogonal imaging and beam's-eye-view (BEV) of glancing fields, and only medial glancing BEV on Days 2-5. 5mm institutional imaging protocol action threshold was adhered to. Setup errors of Day 1 orthogonal images were analysed. 6D data from continuous patient surface-monitoring during treatment were evaluated as intra-fraction motion variation.

Results: For all patients, 6D-system automatic positioning correlated with visual assessment of borders on skin. Mean setup errors of -0.50 ± 2.88 mm (longitudinal), -1.17 ± 3.06 mm (lateral), and -1.00 ± 3.35 mm (vertical) were well-within 5mm-action threshold. BEVs from Days 2-5 were also acceptable following surface-guided setup. Intra-fraction motion analysis demonstrated mean variation of -0.17 ± 0.91 mm (longitudinal), -0.09 ± 0.59 mm (lateral), and -0.27 ± 1.08 mm (vertical). Angular mean in roll, pitch and yaw were $0.08 \pm 0.33^\circ$, $-0.06 \pm 0.39^\circ$, $-0.05 \pm 0.33^\circ$ respectively.

Conclusion: Despite initial learning curve from tattoo-based to surface-guided setup, preliminary results substantiated by radiographic evidence validated institutional action levels and serve as a springboard for surface-monitoring action threshold implementation. Although larger sample is necessary, these promising results underpin benefits of partial-breast SGRT with potential for whole-breast radiotherapy.

Evaluation of the usefulness of the MV3D RECON technique with Bone Removal in CT Brain Angiography

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Purpose: The reproducibility of blood vessels in MIP 3D reconstruction of DSA images in CT brain angiography may be limited due to various factors. This study aims to analyze the factors causing image quality degradation and to evaluate the usefulness of Modified Vascular 3D Reconstruction (MV3D Reconstruction) using the bone removal technique.

Subjects and Methods: This study analyzed a total of 115 patients (52 men and 53 women) who underwent CT brain angiography at our hospital from January 23, 2023, to December 31, 2023, and experienced reduced image quality due to artifact occurrence. The Somatom Definition Force (Siemens Healthcare, Forchheim, Germany) was used as the examination device, and Syngovia (Siemens Healthcare, Germany) for image post-processing and reconstruction. Patients were divided into two groups based on the artifact type: Group A (motion) and Group B (vein reflux). The vascular reproducibility of DSA 3D reconstruction images and MV3D reconstruction images was qualitatively evaluated using a 5-point Likert scale.

Results: As a result, when MV3D Reconstruction is applied, the reproducibility of group A is 35% and group B is more than 50%. ($P < 0.01^*$)

Conclusion: Various factors contribute to the degradation of vascular image quality in CT brain angiography. The MV3D reconstruction method, incorporating the bone removal technique, improves the reproducibility of head and neck vascular images in cases of motion or venous reflux.

Clinical audit of Radiology department in central government hospital of Nepal

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Background: Equitable access to quality health services is a fundamental right of every citizen. As access to quality health services is an important domain of universal health coverage. Clinical audit is a crucial tool for maintaining a high standard of care in the hospital. This study aims to highlight the discrepancies between actual practice and standard in order to identify the changes needed to improve the quality of care and to implement the changes of Radiology department in central government hospital of Nepal.

Methods: A descriptive, cross-sectional survey encompassing central government hospital was conducted. A structured online questionnaire comprising 41 questions was employed and classified into 2 sections, encompassing demographic data and clinical audit tool. Microsoft Excel and SPSS V.25 were used to analyze the data, and frequencies were computed.

Results: Of the 31 central government hospitals in Nepal, 19 (61.3%) are located in Bagmati province. Six of the thirty-one hospital radiography staff members have completed at least BLS or ACLS training. There is no biomedical engineering support at 8 Hospital. Hospitals that have adopted RIS or PACS are 41.9%. There are no personnel radiation dose monitoring devices in 22 out of 31 hospitals. Only six hospitals provide staff members with recurring radiation protection training. In the imaging sector, 74.2% of hospitals have an obvious radiation hazard warning for expectant moms.

Conclusion: This study highlights the relatively medium level of clinical audit in central government hospital of Nepal. However, the identified lack of knowledge pertaining to the clinical audit emphasizes the need for further education and training in this area. To address this gap, we recommend the establishment of comprehensive orientation of clinical audit for radiology professionals. Encouraging equitable and high-quality healthcare will aid in achieving the Sustainable Development Goals (SDGs) through clinical audit.

Cardiac magnetic resonance evaluation of epicardial adipose tissue in hemodialysis patients

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Background: Epicardial adipose tissue (EAT) is a predictor of cardiovascular risk in the general population. However, the value of EAT in hemodialysis patients has not been fully validated. The aim of this study was to evaluate the correlation between EAT and cardiac structure and function parameters in hemodialysis patients, and to explore the relationship between EAT and dialysis age.

Methods: Forty patients with chronic kidney disease undergoing regular hemodialysis and five healthy volunteers were enrolled prospectively. All participants underwent cardiac magnetic resonance scanning using balanced steady-state free precession sequence. Images included continuous short-axis views covering the entire left ventricle, two-, three- and four-chamber views. Ventricular function parameters and epicardial fat volume were obtained by post-processing software. On the short-axis cine stack, EAT was delineated from the most apical to basal level of left ventricle at end-diastole. Fat volume was calculated by modified Simpson's rule, with body surface area corrected for individual differences.

Results: Compared with healthy volunteers, EAT in hemodialysis patients was significantly higher (40.7 ± 5.5 ml/m² vs. 62.8 ± 17.3 ml/m², $P < 0.001$). EAT was positively correlated with left ventricular end-systolic myocardial mass index ($r = 0.59$, $P < 0.001$) and left ventricular end-diastolic myocardial mass index ($r = 0.61$, $P < 0.001$). There was a negative correlation between EAT and left ventricular global

radial strain ($r = -0.33$, $P = 0.038$). There was no significant correlation between EAT and hemodialysis age ($P = 0.587$), left ventricular ejection fraction ($P = 0.086$), right ventricular ejection fraction ($P = 0.331$).

Conclusions: Hemodialysis patients have more EAT. EAT was significantly correlated with myocardial mass and global radial strain. Further studies are needed to evaluate the value of EAT in predicting cardiovascular events in hemodialysis patients.

The impact of artificial intelligence and robotics on radiologic technologists in interventional cardiology: A systematic review

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Background / Purpose: Artificial intelligence and robotics have emerged as a transformative force in the field of interventional cardiology, enabling novel approaches to address the complex challenges associated with treating the world's leading cause of death. This review thoroughly examines how the rising influence of artificial intelligence and robotics is transforming the responsibilities and functions of radiologic technologists considering the continually evolving capabilities of intelligent technologies.

Methods: A systematic literature review was used to identify, select, and critically appraise research to determine the impact of artificial intelligence in interventional cardiology. The literature reviewed was collected from the following databases: CINAHL, PubMed, Science Direct, and Medline. The search was limited to full-text and scholarly journals published between 2013 and 2023 in the English language. The literature search for this systematic review was performed using the Preferred Reporting Items for Systematic Reviews and Meta-analyses reporting guidelines.

Results: Advances in artificial intelligence in the catheterization laboratory are revolutionizing the way we process and interpret angiographic X-ray images, integrate them with other imaging modalities, and improve diagnosis and management. Intelligent systems, robotics, and innovative image-processing techniques are now making their way into interventional cardiology, leading to significant reductions in radiation exposure while enhancing diagnosis and management.

Conclusion: Radiologic technologists must continue to adapt and grow in response to the ever-evolving capabilities of intelligent technologies. As the adoption of artificial intelligence and robotics increases so too will the opportunities for radiologic technologists, but they must actively engage and participate to ensure they are not excluded from the implementation of artificial intelligence systems and the technologies they enable.

A critical analysis of personal radiation protection in the catheterization laboratory: A systematic review

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Background / Purpose: Over the last decade, there has been a growing body of evidence on the adverse health effects of occupational exposure to ionizing radiation from fluoroscopically guided procedures, including left-sided brain tumors, skin cancer, posterior subcapsular lens changes, and thyroid disease. It is assumed that traditional radiation protection equipment provides adequate protection from exposure

to scattered radiation. However, a growing body of evidence casts doubt on whether cath lab personnel exposed to ionizing radiation are being adequately protected.

Methods: A systematic literature review was used to identify, select, and critically appraise research to determine the efficacy of personal protection equipment currently worn in the catheterization lab. The literature reviewed was collected from the following databases: CINAHL, PubMed, Science Direct, and Medline. The search was limited to full-text and scholarly journals published between 2013 and 2023 in the English language. Articles were selected for inclusion based on relevance. The literature search for this systematic review was performed using the Preferred Reporting Items for Systematic Reviews and Meta-analyses reporting guidelines.

Results: The recurring theme in this literature review is that the orientation of the body to the source of radiation scatter appears to be critical and significantly reduces the effectiveness of personal radiation protection equipment in the cath lab.

Conclusion: The orientation of personnel who perform fluoroscopically guided procedures towards the source of scatter exposes them significantly to radiation. Traditional personal radiation protection aprons and equipment frequently provide inadequate shielding in the cath lab environment. Considering the increasing evidence highlighting the occupational risks associated with fluoroscopy, it is crucial to reassess personal radiation protection to ensure the safety and well-being of interventional teams responsible for life and limb saving procedures.

Establishment of Institutional Diagnostic Reference Level for Computed Tomography Coronary Angiogram

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Introduction: Computed Tomography Coronary Angiogram (CTCA) can be routinely performed using prospective or high-pitch ECG gating, acting as valuable diagnostic imaging tool for cardiovascular disease. However, one of the concerns associated with CTCA is the ionizing radiation. Establishing an institutional diagnostic reference level (DRL) for CTCA in adults is a valuable initiative to optimize radiation dose and ensure patient safety. The aim of the study is to establish institutional diagnostic reference level in CTCA for adult 16 years old and above.

Methods: One-year CT dose data of 232 patients above 16 years old regarding CTCA from 01 Jan 2022 to 31 Dec 2022 were retrospectively collected for analysis from existing dose-tracking software. CTCA comprises two parts of scans: calcium score and angiogram. Calcium score was performed with high-pitch ECG gated protocol while angiogram was performed with either prospective sequence protocol or high-pitch protocol based on the patient's heart rate. The data extracted included information on scan protocols, patient demographics and radiation dose parameters. Excel version 2016 was used to calculate the mean, 75th percentile, and 90th percentile of CT dose index (CTDIvol) and dose length product (DLP) distribution according to calcium score, prospective ECG-gated and high-pitch scanning protocols.

Result: The institutional DRL for CTCA for our CT units were established as mean (50th percentile) of CTDIvol (mGy), DLP (mGy.cm) for CT calcium score exam, prospective ECG-gated exam and high-pitch ECG-gated exam. Calcium score exam: (1.35 mGy), (25.15mGy.cm) respectively; Prospective ECG-gated exam: (18.43mGy), (251.55mGy.cm) respectively; High-pitch ECG-gated exam: (2.98mGy), (58.9 mGy.cm) respectively.

Conclusion: The study indicates that CTCA using High-pitch ECG-gated protocol results in much lower radiation exposure compared to the prospective ECG-gated protocol. The reported matrix offers a variety of dose information for quality improvement activities.

Knowing just Enough: Correlating Ultrasound Images with Other Imaging Modalities

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Background/Purpose: The purpose of this presentation is to inform sonographers about the importance of understanding/reading other imaging modalities to correlate or anticipate their ultrasound findings.

Methods: A Philips EPIC ultrasound machine was used to evaluate various ultrasound findings that were then correlated with or anticipated from another imaging modality.

Results: On different occasions the sonographer was able to develop an understanding of how pathological processes appear on other imaging modalities. In addition, the sonographer was able to gain knowledge on the layout of other imaging modalities which will be useful in providing the best patient care.

Conclusions: Sonographers should be able to identify normal anatomy, understand body orientation, and recognize abnormalities on other imaging modalities. In addition, they should be able to correlate ultrasound findings or anticipate their findings by viewing other imaging modalities prior to completing their ultrasound exam.

Digital Health: How should radiographers be trained when it comes to DH? The approach at Monash University

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Background: Digital Health (DH) is a fundamental principle of healthcare as technological advancements reshape healthcare delivery to enable safer, better-quality healthcare. There is much thinking to be done to consider how healthcare professionals of different types should be trained when it comes to DH to prepare a future-focused workforce. This is particularly crucial in medical imaging as radiographers operate in technologically rich environments. It is imperative that radiographers use DH technologies to optimise their techniques and understand their obligations when working in technologically rich environments.

Methods and results: The presentation explores the multifaceted approach taken toward embedding DH into the radiography curriculum at one University in Australia. It emphasises the application, challenges, and impact of DH education. The Faculty of Medicine, Nursing and Health Sciences, Faculty of Pharmacy and Pharmaceutical Sciences, and Faculty of Information Technology at Monash University worked to establish a curriculum framework with common education needs across all health professional degrees. DH education is integrated in a consistent yet tailored way. One of the most commonly reported challenges of DH education is the alignment of teaching, learning and assessment with real-world scenarios. We have addressed this by bringing real-life scenarios and expertise into the educational experience. Students wrestle with issues that present in medical imaging. The presentation will present a series of case studies to showcase this. A diverse range of DH assessment strategies have

been described in the literature. Assessment strategies that align with the unique characteristics of DH technologies must continue to be developed.

Conclusion: Integrating DH into healthcare education is imperative to prepare a workforce that can effectively operate in these environments. Teaching learning and assessment strategies that are authentic to real-life must be embedded in DH education in healthcare. There remains a need to develop standardised frameworks for assessment in DH.

Improved patient outcomes and risk mitigation in Emergency Departments using a hybrid Radiographer Comment model

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Background/Purpose: Verbal communication of medical imaging findings can be misinterpreted and lacks transparency. A hybrid model using radiographer comments and verbal notification to Emergency Departments (ED) was piloted across five hospitals for the more timely and safe communication of abnormal general x-ray appearances at point of care. Pilot data was evaluated to identify patient benefits and risks.

Methods: A multidisciplinary steering group advised on design and implementation strategies. The radiographer comments were transmitted from imaging consoles to ED dashboards and verbal calls provided to the ED doctor/referring team for critical/urgent conditions.

Radiographer comments (n=1102) were sent to five Emergency Departments (ED) by 69 radiographers (24/7) for a minimum of three months. Positive Predictive Values (PPV), reporting Turn Around Times (TAT) and clinically significant cases were collected at pilot sites. Radiographer comments were compared with radiology reports and classified as True Positive (TP), False Positive (FP) or indeterminate (ID) by two independent auditors. FP and ID comments were investigated with ED referrers and/or site radiologists. Risk assessments were conducted by two independent radiologists using low, moderate, high-very high categories. Radiology report discrepancies found incidentally were confirmed with ED doctors and further imaging data. Wilson Score Intervals determined confidence levels.

Results: The average pooled PPV was 0.96; (0.949 - 0.972; 95% CI). Incorrect comments (42) were analysed for potential harm; (3.9%; 95% CI: 2.9 - 5.3). A risk assessment for these demonstrated 37 low, five moderate and no high-very high-risk cases. 282 patient benefits (26.4 %; 95% CI: 23.8 – 29.1%) and 42 radiology report discrepancies were identified; (3.9%; 95% CI: 2.9 - 5.3).

Conclusions: The model is based on patient advocacy and has the potential to save lives. A quarter of patients benefited from radiographer comments. Risk mitigation was possible in 3.9% of cases. No adverse outcomes were reported.

Multimodal SVM Classification for Early-stage Alzheimer's Disease Diagnosis Using T1-weighted MR and F-18 FDG PET Imaging

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Alzheimer's disease is a significant global health challenge characterized by progressive brain degeneration associated with aging. Early detection is crucial for improved prognosis and treatment outcomes. Our study aimed to develop a support vector machine (SVM) classification model using T1-weighted MR and F-18 FDG PET brain imaging to classify cognitive normal (CN) and early-stage Alzheimer's disease, including early mild cognitive impairment (EMCI) and late mild cognitive impairment (LMCI), in individuals aged 65-75. The study comprised three steps. Firstly, image preprocessing involved uniformity processing, B1 bias field correction for MR images, and FWHM optimization with spatial/intensity normalization for PET images. Secondly, MR images were registered to the MNI305 brain template for structural segmentation, and PET images were normalized using the standardized PET template. Co-registration of normalized PET images to segmented MR images provided anatomical segmented PET uptake volumes. These served as input for the classification model. Thirdly, SVM models classified CN vs. LMCI, EMCI vs. LMCI, and CN vs. EMCI using MRI, PET, and combined PET/MR. Feature sets included all features, clinical-based features, and F1-score ranked features, resulting in 27 classification models. In CN vs. EMCI, combined PET/MR with all features achieved 0.71 AUC, 65.78% accuracy, and 68.67% specificity. For CN vs. LMCI, superior performance was observed with combined PET/MR using F1-score ranked features: 0.82 AUC, 77.78% accuracy, and 77.55% specificity. In EMCI vs. LMCI, PET alone with all features achieved the highest performance: 0.72 AUC, 69.23% accuracy, and 60.32% specificity. In conclusion, PET is pivotal in MCI stage differentiation, and using all features aids in challenging tasks (CN vs. EMCI and EMCI vs. LMCI). The combined PET/MR modality notably distinguishes CN from MCI, emphasizing the potential of multimodal imaging to enhance differentiating cognitive states in individuals.

An investigation of parental involvement in explaining imaging procedures to children in an Irish paediatric hospital

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BACKGROUND: Children often present for imaging displaying signs of distress and anxiety about their surroundings. Authors agree there are deficiencies in how this anxiety and distress is addressed. When children are anxious, the challenges in producing diagnostic images cannot be underestimated. Parents have a pivotal role in explaining examinations to children, as inherently they hold the utmost trust from their child.

PURPOSE: The current investigation determined measures taken by parents to prepare their child for imaging and considered the effectiveness of these measures.

METHODS: Parents of children aged two to sixteen were interviewed over nine days in one large, paediatric, city centre hospital. The interview established the content of parental explanations, sources of information from which parents drew their information, and parents' opinion of the child's tolerance of the examination. The 32 interview transcripts underwent thematic analysis. The accuracy and age

appropriateness of the explanations were considered, parental perceptions of child tolerance were analysed, and useful resources for future reference were considered.

RESULTS: Parents who talked to their children gave age-appropriate explanations. Parents consider practical information is important, including what rooms look like, the machinery, noises and lead coats. However, a majority of parents did not speak to their children about an examination in advance of arriving at the hospital. Parents perceptions of how well a child tolerates an examination are focussed on whether the examination is completed and an image produced rather than how well the child copes.

CONCLUSIONS: Presentation of information in easily noticeable, visual formats, especially within waiting rooms, could promote conversations between child and parent, and enable greater preparation of children for imaging. Information should emphasise the practical aspects of procedures. Radiographer initiatives are needed to educate parents that imaging procedures do not have to be stressful for children.

Comparison of image-guidance in proton and photon radiation therapy: Preliminary clinical experience

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Proton therapy (PT) has a unique depth dose profile (Bragg peak), where it is more superior than IMRT in target volume dose coverage and lower OARs doses. Proton is more sensitive to density and contour changes along the traversed beam as these would affect Bragg peak dose deposition and overall dosimetry. Geometrical uncertainties are crucial in affecting dosimetry for both IMRT and PT, however more detrimental for the latter as they affect proton's penetration range. To minimize these uncertainties, image-guidance in PT is essential. Hence, we aim to compare PT and IMRT image-guidance based on our early PT clinical experiences. From June 2023 to January 2024, 74 patients (7 brain, 32 head-and-neck (HN), 10 thorax-abdo, 18 prostate and 7 paediatrics) received PT in our centre. PT clinical imaging experiences were compared with departmental IMRT imaging protocols. IMRT (orthogonal kV and/or CBCT) used bone-based and soft-tissue-based registration. Soft-tissue-based registration is inevitable in PT (CBCT) due to additional need to focus on overall contours. Thus, low-dose contours acting as beam shape surrogates are also implemented in PT image registration for evaluation of overall contour match along individual beam path. In brain and HN cases, matching criteria and correction strategies are similar for IMRT and PT. However, additional attention is given to shoulder positions, sinuses filling and contour variations in PT HN image verification. Prostate and liver cases used CBCT matching for both treatment techniques. Furthermore in PT, additional real-time fiducial tracking is utilised to reduce intra-fractional motion. Image-guidance enables accurate target-alignment and monitoring of anatomical/contour changes to trigger adaptive replanning if required. To achieve proton's superior robust plan, surrounding anatomical structures must constantly be in the same position as planned in addition to precise target-alignment. Thus, 3D-volumetric imaging and 6D correction strategies are highly relevant in PT compared to IMRT.

The glow and grow treatment path in Hong Kong's first Proton center

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Background: The growth of Proton centers to provide radiotherapy services across Asia and Europe countries are escalating. The success in Proton therapy showed lesser side effect and improved dosimetric plans. Besides, the precise and efficient delivery to execute treatment plans added the glory to proton treatments.

Aim: In 2023 July, Hong Kong had its first Proton Centre in operation, sixty-nine patients had been treated until 2024 January. We aim to share the initial proton treatment experience during the last 6 months of operation.

Method: A number of different disease type including CNS, breast cancers, prostate cancers and lymphomas were treated. The first proton therapy center in Hong Kong is incorporated with HITACHI PROBEAT V, with two treatment rooms, each room had a half arc gantry and a 6D robotic couch. Clearance checks for possible collision and scheduled verification CT scans were arranged for all our proton therapy patients. The success of incorporating MR images for prostate cancers in our treatment image verification and the active-breathing control (ABC) to compensate the motion uncertainty in thorax region, had allowed us to facilitate precise treatment.

Results: A total number of sixty-nine patients were treated successfully with proton therapy. Twelve patients had daily MR verification, three patients had ABC proton treatment and there were six re-plans due to contour changes. Nine pediatric cases were treated and only one of them underwent anesthesia for the whole course treatment.

Conclusion: The success and glory of being the first proton therapy center in Hong Kong had lead us into a new era in radiation therapy. Despite the challenges in our initial setting up in proton therapy, the capacity of patients, especially pediatric cases would benefit in proton therapy is uprising.

FOCUS DWI and Deep Learning Reconstruction in breast MRI: A comparison with conventional DWI

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Purpose: To employ deep-learning based reconstruction (DLR) to improve the SNR of FOCUS DWI for breast imaging in Asian patients and investigate the feasibility and performance of reduced-FOV FOCUS DWI and FOCUS DWI with deep learning-based reconstruction (DLR) for breast MRI in Asian patients with small breast volumes.

Materials and methods: Forty-nine female patients suspected of having breast cancer from July 2023 to December 2023. They underwent breast MRI examinations using three sequences: Conventional DWI, Focus DWI, Focus-DLR DWI. Two radiologists independently assessed image quality using a 5-point Likert scale. They also outlined the lesions, calculating the signal-to-noise ratio (SNR) of the lesion, the Contrast-to-Noise Ratio (CNR) between the lesion and surrounding tissue, and the Apparent Diffusion Coefficient (ADC) of the lesion. Image scores, SNR, CNR and ADC were compared using the Friedman test.

Results: FOCUS-DLR DWI had higher scores in terms of the overall image quality, the anatomical details, lesion conspicuity, artifacts and distortion than conventional DWI ($P < 0.001$, $P < 0.001$, $P < 0.001$, $P < 0.001$, $P < 0.001$). The SNR of FOCUS-DLR DWI was higher than that of conventional DWI and FOCUS DWI ($P < 0.001$, $P < 0.001$), while there were no statistically significant differences between FOCUS-DWI and conventional DWI ($P > 0.05$). What's more, in terms of CNR values and ADC values, there were no significant difference among three sequences.

Conclusion: Our findings indicate that FOCUS DWI with deep learning-based reconstruction produces superior images than conventional DWI, enhancing the applicability of this technique in clinical practice. Deep learning-based reconstruction provides a new direction for optimizing DWI imaging techniques in Asian breast MRI.

Differentiation of Benign and Malignant Lymph Nodes using Ultrasound-based Radiomics and Machine Learning

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Background: The evaluation of lymph node characteristics is crucial for tumor staging and patient prognosis assessment, but cytological and histopathological examinations of lymph nodes are invasive and costly. This study aims to develop machine learning models for differentiating benign and malignant lymph nodes based on radiomics features of grayscale ultrasound images and patients' clinical characteristics.

Methods: Between 2021 and 2023, a total of 285 ultrasound images of lymph nodes were collected from 88 patients. The diagnosis of lymph nodes was confirmed by pathological examination. The image feature reduction process was done by student's t-test, Pearson correlation analysis, and Random Forest feature importance selection. Six well-established machine learning models, including Support Vector Machines (SVM), Stochastic Gradient Descent (SGD), k-nearest Neighbors (KNN), Random Forest, XGBoost, and LightGBM, were developed using a combination of patient's clinical features and radiomics features of ultrasound images. The cases were randomly divided into training and test sets in an 8:2 ratio, and the area under the receiver operating characteristic curve (AUC) was adopted to evaluate model performance.

Results: There were 135 malignant and 150 benign cases in this study, including neck and axillary lymph nodes. A total of 11 radiomics features and one clinical feature were generated after the selection process, and they were used to build the final model. The AUC values of the SGD, SVM, KNN, Random Forest, XGBoost, and LightGBM in differentiating benign and malignant lymph nodes were 0.817, 0.765, 0.746, 0.816, 0.766, and 0.747, respectively.

Conclusion: By utilizing machine learning models, particularly the SGD and Random Forest, it is possible for radiomics features from ultrasound images to effectively classify benign and malignant lymph nodes, thereby improving diagnostic efficiency.

Clinical Experience of a Commercially Available Bra for Immobilization in Breast Cancer Patients during Radiotherapy

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Purpose: Adjuvant radiotherapy is a common treatment regime for breast cancer patients. Immobilization of breast is challenging because of its deformity. In 2019, a commercial FDA-approved

bra(Bra) is available for breast immobilization during radiotherapy. Our hospital has used Bra for oncologist-initiated or pendulous patients since then. This work aims to share our clinical experiences and findings from some retrospective studies using Bra in terms of reproducibility, dosimetry, and acute radiation dermatitis (ARD).

Method: A pilot study was conducted to evaluate the reproducibility of Bra prior to clinical implementation. With the promising result, a designated team was trained to standardize the usage of Bra, from sizing, fitting to treatment reproducibility. In the initial cases with 2-field tangential conformal radiotherapy (Tang), 2 treatment plans were compared with and without Bra to select the plan with better dosimetric outcomes. Pre-treatment image verified setup accuracy. A separate reproducibility evaluation study was conducted for patients underwent Tomotherapy, utilizing volumetric information provided by pre-treatment CT. ARD was assessed weekly using Radiation Therapy Oncology Group(RTOG) acute radiation morbidity scoring criteria(Grade 0-4).

Results: Twenty-nine patients underwent breast radiotherapy (Tang: 23, VMAT: 2, Tomotherapy:4) had used Bra and completed the course with zero dropout rate. For the first nine cases, the plan with Bra had a significant 3.6% decrease in V20 of ipsilateral lung and 1Gy decrease in heart mean dose. The mean translational(mm) and rotational($^{\circ}$) shifts were -0.51 ± 3.08 (Left-Right), 0.94 ± 4.25 (Superior-Inferior), 0.02 ± 4.87 (Anterior-Posterior) and 0.30 ± 1.05 (roll). No patient with Bra suffered from grade 3 or 4 ARD. 8 patients with Bra experienced grade 2 at the last treatment.

Conclusion: Our experience has demonstrated dosimetric benefits with promising reproducibility and manageable ARD in using Bra. A trained dedicated team is essential to its implementation.

A Case Study: Diagnosis of Grynfeltt-Lesshaft Hernia Via Dynamic Ultrasound Imaging Techniques

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Purpose: The purpose of this case study is to inform sonographers on the diagnosis, ultrasound appearance, and implementation of dynamic ultrasound scanning techniques of Grynfeltt-Lesshaft hernias.

Materials and Methods: Using both static and dynamic ultrasound imaging techniques to evaluate acute presentation of an atraumatic lumbar mass with fluctuation in size in a female patient over 60 years of age, the diagnosis of Grynfeltt-Lesshaft hernia was established. When evaluating lumbar masses, the role of the sonographer must include dynamic stress maneuvers via Valsalva maneuver and manual external probe pressure in order to determine mobility of masses and assess integrity of adjacent anatomical structures. Investigation of deep anatomical structures in addition to views of a seemingly superficial mass is crucial for accurate diagnosis via ultrasound.

Results: Per the recommendation of the interpreting radiologist, additional CT imaging was obtained and the ultrasound findings were confirmed. After the diagnosis of Grynfeltt-Lesshaft lumbar hernia was established, the recommended course of treatment was surgical repair of the structural defect of the lumbar triangle.

Conclusions: Grynfeltt-Lesshaft lumbar hernia is a very rare kind of lumbar hernia with fewer than three hundred documented cases. The role of the sonographer in evaluating lumbar masses must include investigation of anatomical structures deep to the superficial lumbar mass in question in conjunction with dynamic imaging techniques. An in-depth examination of the superficial and deep anatomy

throughout the ultrasound enables physicians to establish a critical diagnosis and expedite treatment for the patient to avoid potential complications such as bowel incarceration.

INTERACTIVE 3D MODELS AND ANIMATIONS FOR CARDIAC IMAGING EDUCATION

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Background: Cardiac imaging is a specialized branch of medical imaging that focuses on capturing detailed images of the heart. The coronary angiography procedure is one of the cardiac imaging techniques where radiographers use different angles and projections to get a comprehensive view of the coronary arteries in the heart and assess any potential blockages or abnormalities. Radiography student needs to grasp the theoretical and practical knowledge of these procedures before attending their clinical attachments and working in the field. However, the current teaching relies on static visualization (eg. still illustrations and photographs) which is insufficient to deliver the complex concepts in cardiac imaging. Practical sessions are challenging due to the limited access to the facility and involve ionizing radiation. Integrating 3D models and animations into e-learning for teaching cardiac imaging can significantly enhance the learning experience and provide an immersive and interactive environment.

Methods: 3D models and animations were developed using Autodesk Maya software from creating 3D models to animations and rendering of coronary angiography procedures demonstrating different angles and projections.

Results: 3D models and animations provide a dynamic visualization of the complex imaging procedure. All animations also provide a short description of each angulation, projection, and image, as well as other important notes related to clinical applications and scenarios. This allows students to learn the real-life scenarios and situations they might encounter in imaging patients in the hospital. This study could be extended for visualization in augmented reality (AR) where students can turn the 3D models around and manipulate the model in their own hands to perform the coronary angiography procedure.

Conclusion: 3D models and animations in cardiac imaging education simplify abstract processes and enhance understanding, in line with the needs of the current generation and the fast-paced Industrial Revolution 4.0 (IR 4.0).

Developing and validating a multi-omics prediction model for severe acute oral mucositis in nasopharyngeal carcinoma patients undergoing radiation therapy

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Background: Oral mucositis is a common and painful toxicity which can severely affect patients' quality of life. This study focused on developing and externally validating a prediction model for severe acute

oral mucositis (OM) in nasopharyngeal carcinoma (NPC) patients undergoing radiation therapy (RT). We attempted to harness pre-treatment clinical, dose-volume-histogram (DVH), radiomic and dosiomic features to better predict the occurrence of severe OM.

Methods: A retrospective analysis of 464 histologically confirmed NPC patients treated at two public institutions in Hong Kong was performed. Model development and internal validation was conducted on institution A (N=363) and external validation was evaluated on institution B (N=101). Severe OM was defined as the occurrence of CTCAE/RTOG grade 3 or higher during treatment. Two predictive models were constructed: 1) conventional clinical and DVH features, and 2) a multi-omics approach to include clinical, DVH, radiomic, and dosiomic features. Both models underwent rigorous optimization, involving mRMR feature selection, data scaling and model fitting conducted within 20-fold cross-validation on institution A.

Results: The multi-omics model outperformed the conventional model in internal and external validation. Specifically, the multi-omics model achieved area under the receiver-operating characteristic curve (AUC) scores of 0.67 (0.61, 0.73), and 0.65 (0.53, 0.77) respectively, compared to the conventional model's scores of 0.63 (0.56, 0.69) and 0.56 (0.44, 0.67). The 95% confidence intervals show that only the multi-omics model significantly outperformed random guessing (AUC=0.5) in external validation.

Conclusion: These findings suggest that radiomics and dosiomics features, by quantifying pre-treatment tissue radiodensity and spatial dose distribution, can enable better identification of patients at risk of severe OM. Further exploration of radiomics and dosiomics-based prediction models is warranted to facilitate improved clinical decision-making, thereby enabling more personalized care for the prevention and management of OM.

Feasibility of voluntary deep inspiration breath-hold radiotherapy technique (vDIBH-RT) implementation without DIBH-assisting device

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Background: Voluntary deep inspiration breath-hold radiotherapy (vDIBH-RT) is an effective cardiac dose reduction technique during left breast radiotherapy. This study aimed to assess the accuracy of the implementation of the vDIBH technique among left breast cancer patients without the use of a special device such as surface-guided imaging system.

Methods: The vDIBH-RT technique was implemented among thirteen (13) left breast cancer patients at the Advanced Medical and Dental Institute (AMD), Universiti Sains Malaysia. The breath-hold monitoring was performed based on breath-hold skin marks and laser light congruence observed on zoomed CCTV images from the control console during each delivery. The initial setup was verified using cone beam computed tomography (CBCT) during breath-hold. Each field was delivered using multiple beam segments to allow delivery time of 20 seconds which can be tolerated by patients in breath-hold.

The data were analysed using an in-house developed MATLAB algorithm. PTV margin was computed based on van Herk margin recipe.

Results: The setup error analysed from CBCT shows that the population systematic error in lateral (x), longitudinal (y), and vertical (z) axes were 2.28 mm, 3.35 mm, and 3.10 mm respectively. Based on the CBCT image guidance, the Planning target volume (PTV) margin that would be required for vDIBH-RT using CCTV/Laser monitoring technique is 7.77 mm, 10.85 mm, and 10.93 mm in x, y, and z axes, respectively.

Conclusion: It is feasible to safely implement vDIBH-RT among left breast cancer patients without special equipment. The breath-hold monitoring technique is cost-effective, radiation-free, easy to implement, and allows real-time breath-hold monitoring.

Entrustable Professional Activities for Radiation Therapy Students: A Literature Review

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Background: The evolving healthcare landscape in Australia demands that Radiation Therapy (RT) graduates demonstrate competence and readiness to practice in diverse settings upon training completion. Entrustable Professional Activities (EPAs) are defined as units of professional practice. They constitute what clinicians do as daily work and the responsibilities and tasks that must be done in delivering patient care, such as assisting with treatment and simulation setups for cancer patients. This literature review explores the feasibility of implementing EPAs in the RT setting to standardise supervision and aid students in meeting legislative and academic requirements during shortened clinical placements.

Method: To identify relevant articles, a search of Ovid MEDLINE(R) ALL using a combination of MeSH terms and keywords for the two main concepts- EPAs and Radiation Therapy was conducted, yielding 384 results. Abstracts and titles were reviewed by both authors against inclusion criteria focusing on EPAs in RT, allied health and medical education.

Results: While evidence supporting EPAs in allied healthcare and medical settings is abundant, specific evidence for RT practice is limited. Literature in allied health and medical education highlights the number of benefits of EPAs for both students and educators in their specialties, such as cultivation of student confidence, a sense of ownership, and responsibility in professional development. This approach has the potential to enhance patient and student safety by linking competence to specific tasks, ensuring students acquire essential clinical skills before assuming independent roles.

Conclusion: The literature has demonstrated that the standardised use of EPAs may address the challenges of meeting legislative requirements within condensed clinical placements for RT students. Overall, the implementation of EPAs in RT would support both students and educators to meet the evolving demands of healthcare education and promote standardised competence among RT graduates.

Effects of aerobic exercise training (AET) on carotid artery morphological and functional status in post-stroke patients as assessed by duplex carotid artery techniques (DCUS): a preliminary randomised controlled trial

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Background: Cerebrovascular disease (CVD) poses major public health and socio-economic burden worldwide due to high morbidity and mortality rates. Aerobic exercise training (AET) has potential to enhance cerebral arteries' morphological and functional status. The study sought to assess effects of AET on carotid arteries' (CAs') morphological and functional status in post-stroke patients as assessed by duplex carotid ultrasound (DCUS).

Methods: A randomised controlled trial (RCT) involving 30 consecutive post-stroke adults, aged ≥ 50 years, was conducted. Subjects were randomly assigned into 1.) Cycling and 2.) Stretching groups. Subjects in cycling group received 36 sessions of cycling exercise (moderate-high intensity (%HRR), 3 times per/week), while subjects in stretching groups received 36 sessions of stretching exercise. Bilateral CAs were insonated at 1cm distal CCA segment (ROI), and arterial stiffness analysis and 3D volumetric stenosis were performed. Mean difference (MD) between Post and Pre-AET values represented outcome measures.

Results: 30 subjects, (mean age = 63.3 ± 7.2 yrs) completed the study protocol. Pre cycling and stretching CAs β -stiffness index values were 11.3 ± 8.3 and 9.7 ± 5.0 , respectively, and corresponding Post AET values were 7.2 ± 2.6 and 10.1 ± 10.4 , respectively. The within group change score in CAs β -stiffness index was significant for cycling group (MD = -4.14 ± 8 , $t = -2.911$, $p = 0.007$), whilst no significant difference was observed in stretching group (MD = 0.4 ± 10 , $t = -0.205$, $p = 0.839$). Decrease in 3D volume stenosis was observed in cycling group (MD = $-1.84\% \pm 3.44$, $t = -2.927$, $p = 0.007$) versus stretching group (MD = $-0.98 \pm 3.9\%$, $t = -1.38$, $p = 0.177$). Pre and Post cycling 3D volume stenosis was $5.7 \pm 4.9\%$ and $3.9 \pm 3.8\%$, whereas Pre and Post stretching volume stenosis was $5.7 \pm 4.5\%$ and $4.8 \pm 3.5\%$, respectively.

Conclusions: Preliminary results show beneficial effects of cycling AET on CA's morphological and functional status in post-stroke patients. Future studies to assess translational benefits of observed changes on quality of life are recommended.

Fast and low dose myocardial perfusion imaging SPECT using deep learning-based denoising

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Background/Purpose: Myocardial perfusion imaging (MPI) SPECT is one of the most used diagnostic examinations for coronary artery disease. However, issues of prolonged scan time and relatively high radiation dose remain to be resolved. This work develops a deep learning (DL)-assisted fast/low dose MPI SPECT technique without compromising diagnostic accuracy by using extensive patients' imaging data and rigorous clinical evaluation.

Methods: Six hundred pairs of stress and rest ^{99m}Tc-sestamibi MPI images were collected retrospectively from Queen Elizabeth Hospital in Hong Kong. Simulation of half and one third time/dose dataset were performed by discarding 50% and 66.6% of projections profiles from full time (FT)/full dose (FD) ground truth dataset. A Generative Adversarial Networks with Dual-Domain U-Net Based Discriminators (DUGAN) was used to generate synthesized FT/FD images from reduced time/low dose

images. Similarity between synthesized images by DL and standard FT/FD images was evaluated using both DL and clinical evaluation metrics by two Nuclear Medicine physicians and a physicist.

Results: The synthesized FT/FD images from the half time/dose images using DUGAN showed superior overall imaging performance achieving the maximum absolute error (MAE) of 0.0042, root mean square error (RMSE) of 0.2175, and structural similarity index (SSIM) of 0.9767 ($p \leq 0.05$) for the rest dataset and the MAE of 0.0027, RMSE of 0.1874 and SSIM of 0.9902 ($p \leq 0.05$) for the stress dataset.

Conclusions: Our proposed DL based technique together with clinical validation demonstrates the feasibility to reduce scan time and radiation dose in MPI SPECT imaging without sacrificing diagnostic performance. Particularly, such approach could be readily implemented in the clinics owing to no special requirement of different scanners or procedures. This study could pave the way for clinical translation and unleash the potential of DL to revolutionize the clinical practice of SPECT imaging.

Clinical evaluation of automated planning in photon backup plan generation for proton therapy: A pilot study

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Background: Proton therapy is increasingly recognized for its superior dosimetric advantages over photon. However, it is essential to have a photon backup plan in place for cases treated with proton therapy to account for any potential machine breakdowns. Generating backup plans manually can be laborious. Therefore, this study investigates the efficacy of RayStation Fallback planning for efficient and high-quality photon backup plan creation.

Methods: Five prostate cancer patients previously treated with radiotherapy were selected for this retrospective study. The RayStation treatment planning system was employed to generate proton plans, while its fallback (FB) planning module was utilised to generate the backup plans using TomoTherapy (FB-TOMO) and volumetric modulated arc therapy (FB-VMAT). Plan evaluation was conducted utilizing dose-volume histogram parameters for targets (TV) and organs-at-risk (OAR).

Results: Average planning time for FB-TOMO and FB-VMAT was 226.8 seconds and 227.4 seconds respectively. Both types of FB plans demonstrated satisfactory coverage of the clinical target volume (CTV). Compared to original proton plans, both FB-TOMO and FB-VMAT exhibited improved OAR sparing but compromised target dose homogeneity and plan robustness. When comparing the 2 FB plans, FB-TOMO demonstrated lower hotspot volumes, better conformity and homogeneity of target dose, whereas FB-VMAT generally achieved lower OAR doses, except for high doses in the rectum and femoral heads. One FB-VMAT plan failed rectal V38Gy constraint, and another plan failed femoral head constraints.

Conclusion(s): This pilot study highlights the potential of the FB planning module to efficiently generate photon contingency plans based on proton plans, particularly favoring FB-TOMO. Further validation on a larger scale is necessary to comprehensively evaluate the feasibility of this approach across disease sites. In addition to contingency planning, the FB module could also facilitate timely multi-modality plan evaluations.

Artificial Intelligence-assisted Therapeutic Outcome Monitoring of Head and Neck Cancer using Angiogenesis Imaging after Targeted Therapy and Immunotherapy

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Purpose: Angiogenesis is a key factor in determining tumor progression and antitumor response. The integration of angiogenesis imaging into treatment response monitoring has shown promising results and brought significant advancements in managing head and neck cancer (HNC). Despite vigorous development of angiogenesis imaging for the prediction of therapeutic outcomes, there is a lack of reliable analytical methodologies for accurate interpretation and classification of angiogenesis images from the HNC models. This study aims to develop a multi-level ensemble classifier that can distinguish normal, cancerous, and post-treatment samples, enhancing the comprehension of the effects exerted by Cetuximab and anti-CD47 therapy on HNC

Method: We developed an ensemble model combining predictions from CNNs (DenseNet121, Vgg16, ResNet50) and machine learning classifiers (SVM, KNN, Naive Bayes). Predictions from both models were firstly averaged and then unified through Bootstrap Aggregating. A total of 784 samples containing images and vascular records were selected and analyzed. This ensemble model was critically evaluated against models solely based on either imaging or vascular data

Result: The ensemble model demonstrates a superior performance, achieving 94.28% accuracy (ACC), 0.96 area under the curve (AUC), 89.32% sensitivity (SEN), and 90.17% specificity (SPE). In comparison, the image-based model records an ACC of 91.42%, AUC of 0.93, SEN of 85.40%, and SPE of 88.76%, while the vascular record-based model records an ACC of 85.71%, AUC of 0.90, SEN of 86.33%, and SPE of 82.57%

Conclusion: This research highlights the advanced capabilities of the multi-level ensemble model in classifying various treatment responses. To this end, we provide, for the first time, a personalized analytical tool for monitoring tumor angiogenesis, thus verifying targeted and immunotherapeutic responses on HNC models.

The use of Virtual Reality (VR) in Radiation Therapy Training

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Background: Radiation Therapy (RT) training is a very complex process, involving the use of very expensive state-of-the-art technology and a wide spectrum of concepts, scenarios and skills to train students to deliver safe radiation treatments to patients. Studies have shown that the addition of 3D immersive tools into the RT training curriculum may enhance pedagogical value and understanding of RT theory thus narrowing the theory-practice gap.

Hence, we aim to develop a RT Virtual Reality (VR) platform that supports training procedures and scenarios that leads to individualized learning. Adding advanced 3D immersive tools may enable understanding of concepts at a higher level than what is achievable in current training programs. While VR has been widely used in medicine and nursing, its use in RT education is limited and has not been fully explored.

Methods: A mixed study method was used, including “checkpoints” to provide opportunities for self-testing, practicing and assessment which provide valuable feedback. The VARK questionnaire and Unified Theory of Acceptance and Use of Technology (UTAUT) questionnaires were used to assess students’ learning preference and their acceptance for new technology. Pre- and post-program evaluation was conducted to determine the effectiveness of the VR systems in enhancing their clinical knowledge and skills.

Results: A significantly higher median score was found post-VR usage ($p < 0.02$), showing higher VR acceptance than the traditional method. Additionally, no significant differences in VR acceptance were found between uni-modal and multi-modal learners ($p > 0.05$). The VR group also showed a significantly higher score for the perceived knowledge and skills in performing a whole-brain RT (WBRT) procedure ($p < 0.03$).

Conclusion: Our studies have shown that VR can bridge the theory-practice gap in RT training through experiential and active learning. Students can practice simulated clinical scenarios at their own convenience, without the fear of disruptions and the risk of making errors.

PREVALENCE AND VARIATIONS OF SESAMOID BONES IN THE HANDS OF PATIENTS VISITING TEACHING HOSPITAL OF KASKI DISTRICT: A RETROSPECTIVE STUDY

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Introduction: Sesamoids are small, well-corticated, ovoid or nodular, may be bipartite or multipartite bones/ ossifications found close to a bone or a joint that are subject to significant morphological variations. Although it is difficult to determine the symptomatic nature of these bones, imaging provides important diagnostic information. The objective of this study is to assess the prevalence and variations of sesamoid bone in hands of patients visiting a teaching hospital of Kaski district.

Methods: A hospital based retrospective cross-sectional study was conducted by analyzing X-rays of hand with Anteroposterior (AP) view, a total of 150 both male and female patients between the age group of 18 to 85 were imaged between August 1, 2022 to December 30, 2022 at Department of Radiology & Imaging (X-Ray Unit). Presence of sesamoid bone of hand was noted on 1st, 2nd, 3rd, 4th and 5th metacarpophalangeal joints (MCPj), and the 1st interphalangeal joint (IPj), separately. The data were analyzed for correlation using Pearson’s correlation test. Ethical approval was taken from the Institutional Review Committee of Gandaki Medical College (Reference No. 159/079/080).

Results: The prevalence of sesamoid bone at 1st, 2nd, 3rd, 4th and 5th MCPj, and 1st IPj were 100 (100%), 60 (46%), 24(16%), 20(13.3%), 100(66.7%), and 114(76%) respectively. Variation was more prominent among females at 2nd, 3rd and 5th MCPj and 1st IPj, Also, SB variation was more prominent on left hand compared to right hand in 2nd, 4th and 5th MCPj and 1st IPj.

Conclusions: No significant correlation between the gender and laterality with presence or absence of SB in the hands were noted.

A scoping review of roles and competences of healthcare professionals working in breast cancer treatment and care: results for radiographers and radiation therapists

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Background and purpose: Breast cancer is the most common cancer among women worldwide. The treatment pathway of breast cancer requires health care professionals with a high level of competence, among them radiation therapists and radiographers. The purpose of this review was to explore the roles and competences of radiation therapists and radiographers in breast cancer treatment and care.

Methods: The search was structured using the Participant-Concept-Context framework. MEDLINE, EMBASE, CINAHL, ERIC, PsychInfo, Cochrane Library, Scopus and Web of Science was searched for studies of qualitative designs, quantitative designs, and reviews. Contents analysis of the data were performed.

Results: Clinical specialist radiation therapist who specialise in breast cancer treatment are working at an advanced level of practice. They plan and perform radiation therapy and support the patient through the whole radiation therapy process. Several studies about the roles of radiation therapists are focusing on role development. Radiographers' roles are according to the literature the production of diagnostic and follow-up images and providing information about test results to the breast cancer patients. Radiation therapists and radiographers are members of multiprofessional teams.

Conclusion: More research about roles and competences of radiographers and radiation therapists working in breast cancer treatment and care is needed.

Funding: ERASMUS+ funded the Ebreast II project, who conducted this review.

Differential DNA damage induction and repair by protons as compared to X-rays in breast cell lines.

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Background: Breast cancer remains the most common cancer in females and the second leading cause of death in females worldwide. Photon-based megavoltage (MV) radiation therapy remains to be an important treatment modality in the management of breast cancers. However, proton therapy has attracted a lot of interest due to the ability to unique physical characteristics that allows conformal irradiation of the tumour with a low entrance dose and low doses to the normal tissues proximal to the tumour, while there is no dose deposited beyond the Bragg peak. In terms of biologic effectiveness, both photons and protons are classified as low linear energy transfer (LET) types of radiation and have comparable relative biologic effectiveness (RBE) values. Previously, a standard RBE value of 1.1 was assumed for protons, however, growing evidence supports that the RBE of protons differs under different circumstances such as cell line, proton beam energy and dose per fraction used.

Methods: Malignant (MCF-7), spontaneously immortalised normal (MCF-10A) and triple-negative (MDA-MB-231) breast cancer cell lines. MCF-7, MCF-10 and MDA-MB-231 human breast cell lines will be utilised to conduct gamma-Histone subtype H2A isoform X (γ -H2AX) assays. Cells were irradiated with either 2Gy X-rays or protons and assayed at 1hour and 24-hours post-treatment.

Results: Increased yield of γ -H2AX foci, surrogate marker of double strand breaks, was observed at 1-hour post-irradiation in MCF-7 and MDA-MB-231 cell lines as compared to MCF-10A cell line. A significantly higher number of foci was observed in proton irradiated cells, as compared to X-irradiated cells at both 1-hour and 24-hours post-irradiation with protons.

Conclusion(s): Protons induce complex DNA breaks that are difficult to repair in breast cell lines. Retention of foci at 24-hours post-irradiation is potentially due to differential repair pathway choice between the two radiation types.

Role of radiology in Vesicovaginal calculus, a rare complication of VVF

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Background / Purpose: In developing countries, Vesico-vaginal fistula (VVF) results following obstetric trauma or iatrogenic during hysterectomy. Large calculus associated with VVF is relatively rare, with the risk factors are presence of foreign body, urinary tract infection, and prolonged duration of disease.

The diagnosis is often delayed, and mortality sometimes occurs with delayed diagnosis and treatment.

Methods: Radiology has an important role for vaginal and bladder stone evaluation and diagnosis used in VVF are abdominal plain x-ray, ultrasonography (USG), intravenous urography (IVU) and Multi-slice computed tomography (MSCT).

In our Hospital We reported a case of VVF with vaginal and bladder stone in 37 years old woman and reviewed the evaluation and treatment and highlighted the role of the radiology team in managing patients with this condition.

Results: Through a combination of radiological modalities like USG, CT, Xray, and additional cystoscopy as well as vaginoscopy, diagnosis and the definitive management was done on time.

Conclusion: Although the incidence of VVF accompanied by a large vaginal and bladder stone is rare, early detection with a multi modality approach in Radiology with a team of clinicians and technologists coupled with an interdisciplinary collaboration will be beneficial to the patients and case documentation also.

Establishment of an Imaging-based Drug Screening Platform via CDKN1A RNA fate change responding to DNA damages

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Introduction: Radiotherapy (RT) eliminates tumor cells by high doses of radiation causing DNA damage. However, some tumor cells are reported with radiation resistance that can compromise the efficacy of RT. Cyclin Dependent Kinase Inhibitor 1A (CDKN1A or p21) is a gene associated with the regulation of cell cycle, including DNA damage repair mechanism. The resistance can be a result brought by the suppression of CDKN1A expression. Preliminarily, a stress-responsive protein, Musashi-1, was found to inhibit CDKN1A through direct 3'UTR binding. Therefore, this study aims to develop a radiosensitizer screening platform utilizing the Musashi-1-CDKN1A regulatory circuit to speed up the discovery of novel anti-cancer therapy.

Methodology: Glioblastoma (GBM) cells with wild-type and loss-of-phosphorylation Musashi-1 were established by lentiviral infection. The radiosensitivity was assessed by clonogenic assays. Comet Assay was performed to quantitatively compare DNA damage levels. Western blots were used for the assessment of protein levels in different conditions. A renilla luciferase-based CDKN1A 3'UTR reporter system was obtained from Dr. Gorospe and was subjected to molecular cloning to magnify the bioluminescent signal.

Results: Musashi-1 is proved to be oncogenic in clonogenic assays and the subsequent radiation resistance. However, most oncogenic behaviors were eliminated when the phosphorylation site is mutant. The protein level of CDKN1A was enhanced with Musashi-1 loss-of-phosphorylation. However, mRNA and Musashi-1-bound RNA remain unchanged, suggesting a translational regulation may occur. The tail moment in the comet assay suggested the enhancement of radiosensitivity when Musashi-1 phosphorylation is deprived.

Discussion: Our study indicated that the phosphorylation of Musashi-1 can be a therapeutic target due to its ability to hinder the DNA repair mechanisms of GBM cells. To further exploit this mechanism, a luciferase reporter system can be established to screen for potential radiosensitizers, such as kinase inhibitors that can prevent the phosphorylation of Musashi-1 to increase the efficacy of RT treatment.

An Institutional experience of Prostate cancer Radiotherapy treatment with Full bladder Vs Gold fiducial marker: Pro and Cons

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Background: Prostate cancer is the second most common diagnosed cancer in males. Radiotherapy for patients with prostate cancer is preferably provided with bladder protocol. Alternatively use of intra prostatic gold fiducial markers has been utilised due to their accuracy, safe use and reproducibility. Research papers indicate equal weightage to both models used in treating prostate cancer. In this study we compare the results, its merits-demerits, complications during radiotherapy treatment.

Methods: from September 2021 till August 2023, 198 patients with prostate cancer with age group 56 to 87 were enrolled for this study. Out of this 146 patients with bladder protocol (500 ml water post empty bladder with wait time 30 minutes) and 52 patients with gold fiducial markers inserted under trans rectal ultrasonography guidance. Patients were monitored for any possible complication during the entire treatment regime

Results: All patients were treated following the specified protocols, and they all tolerated the treatment with minimal discomfort. With gold fiducial marker observed less discomfort as compared with bladder protocol. Out of 146 patients, 5 patients not able to control urine near the end of treatment schedule. No other major complications noted.

Conclusion: TRUS guided fiducial implant for prostate cancer is safe, reduces discomfort, shorter treatment duration, when compared with bladder protocol patients. Delay or multiple imaging required in few instances due to over / less bladder filling, presence of rectal gas in the treatment portal

Paediatric Radiotherapy Preparation: A Scoping Review

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Background: Delivering daily fractionated radiotherapy (RT) to paediatric patients, especially those under 10, is challenging due to the need for immobilization and solitude. This often necessitates repeated sedation or general anesthesia (GA) (ranging 3-35 fractions) daily throughout RT. The additional risk and requirement for daily fasting pose significant physical and psychological stress for both patients and their carers. Implementing effective preparation strategies can enhance compliance and foster positive treatment experiences for both patients and carers, potentially reducing the need for

sedation/GA. This study reviews existing preparatory services worldwide, identifying gaps and challenges in their provision.

Methods: A scoping review was performed on literature published in English from 2000 to 2023, sourced from PubMed, EMBASE, Scopus, and Web of Science. The search strategy employed key terms related to paediatric RT preparation. Inclusion criteria were focused on studies detailing preparatory services for paediatric RT screening and selection involving two independent reviewers, with conflicts resolved by consensus or third-party consultation. Data extraction highlighted intervention specifics, outcomes, and service gaps.

Results: Screening identified 593 papers, with 73 meeting the criteria. Approximately 24% of the screened papers highlighted challenges faced by paediatric patients and carers, including misunderstandings and anxiety. Notably, 58% of patients, especially those under three, required sedation/GA for immobilization. In 19% of papers, the use of GA is linked to rare but severe neurocognitive and respiratory complications. An emerging shift aims to minimize the use of sedation/GA through strategies such as pre-treatment visits, virtual reality simulations, play therapy, and distraction techniques. Significant service gaps include the lack of multidisciplinary collaboration and specialized paediatric facilities.

Conclusion: This study highlights the critical need for strategies to promote positive experiences in paediatric RT, emphasizing pre-treatment support through gamification and technologies, alongside the importance of multidisciplinary collaboration and specialized facilities to enhance personalised care.

Prognosis prediction in head and neck squamous cell carcinoma by radiomics and clinical information

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Background: Head and neck squamous cell carcinoma (HNSCC) is characterized by its heterogeneous nature and significant association with Human Papillomavirus (HPV) infection. This study aims to propose radiomic and clinical factors models on predicting prognosis of HNSCC.

Methods: Pre-treatment CT images containing radiotherapy structures of HNSCC radiotherapy patients (n = 299) were retrieved from The Cancer Imaging Archive (TCIA). 3D Slicer software (v. 4.10.2) with the PyRadiomics extensions was used to extract 107 radiomic features. Next, five different machine learning algorithms (decision trees, random forests, extreme boost, support vector machine and generalized linear model) were trained and validated to predict the 5-year overall survival (OS). In addition, clinical data, including patient demographics and tumor characteristics, were independently analyzed to create a clinical model. Their results were enhanced through a voted ensemble approach. Subsequently, a probability-weighted enhanced model (PWEM) was generated by incorporating both models. Their performance was evaluated using a receiver operating characteristic (ROC) curve.

Results: The voted ensemble radiomic model, clinical factor model, and PWEM exhibited good predictive performance, with AUCs of 0.772, 0.786 and 0.864 respectively. PWEM is considered the best among the three models.

Conclusion: Our developed models could achieve good predictive performance on HNSCC prognosis. Larger scale of prospective clinical studies are required to implement the models for clinical use.

POSTER PRESENTATIONS

Comparing radiobiological indices of 3D-CRT and IMRT in hypofractionated breast cancer irradiation

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Purpose: This study aimed to compare the radiobiological indices of three-dimensional conformal radiation therapy (3D-CRT) and intensity modulation radiation therapy (IMRT) for hypofractionated breast cancer irradiation.

Methods: This retrospective study included 244 patients who received hypofractionated whole breast radiotherapy between January 1 and December 31, 2020. Dose-volume histogram (DVH) files were extracted from the treatment planning system. The radiobiological evaluation was performed using the DVHmetrics web application, which compared 3D-CRT and IMRT plans in terms of isodose coverage, dose homogeneity, and organ-at-risk (OAR) sparing. Tumor control probability (TCP) was calculated using the Niemierko model, and normal tissue complication probability (NTCP) was calculated using the Lyman-Kutcher-Burman (LKB) model.

Results: The mean dose of the clinical target volume (whole breast) was 4380.27 ± 141.62 cGy in 3D-CRT and 4490.24 ± 64.33 cGy in IMRT. The mean dose of tumor bed was 5133.01 ± 129.22 cGy in 3D-CRT and 5091.15 ± 87.92 cGy in IMRT. The homogeneity index (HI) was excellent at IMRT for both the whole breast and tumor bed. In whole breast, tumor control probability (TCP) was $96.48 \pm 0.98\%$ for 3D-CRT and $97.70 \pm 0.27\%$ for IMRT. Normal tissue complication probability (NTCP) of the heart was calculated to be close to 0 in both cases. Complications in the whole lung and ipsilateral lung were both somewhat higher with IMRT.

Conclusion: In the present study, the IMRT technique had an advantage on the HI and TCP in hypofractionated breast cancer irradiation. The symptomatic NTCP of lung was measured as lower with 3D-CRT, but the absolute difference between IMRT and 3D-CRT was not higher than 1%.

Identify the level of anxiety and depression experienced in cancer patients receiving radiation therapy - a single institution study

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Cancer patients experience levels of mental and psychological stress during their treatment journey. This commonly manifests as anxiety or depression, followed by adjustment problems and post-traumatic stress. This study is to determine the prevalence and etiology of anxiety and depression in cancer patients that can affect their general and mental well-being during the course of radiation therapy. Eligible patients will be identified from the list of patients who have consented for a course of radiation therapy. They will be approached by the study team during the day of their CT-SIM procedures and privacy is ensured if they consented to take part in the study. The survey is carried out through an online platform and will take about 15 minutes to complete. Participation is voluntary, responses are anonymous and no incentive will be offered. Study protocol is approved by the Institutional Review Board. The preliminary data analyzed the first 52 patients in the study. 77% of them undergoing other

treatments while receiving radiation therapy. Chi-Square Tests were used to identify the level of anxiety and depression experienced. 21% reported to have experience borderline / abnormal anxiety while 9.6% experience borderline / abnormal depression. Different age group has no significant difference in level of anxiety and depression ($p= 0.150$, 0.692 respectively). Different treatment sites has no significant in level of anxiety and depression ($p=0.399$, 0.785 respectively). However, there is a statistical significant difference ($p=0.039$) in the level of depression experienced for participants whom undergoing other treatments during radiation therapy. Our findings show no statistical significance indicating that cancer patients experienced anxiety and/or depression while receiving radiation therapy. However, this current data may not be an accurate representation due to the stigmatization associated with declaring mental distress in Singapore.

Visualization of lead protective clothing inspection information

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Purpose: Radiography is one of the important examination in hospital . Excessive radiation exposure of medical staff may induce cell mutations and lead to the occurrence of cancer. In order to ensure that medical staff have adequate radiation protection capabilities, lead clothing is the most direct and efficient shield that blocks X-ray radiation. However, it will wear out depending on the frequency of use, age, and storage methods. Regularly testing the quality of lead clothing can ensure the effectiveness of radiation protection, and then make the test result information transparent, turning the previously difficult-to-see lead clothing test results into information that medical staff can see at any time.

Method: First, formulate a standard process for lead clothing testing, revise the testing report format and Strengthen the double review personnel mechanism. Scend, the test report is converted from the original Word file into a PDF file, uploaded to the Google Cloud Storage System (Cloud Drive), and uses the Google Cloud Storage System to generate a shared URL and create a QR code. Last, Innovative ideas apply the traffic light concept to the test results, edit the QR code style, use the colors "green, yellow, and red" to represent "usable, defect and disposal " respectively, and print it out and paste it on the lead clothing to become each piece of lead clothing unique identity card.

Results: "Visualization effect" uses QR code color to distinguish the performance. Different colors represent different lead clothing efficiencies. In emergency medical treatment, you can immediately choose the appropriate lead clothing to avoid "The Emperor's New Lead Clothes" situation. **Conclusion:** QR code lead protective clothing combines modern technology and medical protection, allowing the effectiveness of lead clothing to be presented "more real-time and more realistically".

The Perspective of Radiation Therapists (RT) and Student RTs towards Elderly patients in Singapore

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Background: The proportion of elderly cancer patients is increasing. These patients may require radiation therapy and will be under the care of RTs in their cancer journey. Therefore, the perspective of RTs and student RTs on elderly cancer patients can affect the quality of care provided. This study aims to understand the factors influencing the perspective of RTs and student RTs towards elderly oncologic patients.

Methods: Registered RTs working in Singapore and full-time local undergraduate student RTs were invited to participate in the anonymous online questionnaire survey. The respondents' socio-demographics and total attitudinal scores for perspective towards elderly oncologic patients, measured using the 5-point Likert scale questions, were analysed.

Results: From September 2022 to November 2022, 92 participants completed the survey (median age 21-25 years, 72.8% female, and 79.3% Chinese), and the response rate are 34% (RT) and 75% (student RTs). Spearman correlation showed an association in the total attitudinal score with occupation and institution. Both student RTs and RTs from restructured hospitals have a significantly higher total attitudinal score compared to RTs and RTs from private institutions respectively. This suggests that the student RTs and RTs from restructured hospitals are likely to have a higher tendency to view elderly cancer patients negatively. However, gender, race, working experience, and lived/ living with the elderly had no association with the total attitudinal score.

Conclusion: This study has shown that may be a bias affecting attitudes towards elderly cancer patients in Singapore. Creating awareness and education in the profession is essential to improving geriatric oncology care to prevent ageism. It remains important to shape the student RTs' perspective of ageing positively to better equip them in caring for elderly cancer patients.

The Perspective of Radiation Therapists on Working in Older Age in Singapore

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Background: As Singapore's population ages, the healthcare sector is confronted with the imperative of workforce optimisation to address escalating demands. Concurrently, projections indicate that by 2028, 30% of Singapore's radiation therapists (RTs) will surpass 50 years of age. This study aims to explore the perspectives of RTs regarding the challenges and factors associated with working in their later life.

Methods: An anonymous online questionnaire was disseminated among registered practising RTs in Singapore, encompassing qualitative questions about working in older age and sociodemographic data collection. Between September and November 2022, 74 participants (median age 31-35 years, 77% female, 78.4% Chinese) completed the survey, yielding a response rate of 34%. Thematic analysis was employed to extract insights from the responses.

Results: Approximately half of the respondents (44%) considered age 65 as a limiting factor in keeping up with the demands of job scope as RT. 69% of respondents "would like to work after the retirement age if they have the ability to do so". "Management" and "Patient Educator/Liaison" emerged as prevalent preferences for job scopes among older RTs. Noteworthy themes encompassing challenges in older age included "physical demand" and the evolving landscape of "advanced technology" within the field.

Conclusion: This pioneering study examined the factors and challenges of the ageing workforce for radiation therapists in Singapore. The findings provide significant insights into the nuanced considerations and preferences of older RTs, presenting potential avenues for job redesign within the evolving healthcare landscape.

RESEARCH ON THE CORRELATION BETWEEN EMPHYSEMA SEVERITY MEASURED BY CT COPD AI SOFTWARE ON CT SCAN AND SPIROMETRY TEST

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Background: In the era of artificial intelligence (AI) development, the applications of AI in healthcare for diagnosis and monitoring are becoming increasingly popular. CT COPD AI software has recently been developed to diagnose chronic obstructive pulmonary disease (COPD). This study aims to investigate the relationship between emphysema severity measured by CT COPD AI software and spirometry results.

Methods: A retrospective study was conducted on patients who underwent both computed tomography (CT) and spirometry at Hoan My Sai Gon Hospital from January 2022 to June 2023. The relationship between the results obtained from the CT COPD software analysis and spirometry was investigated.

Results: A total of 185 cases were included with a mean age of 57.97 ± 16.27 years. A significant positive correlation was found between emphysema grade calculated by CT COPD software-measured lung function and the obstruction grade on spirometry ($r = 0.645 \pm 0.043$, $p < 0.001$). Moreover, significant negative correlations were found between the emphysema percentage measured by CT COPD software and FEV1 ($r = -0.579$, $p < 0.001$), between the emphysema percentage and Gensler ($r = -0.657$) and $p < 0.001$).

Conclusion: There is a correlation between the degree of emphysema in the lungs measured by CT COPD software and the level of airway obstruction. Additionally, significant negative relationships were found between the emphysema percentage and both FEV1 and Gensler. For patients with respiratory failure, acute illness, or the inability to perform spirometry test, CT scan is an effective alternative choice to predict the level of degree of obstruction.

CLINICAL COMPETENCIES AND PERFORMANCE OF RADIOLOGIC TECHNOLOGY INTERNS IN GENERAL RADIOGRAPHY

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The study sought to assess the clinical competencies and performance of radiologic technology interns in general radiography, with the ultimate goal of providing an improved internship training program based on the identified standard core competencies and performance for RT interns. The researcher utilized the descriptive-correlational research approach. Respondents for the research were drawn from three training institutions in Cavite. In addition, 30 training officers took part in the study.

The training institutions were selected based on the criteria in the Policies and Standards for Radiologic Technology Education CMO No. 7, series of 2018. HEI shall enter into a contract of affiliation with hospitals with radiological facilities duly licensed, have a Radiologic Technology Clinical Training Program and the availability of a clinical coordinator to oversee student performance are among the criteria selected. An adopted questionnaire was utilized as the tool to assess observed clinical competence and a self-made questionnaire was used to observe the clinical performance of the RT interns while utilizing general radiography. According to the responders, RT interns' cognitive, psychomotor, reactive, and interactive clinical abilities in General Radiography had high clinical competency. Clinical performance in general radiography was found to be very good. Because the estimated probability value of 0.000 for all clinical competence was less than the 0.01 significance threshold, there was a significant link

between the observed clinical competencies and the level of clinical performance of RT interns in General Radiography. The researcher stressed the importance of developing an improved internship training program to address the gaps identified in the study.

Balancing CT Scan Inpatient Orders: From Request to Exam Completion

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Background: In a classic children’s book notable scenario, “the cat falls while trying to balance too many things and drops everything that he was holding”. This holds true at the CT Scan department of SBH, it is a balancing act on how to prioritize patients according to the level of acuity, and the demands from the inpatient population. Effective patient throughput is a keystone to ensure excellence in patient care. Evidence based-practice not only help realized quality patient care but also achieve better financial performance for the hospital.

Methods: This study utilized a basic quality improvement tool PDCA or Plan, Do, Check, Act

PLAN:

Provide evidence-based best practices on patient throughput as follows:

- Daily review of pending CT order list
- Establish acceptable threshold or left over CT metric
- Add CT as a standing item during Morning Huddle
- Pending CT’s is a required Shift Report Item

DO

- Established standard work
- A continued focus on CT Turn Around Time
- Review current staffing model and adjust accordingly
- Implement a contract with a school to Train CT techs

ACT

- Daily tracking of CT orders
- Workflow modification when patients are not available to transport to the department due to current condition
- Strong coordination with the ordering clinicians
- Cross trained technologists, monitor their efficiency and workflow to achieve desired outcome

Results: Data yielded a dramatic improvement from Nov 2021 at 25.49 hours with 316 orders versus January 2023 at 7.99 hours with higher volume of 386 inpatient CT orders

Conclusion: A major implication from the results indicated that with correct balancing of CT orders along with creative and sustainable plan of actions can lead to a better Turn Around Time, improved satisfactions both from the technologists and ordering physicians, and the hospital financial bottom line.

Exploring the Association between Mammography Dose Optimization and Image Quality

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Background: Mammography plays a crucial role in early breast cancer detection, but it involves exposing patients to ionizing radiation. Optimizing the balance between image quality and radiation dose is essential to maximize diagnostic accuracy while minimizing potential risks.

Purpose: This study aimed to investigate the relationship between dose optimization and image quality in mammography by analyzing contrast-to-noise ratio (CNR) and signal-to-noise ratio (SNR) for two different mammography systems.

Methods: Phantom studies were conducted using polymethyl methacrylate (PMMA) phantoms to simulate breast tissue. Measurements were performed on a GE mammography unit at CenterA in Dubai and a Siemens unit at Center2 in Dubai as well. Contrast to Noise Ratio CNR and Signal to Noise Ratio SNR were calculated from the acquired images under various exposure conditions, including different tube voltages (kVp), anode/filter combinations, and automatic exposure control (AEC) modes. The mean glandular dose (MGD) was also estimated for each exposure setting.

Results: The results revealed that higher tube voltages and rhodium filtration generally improved CNR and SNR while increasing MGD. The AEC modes exhibited varying performance in terms of dose optimization and image quality across different breast thicknesses and glandular compositions. Specific exposure parameters were identified that achieved optimal CNR and SNR values while minimizing MGD for each mammography system.

Conclusion: The findings provide valuable insights for radiologists and medical physicists to develop tailored imaging protocols that ensure high diagnostic accuracy while adhering to the ALARA (As Low As Reasonably Achievable) principle for radiation protection.

Evaluation of image quality on low contrast media with deep learning image reconstruction algorithm in prospective ECG-triggering coronary CT angiography

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Purpose: To assess the value of low-dose contrast media (CM) injection protocol with deep learning image reconstruction (DLIR) algorithm on image quality in coronary CT angiography (CCTA) for patients with extensively ranged heart rate (HR).

Methods and Materials: 210 patients undergoing CCTA were prospectively involved and randomly assigned to three groups with different-dose contrast injection protocols: Group A, 0.7 mL/kg CM (n=70); Group B, 0.6 mL/kg (n=70); Group C, 0.5 mL/kg (n=70). All patients were examined via a prospective ECG-triggering scan protocol within one heartbeat. A high level of deep learning image reconstruction (DLIR-H) was used for image reconstruction with a thickness and interval of 0.625mm. The CT values of ascending aorta (AA), descending aorta (DA), pulmonary artery (PA), Superior vena cava (SVC), left and right atria and ventricles, the proximal, middle and distal segment of the three main coronary arteries and coronary vein (CV) were measured and analyzed for objective assessment. Two radiologists assessed images on image quality and diagnostic confidence using a 5-point Likert scale.

Results: The CM doses were 46.81 ± 6.41 mL, 41.96 ± 7.51 mL and 34.65 ± 5.38 mL for Group A, B and C, respectively. The objective assessments on AA, DA and the three main coronary arteries and the overall subjective scoring showed no difference among the three groups (all $p > 0.05$).

Conclusions: The CM dose of CCTA assisted with DLIR could be reduced to 0.5 mL/kg in patients with extensive range HR, while maintaining good image quality and diagnostic confidence.

Comparative Study of Artificial Intelligence Triggering Technique and Conventional Bolus Tracking Triggering Technique in Coronary CT Angiography

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Purpose: To validate the scanning timing of artificial intelligence (AI) trigger technique in Coronary CT angiography (CCTA) and compare its subjective and objective image quality against the traditional bolus tracking technique.

Methods: In this prospective study, 204 patients were serially divided into two groups to perform CCTA scans: traditional bolus tracking technique featuring a fix delay time (DT) (Group A) or AI trigger technique featuring a patient-specific DT (Group B). All CT scanning and contrast media protocol parameters were kept identical between groups. One reader evaluated objective image quality, while two readers rated subjective image quality. All patients in both groups were divided into two groups according to heart rate (heart rate <75 bpm and heart rate ≥75 bpm), and CT values of coronary vessels from both techniques were compared within the two groups for subgroup analysis. Objective image quality was compared between groups via two-sample t-test and linear regression, while the subjective ratings were compared with chi-square analysis.

Results: The two groups each had 102 (mean age 53±12years; 51 male) and 102 participants (mean age 53±10 years; 51 male), with comparable baseline characteristics. The range of delay time in group B was 4.6s-9.8s (6.45 ± 0.78s). Compare with group B, the mean vessel enhancement in group A was significantly higher in all coronary vessel segments (all $P < 0.05$). In the subgroup analysis, vessel CT values were higher in group B than in group A in two different heart rate subgroups (all $P < 0.05$). Both readers rated the subjective image quality of both groups, with group B scoring higher than group A ($P < 0.001$).

Conclusion: Compared with fixed DT, patient-specific DT could achieve reliable scan timing, optimize vessel opacification and obtain better image quality in CCTA.

Evaluation value of modified left atrial CTA before left atrial appendage occlusion surgery

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Objective: To explore the evaluation value of Canon 320 slice CT using improved technology for left atrial CTA examination before left atrial appendage occlusion (PCLAA).

Method: A prospective collection of 72 patients from our hospital who planned to undergo left atrial appendage occlusion surgery and underwent left atrial CTA using improved techniques. Improved technique: After routine arterial phase scanning (contrast agent: kg * 0.7ml, flow rate: 4.0ml/s), low-dose volume scanning was performed with a delay of 30 seconds; Injection plan: After the routine injection is completed, delay for 6-8 seconds (the smaller the BMI, the shorter the time) and follow the principle of low speed and long time. Continuously inject contrast agent: kg * 0.2ml, with a flow rate of 1.0ml/s. Observe the morphological classification of left atrial appendage, thrombosis, and evaluate the correlation with the selection of implanted occluder.

Result: After processing, the left atrial appendage was classified into chicken wing type (37 cases, 51.4%), cauliflower type (16 cases, 22.2%), wind vane type (14 cases, 19.4%), and cactus type (5 cases,

6.9%); There was a significant correlation ($r=0.968$) between the measurement of left atrial appendage opening diameter using the lateral method and the final choice of occluder, but the difference was not statistically significant ($P>0.05$). 23 cases (31.9%) showed left atrial appendage thrombosis during the arterial phase, and 7 cases (9.7%) showed left atrial appendage thrombosis during the delayed phase, with statistical significance ($P<0.05$).

Conclusion: The improved left atrial CTA can better observe the anatomical information of the left atrial appendage and differentiate the thrombus situation of the left atrial appendage, providing important data for occluder implantation in PCLAA surgery, and has high clinical feasibility and application value.

Application and value of VHP technology in "one-stop" CTA scanning of carotid and coronary arteries

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Objective: To investigate the difference of image quality and radiation dose between 320 slice CT with variable pitch (VHP) one-stop scanning and conventional scanning in carotid CTA and coronary CTA.

Methods: 50 patients with suspected carotid artery disease and coronary heart disease were randomly divided into A and B groups. Group A completed one scan through VHP fusion; First, activate the electrocardiogram monitoring mode to complete the heart scan, and then automatically close and switch to a large pitch scan (Fast) after reaching the bifurcation of the trachea. Patients in group B were divided into two days for routine coronary CTA volume scanning and carotid spiral scanning. The CT values of aortic root, coronary opening, carotid artery (including carotid opening and carotid bifurcation), basilar artery and jugular vein were measured. The image quality was evaluated and statistically analyzed by two experienced radiologists, and the image quality, contrast agent dosage and radiation dose of the two groups were compared.

Results: There were significant differences in the SNR, CNR, CT and SD values of jugular vein between the two groups ($P<0.001$), There was no statistically significant difference in objective and subjective evaluations of other image quality ($P>0.05$). In terms of patient radiation dose and contrast agent dosage, Group A showed a statistically significant decrease of 7.8% and 40.2% compared to Group B ($P<0.001$).

Conclusion: The "one-stop" CTA scanning of carotid and coronary arteries with VHP technology can complete the required examination at one time without affecting the clinical diagnosis and ensuring the image quality, greatly reducing the amount of contrast agent and radiation dose of patients and has high clinical application value.

Improving the diagnostic value of lateral elbow images through modified positioning

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The lateral elbow image is required to rule out any pathologies related to the elbow joint. It is a standard projection complementing the anteroposterior view. During routine audits in our hospital, we

noticed a drop in the quality of lateral elbow images. We hypothesised that patients' physical condition or their carrying angle resulted in positioning difficulties. The carrying angle is defined as the angle at which the forearm naturally deviates away from the humerus. With a larger angle, the standard positioning to obtain a true lateral elbow image may not hold true, leading to closed elbow joint space, and reduced diagnostic value. The aim of this study is to determine a modification that will overcome this angle and through implementation, help to consistently obtain images of high diagnostic quality. This 8-month quantitative study used a literature review to determine optimal lateral elbow positioning. The method involved raising the wrist to overcome the carrying angle. A 5-point scoring system was created to determine the acceptability of the image, with a minimum score of '3' indicating opened joint spaces. The modification was implemented in the hospital's emergency and orthopaedic departments. Patients with implants, existing pathologies and/or below the age of 18 were excluded. Only team members performed the modification to ensure data integrity. Two radiographers with 10-years of clinical experience each evaluated pre and post modification images under the established scoring system. The mean score from the pre to post modification increased from 1.7 to 3.3, showing improved image quality with the raised wrist method. This study proves that the carrying angle does influence the lateral elbow images and any modifications to positioning should consider this. This will not only improve image quality but patients' diagnosis and outcome too.

Bone mineral density analyzed using artificial intelligence-based computed tomography: Association with fracture healing

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Objective: To determine the association between callus formation and bone mineral density (BMD) in fractured ribs using artificial intelligence (AI)-based computed tomography (CT).

Patients and Methods: This single-center retrospective cohort study enrolled 47 patients evaluated by CT for baseline assessment of rib fractures, within 4 weeks after fracture, at our institution between January 2012 and March 2022. Follow-up CT evaluated healing status at a minimum interval of 1 month within 4 months relative to baseline. The primary outcomes were the formation and volume of callus. Descriptive statistics evaluated patients' characteristics and fracture sites. Logistic regression analyses determined associations between BMD with callus formation and volume increase.

Results: Patients with normal BMD (n=19), osteopenia (n=18), and osteoporosis (n=10) had 94, 94, and 75 fractures, respectively. Compared to fractures with normal BMD, age- and sex-adjusted analyses revealed lower rates of callus formation (0.59; 95% confidence interval [CI], 0.47–0.72 and 0.65; 95% CI, 0.54–0.78), volume increases (0.66; 95% CI, 0.56–0.79 and 0.74, 95% CI, 0.63–0.86), and higher rates of poor healing (1.27; 95% CI, 1.11–1.46 and 1.25; 95% CI, 1.12–1.40) for fractures with osteoporosis and osteopenia, respectively. The BMD-based models achieved areas under receiver operator characteristic curves of 0.813, 0.768, and 0.795 for predicting callus formation, increased volume, and poor healing at follow-up, respectively.

Conclusions: Low BMD was associated with lower rates of callus formation, smaller volume, slower healing, and higher rates of poor healing. Therefore, BMD, as an early predictor of fracture healing outcomes, might help mitigate the impact of poor healing.

Assessment of Renal Parenchymal Fat Deposition and Hemodynamics in Type 2 Diabetes Mellitus using Functional MRI

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Purpose: To explore the differences of renal perfusion and renal parenchymal fat deposition in type 2 diabetes mellitus (T2DM) patients and to evaluate the effect of renal parenchymal fat deposition on renal perfusion.

Methods: All participants received arterial spin labeling (ASL) and iterative decomposition of water and fat with echo asymmetry and least squares estimation-iron quantification sequence (IDEAL-IQ) imaging to measure cortical renal blood flow (RBF) and renal parenchymal proton-density fat fraction (PDFF) values. The T2DM patients were classified according to GFR (mL/min/1.73 m²), to determine differences depended on renal perfusion and renal parenchymal fat deposition using one-way ANOVA. The correlation between RBF and renal parenchymal fat deposition and kidney function was evaluated by Pearson's correlation analysis. We also used multivariate linear regression analysis to evaluate the independent relationship between RBF and variables.

Results: A total of 12 healthy volunteers and 81 T2DM patients were finally enrolled. Significant differences in cortical RBF value and renal parenchymal PDFF value were found among groups. Subsequent post hoc test confirmed significant differences between the healthy volunteer and T2DM groups classified in different disease stages. In addition, The correlation between cortical RBF values and renal parenchymal PDFF values showed a negative trend toward significance with an *r* value of -0.36 (*p* < 0.001) and a positive correlation cortical RBF values with eGFR (*r*=0.385, *p*<0.001). In the multivariate stepwise regression analysis, the renal parenchymal PDFF values were independently correlated with the cortical RBF values.

Conclusions: Our study demonstrates the utility of ASL for renal perfusion evaluation and IDEAL-IQ for renal parenchymal fat deposition measurement, in assessing kidney function and disease progression in patients with T2DM. Additionally, we observed a negative correlation between renal blood flow and renal parenchymal fat deposition, suggesting their interplay in impacting renal function.

Design and validation of a scoring system for diagnosing biliary atresia in neonates and infants based on diffusion tensor imaging and blood biochemistry tests

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Purpose: This study aimed to investigate the value of a scoring system established by blood biochemistry tests and MRI parameters for diagnosing biliary atresia (BA) in neonates and infants.

Methods: Between July 2011 and June 2019, 74 patients were included to design (*n*=51) and validate (*n*=23) a scoring system for diagnosing BA, who were 39 males and 35 females and whose age range were 20 days to 272 days. Diffusion tensor imaging was performed with *b* factors of 0 and 1000 s/mm² by a 1.5 T MR unit or with *b* factors of 0 and 600 s/mm² by a 3.0 T MR unit. Blood biochemistry tests were obtained 2 days before the surgery. Parameters with significant statistical difference between BA (*n*=36) and non-BA (*n*=15) groups in the design set were analyzed by binary logistic regression to predict the presence or absence of BA, then the scoring system was designed and validated. The diagnostic power of the scoring system was assessed by area under the receiver operating characteristic curve analyses.

Results: The right liver apparent diffusion coefficient, gamma glutamyl transpeptidase, and aspartate aminotransferase platelet ratio index were selected for the scoring system. The diagnostic accuracy, sensitivity, specificity, positive predictive value, and negative predictive value for predicting BA in the design set were 82.35% (42/51), 88.89% (32/36), 66.67% (10/15), 86.49% (32/37), and 71.43% (10/14), however, in the validation set were 82.61% (19/23), 100% (14/14), 55.56% (5/9), 77.78% (14/18), and 100% (5/5). The area under the receiver operating characteristic curve for the design set and validation set for predicting BA were 0.876 and 0.913 ($p < 0.001$), respectively.

Conclusion: This scoring system can be used as an adjunct to other noninvasive imaging methods in the differential diagnosis of BA and non-BA.

Can educating Radiographers in identifying urgent findings requiring IR intervention improve patient outcomes? A Pilot Study

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Background: Many urgent findings in both X-ray and CT require Interventional Radiology (IR) procedures to help treat the condition; examples include Lower GI Tract bleeds, embolic stroke, pneumothorax, and pleural effusion. Patients benefit from these conditions being treated as soon as possible to maximize positive outcomes (Koh et al 2015), unfortunately due to delays in reporting these findings are often not communicated to the clinicians in an optimal time frame. Radiographers working on hospital settings can identify these urgent/unexpected findings at the time of the examination and contact the referring clinician, who can then expedite treatment including IR procedures.

Method: There is evidence that education resources help healthcare professionals in interpreting radiographs in an interprofessional learning environment (Lockwood and Pittock 2019). To help improve radiographer confidence in identifying urgent findings and alerting clinicians, educational resources were developed and presented to the radiology staff during education meetings detailing various urgent pathologies (found on XR and CT) and how IR intervention is used to treat them.

Results: A retrospective analysis of patients ($n=4$) over 6 months (1st Oct 2022 to 1st March 2023) who had urgent findings commented on by radiographers, which then required IR procedures to found that decisions to treat were expedited and did not have wait for a formal report.

Conclusion: Radiographers have improved confidence in identifying urgent findings and contacting referring clinicians with their comments (through documentation in the patient's electronic medical record as a radiographer comment and via phone follow up for urgent review). More research is needed to further investigate the effectiveness of this education in improving both radiographer confidence in image evaluation and patient outcomes.

Study of appropriate tube voltage for chest temporal subtraction (T-sub) image

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Purpose: We investigated the appropriate imaging tube voltage to obtain good T-sub images using a simulated nodule that resembles the ground glass opacity of early-stage lung cancer.

Equipment used: X-ray system RADENET5 (Hitachi), X-ray tube UH-6FC-31E, additional filters (0.5mm AL+, 0.1mm Cu), CR system (Fuji film), human body phantom PBU-S-3, simulated nodule MAS-2 (Kyotokagaku), dosimeter MAS-2 (Piranha) were used.

Methods of examination: Study of imaging time and distance to obtain the same incident surface dose (0.3 mGy).

Evaluation method: CNR was evaluated by dividing the difference between the mean pixel value of the simulated nodule and the background in the T-sub image obtained by the difference processing method using each imaging tube voltage by the standard deviation of the background.

Results: Quantitative evaluation by CNR showed that the highest CNR was obtained at an imaging tube voltage of 120 kV. 70 kV (CNR: 1.72) was significantly ($p < 0.0027$) lower than 120 kV (CNR: 2.47). There was no statistically significant difference between tube voltages of 80 to 140 kV.

Conclusions: The CNR of simulated tumor shadows in T-sub chest radiography accounted for a high CNR at an imaging tube voltage of 120 kV, but there was no statistically significant difference between 80 kV and 140 kV. This indicated a wide range of tube voltages suitable for T-sub imaging systems.

Changes in the Microstructure and Electrical Properties of Liver Tissue by Ionizing Radiation

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The purpose of this study was to evaluate the effect of radiation exposure on living organisms and to investigate its applicability. In this study, the electrical resistance of the whole body and transmission electron microscope (TEM) changes of liver tissue were investigated in rats according to the increase in radiation dose. Sprague–Dawley rats (5-weeks-old) were randomly divided into 5 groups. Each group received 1 Gy, 5 Gy, 10 Gy and 20 Gy systemic exposure and the non-irradiated group was used as a control for TEM image comparison. After attaching an electrode clip to the forelimb of the rat an AC frequency was applied before and after irradiation using an impedance/gain-phase analyzer and the measurement system was automatically controlled with LabVIEW. Biological changes occur when ionizing radiation is exposed to living tissue. Comparing to before irradiation the difference in the average impedance values at 1 Gy, 5 Gy, 10 Gy and 20 Gy was 563.8 ohm, 2331.8 ohm, 4707.8 ohm and 8441.5 ohm, respectively. By comparing the normal group and the experimental group hepatocyte replication and mitochondrial numbers decreased but mitotic levels increased. In addition, the absolute value of the impedance decreased with increasing radiation dose, and the electrical resistance decreased sharply, especially at ionizing radiation doses of 10 Gy and above. This can be explained in relation to the rupture of biological membranes and can be attributed to changes in the tissue itself, such as membrane permeability and electrolyte content in cellular components. Therefore, this study can be used as an effective approach to characterize the effects of radiation on living organisms and internal changes in tissues.

The Role of MRI in Cervical Cancer Management at Ocean Road Cancer Institute in Tanzania

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Background: In Tanzania, cervical cancer is a major problem facing women, especially for those aged 30 years and above, cancer of the cervix is the most commonly diagnosed cancer and is the leading cause of cancer-related deaths. At Ocean Road Cancer Institute statistics show there were an estimated 1300 new cases and 148 deaths yearly. MRI plays an important role in cervical cancer assessment, from detection, and staging to recurrent disease evaluation.

Purpose: This study aimed to show how cancer services improved since Magnetic Resonance Imaging was introduced at Ocean Road Cancer Institute in Tanzania and the outcome of treatment for cervical cancer patients in Tanzania.

Methods: This prospective study included 10 women who were diagnosed with cervical cancer and MRI protocol including at least one T2-weighted plane and contrasted study were ordered for staging, extension of the tumor, and detecting residue disease after radiotherapy treatment.

Results: Cervical cancer was detected clearly by MRI, and detect its size, location, and extent of the cervical tumor (parametrial extension), and after radiation therapy treatment MRI showed how the cervical tumor responded to chemotherapy, radiation, and other treatments.

Conclusion: The introduction of MRI services at Ocean Road Cancer Institute improves cancer management by playing an important role in staging and determining the treatment strategy, also used for post-treatment follow-up for the detection of recurrence and how cervical tumors respond to chemotherapy, radiation, and other treatments.

Application of perfusion-weighted imaging technology combined with artificial intelligence diagnostic system in acute ischemic stroke

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Purpose: To explore the image quality and diagnostic efficacy of perfusion-weighted imaging technology combined with artificial.

Methods: 52 patients with acute ischemic stroke underwent additional scanning ASL sequence scanning was selected as the observation group; another with DSC sequence was used as the control group. The images were uploaded to the Fast-Stroke AI diagnostic system for analysis. Two senior radiologists used the double-blind method to subjectively score the pseudo-color images processed by the two groups of sequence AI using the Likert scale and observed whether the two groups of pseudo-color images met the diagnostic requirements and whether there were differences in image clarity, image distortion, and artifacts between the two groups. Two weeks later, scored again and observed the consistency of the scores. Objective evaluation involves conducting inter-group tests based on two sets of CBF parameters calculated by AI. SPSS statistical software was used to statistically analyze the data. The measurement data were expressed as mean \pm standard deviation, and a t-test was used for comparison between groups; the Kappa consistency test was performed on the subjective score results of two diagnostic physicians, with $P < 0.05$ as the difference with statistical significance.

Results: In subjective evaluation, the difference in scores between the two observers was not significant and there was strong to strong consistency (Kappa value ≥ 0.75). The subjective image quality of pseudo-color images in ASL and DSC is equivalent and there is no significant statistical difference ($P>0.05$). There was no significant statistical difference between the two groups of CBF parameters ($P>0.05$).

Conclusion: Currently, ASL technology is developing rapidly, and AI diagnostic systems have good diagnostic performance for both ASL and DSC sequences. The combination of the two is worth promoting in acute cerebral infarction imaging.

Application of SMS-RESOLVE DWI technology combined with artificial intelligence diagnostic system in acute cerebral infarction

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Purpose: To evaluate the image quality and diagnostic efficacy of SMS-RESOLVE DWI technology combined with an AI diagnostic system for acute cerebral infarction imaging.

Methods: 104 patients with acute cerebral infarction were scanned with three diffusion sequences: conventional DWI, RESOLVE DWI, and SMS-RESOLVE DWI. Two highly experienced radiologists used a double-blind method to assess acute cerebral infarction DWI ($b=1000s/mm^2$). Subjective evaluation includes the sharpness of anatomical structures, degree of image deformation, degree of magnetic sensitivity artifacts, and overall image quality. AI diagnostic systems objectively measure the SNR, SNRefficity, ADCmin, ADCmax, and ADCmean of three types of DWI sequence images. Compare the subjective and objective evaluation differences of three DWI sequence images.

Results: In subjective evaluation, no significant difference between the diagnostic coincidence rates of observers, and there was a strong consistency (Kappa ≥ 0.75). The subjective image quality of SMS-RESOLVE is superior to that of conventional DWI in all aspects and there is a statistical difference ($P<0.05$). The subjective image quality of SMS and RESOLVE is equivalent and there is no significant statistical difference ($P>0.05$). In objective evaluation, for SNR and CNR, SMS-RESOLVE was higher than conventional DWI and showed significant statistical differences. There was no significant statistical difference between SMS-RESOLVE and RESOLVE ($P>0.05$); There are significant statistical differences in SNRefficity among the three technologies, with SMS-RESOLVE having the highest SNRefficity, RESOLVE taking the second place, and conventional DWI having the lowest SNRefficity. There was no significant difference in the ADCmin, ADCmax, and ADCmean of the three DWI sequences ($P>0.05$).

Conclusion: SMS-RESOLVE DWI technology combined with an AI diagnostic system, can shorten the examination time without reducing image quality, improve the detection rate of subtle cerebral infarction lesions, and thus improve diagnostic efficiency. It is worth promoting in acute cerebral infarction imaging.

Tracking the fatty liver patient with Mode value of MRI images and data analysis

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Background / Purpose: Magnetic resonance imaging (MRI) is a non-invasive diagnostic tool that provides high-resolution images of the liver. MRI can help identify patients who are at risk of developing

more severe forms of liver disease. Early detection of fatty liver disease is crucial for preventing further liver damage and improving patient outcomes.

Methods: MRI imaging, blood tests and body composition tracks fat loss and muscle gain monitoring, can help identify patients who are at risk of developing more severe forms of liver disease and ensure timely intervention when necessary. Intense physical activity was induced after 2021.

Results: MRI imaging, blood tests, body weight and InBody composition was monitored when necessary. From 2013 to 2024, MRI fat ratio of fat image will increase from 6% to 18% in 2018 and then decrease to under 5% by 2024. InBody fat ratio from 2021 29.4 decreased to 2023 of 23.5. Body weight from 2002 63kg, 2011 70.7kg increased to 2020 78.7 and 2022 79.1 and decreased to 2023 of 75 kg. TOTAL CHOLESTEROL from 2002 143, 2011 178 increased to 2017 227 and 2018 227 and decreased to 2022 of 139. TRIGLYCERIDE from 2002 37 increased to 2011 135 to 2022 of 139. ALT (GPT) from 2002 22 2011 27 increased to 2020 133 and 2022 40 and decreased to 2023 of 27.

Conclusion(s): Studies have shown that lifestyle changes, such as dietary modifications and increased physical activity, can help reduce liver fat content and improve liver function. Therefore, regular monitoring of liver fat content through MRI imaging, along with lifestyle modifications, can help prevent the progression of fatty liver disease and improve patient outcomes.

Imaging features to predict the onset time of acute stroke: Model construction and efficacy evaluation research

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Purpose To explore the value of a machine learning model constructed based on DWI image features to predict the onset time of acute stroke.

Methods A retrospective analysis included 317 acute stroke patients treated in the Central Hospital of Shaoyang from January 2022 to January 2023. All patients were completely randomized into training (221) and internal testing (96) based on a 7:3 ratio; patients were divided into $\leq 4.5h$ and $> 4.5h$ according to the onset time. The high signal area of the acute infarction on the DWI image was outlined by the chief physician. 107 image features were extracted by 3D SLICER software, using F test correlation analysis and lasso regression, and the prediction model was constructed using a random forest classifier and validated in the test group. The efficacy of the prediction model was evaluated using the receiver operating characteristic curve and the area under the curve (Area under the curve, AUC). To compare the area under the ROC curve (AUC) and accuracy of manual identification and machine learning models to predict the onset time of acute stroke.

Results ROC analysis showed that the AUC of manual identification predicting the onset of acute stroke was 0.554 (CI:0.44-0.67) and the AUC of machine learning model was 0.848 (CI:0.74-0.95).

Conclusions DWI-based machine learning model predicts the onset time of acute stroke is significantly better than manual identification. In clinical practice, the prediction can be completed by imaging technicians before the end of MRI scan to provide more information for the diagnosis and treatment of stroke patients with unknown onset time.

Investigating the Importance of Patient Positioning when Utilising Automatic Exposure Control in General Radiography

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Background: This study aimed to investigate how the relative changes in patient positioning, (from centred to off-centred), affected dose and image quality when utilising Automatic Exposure Control (AEC) for AP chest, pelvic, abdomen, and lumbar examinations.

Methods: A phantom was exposed to radiation in 21 positions for each examination. A two-way repeated measures analysis of variance was employed to determine the statistical differences in radiation dose and signal-to-noise ratio. Three senior radiographers participated in a visual grading analysis, blindly grading 5 anatomic areas for image quality using a 15-point scale.

Results: Results demonstrated that most off-centred positions caused a significant change in mean dose compared to the ideally centred positions ($p < 0.05$). The difference in dose ranged between -76.7% to 54.1%. The pattern of dose changes also correlated with the direction of off centring ($p < 0.05$). Changes in mis-positioning of the abdomen yielded the most significant changes. The study was limited in determining image quality, likely due to deficiencies related to the phantom.

Conclusion: The study found that even small variations in positioning will likely result in statistically significant change in dose with the majority of mis-positioned images demonstrating such disparity. This highlights the significance of patient positioning on dose when utilising the AEC, with most measurements for off-centring being statistically significant. Consideration of the location of AEC chambers must be considered when positioning patients as well as ensuring accurate centring to guarantee exposures meet the ALARA principle.

UTILITY OF 3D ARTERIAL SPIN LABELLING MR PERFUSION IN DETECTING EPILEPTOGENIC LESION IN EPILEPSY PATIENTS

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Purpose: To study the utility of Arterial spin labeling in detecting epileptogenic lesion in patients with symptomatic epilepsy.

Materials and Methods: Acquisition of 3D pseudo continuous Arterial Spin Labelling Perfusion imaging along with conventional MRI sequences in 3T MRI scanner (GE Discovery 750W). CBF maps were generated using ready view software in Advantage work station 4.6 version. Fusion with structural images were done with integrated registration fusion tool.

Results: Arterial spin labeling perfusion maps showed identification of hyper perfusion in epileptogenic focus during inter ictal phase and hypo perfusion in areas during peri ictal phase. Arterial Spin Labelling MRI bridges the gap between structural MRI and functional neuro imaging. These findings of marked hyper intense areas in raw images defined as the signal intensity of epileptogenic focus. All these were assessed with the help of an experienced neuroradiologist.

Conclusion: Depiction of epileptogenic zone in patients with epilepsy is possible with Arterial spin Labelling Perfusion Technique. ASL perfusion may be the only positive finding in a normal looking scan in which structural MRI may be normal. Arterial Spin Labelling acts as a bridge between MRI and functional neuro imaging.

Multiparametric Mapping of Cardiac Magnetic Resonance Imaging in a Tertiary Referral Centre: Clinical Experiences and Challenges

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Purpose: To evaluate the performance and limitations in T1 and T2 Mapping in cardiac magnetic resonance (CMR) imaging. Cardiac magnetic resonance (CMR) has been well validated as the reference standard for non-invasive diagnostic assessment of the heart with comprehensive evaluation of multiple parameters including cardiac function, morphology, and tissue characteristics. Myocardial mapping of the heart is one of various novel CMR techniques, which has evolved and increasingly utilized and developed for non-invasive tissue characterization of the myocardium. Parametric mapping can be generated from T1/T2 mapping technique using a series of images with different T1 or T2 relaxation times, which are fundamental tissue properties of the myocardium that are altered in the diseased states. The final image is represented by a parametric map and is encoded in the respective pixels of the map depending on the T1, T2 values of the myocardium. This mapping technique can be used to quantify and evaluate focal disease in the myocardium as compared to healthy myocardium based on normal reference values. T1 and T2 mapping hence offer quantitative assessment of changes in tissue composition. However, one of the major obstacles for their clinical use is the variation in native T1 and T2 values related to imaging equipment and sequence. Normal reference ranges are scanner specific and normal control patients are required to determine these values. The role, performance and limitations of multiparametric mapping will be discussed in a series of cases reflecting a spectrum of ischaemic and non-ischaemic aetiologies in cardiac disease at a single tertiary referral centre.

Conclusion: T1 and T2 mapping in CMR as a novel imaging technique has become an extremely useful modality in the qualitative and quantitative assessment of magnetic tissue properties, which reflect alterations of myocardial tissue composition.

To investigate the application of a modified low dose direct method for CTV examination of lower extremities in varicose veins

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Objective: To explore the effect and value of the modified low dose direct method CTV in the diagnosis of lower extremity varicose veins.

Methods: Thirty-eight patients with superficial varicose veins of the lower extremities were examined by modified low-dose direct method CTV imaging in V1 and V2 phases. Two radiologists scored the image quality, and recorded the number of perforating veins in V1 of the deep venous phase and V2 of the total venous phase. The development of perforating veins in V1 was defined as positive perforating veins, and no perforating veins in V1 was defined as negative perforating veins. Objective evaluation: measurement of iliac vein in V1; Femoral vein; Popliteal vein; Tibial vein; The CT value (unit: Hu) of varicose veins and perforating veins in V1 and V2 were calculated, and the corresponding signal-to-noise ratio (SNR) and contrast-to-noise ratio (CNR) were calculated.

Results: Iliac vein; Femoral vein; Popliteal vein; Tibial vein; Varicose veins; The CT values of perforating veins in V1 and V2 phases were 941.8 ± 198.0 , 824.4 ± 277.9 , 987.7 ± 309.7 , 1091.9 ± 275.8 , 858.1 ± 330.7 , 728.9 ± 394.7 , 743.7 ± 232.6 . The lowest CT value of perforating veins was 130HU, with an average of 736.32Hu, which was significantly higher than the average CT value of muscle tissue in the same layer of region of interest (61.3 ± 7.56 Hu). Among the subjective evaluation indicators, 34 cases (89.5%) had good image quality and 4 cases (10.5%) had general image quality. Among 58 limbs of 38 patients, 29 patients (76.3%) had positive perforating veins in V1 stage, and 45 limbs (77.6%) had positive perforating veins. A total of 159 perforating veins were detected, and 443 perforating veins were detected in V2 stage.

Conclusion: Modified CTV can accurately display the range and location of varicose veins, identify the number and location of abnormal perforating branches, and has a high diagnostic accuracy rate, which can better serve the clinical treatment.

Enhancing Microcalcification Detection in Digital Breast Tomosynthesis: A Quantitative Analysis

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Background: Digital-Breast-Tomosynthesis (DBT) is an imaging technique designed to enhance lesion detection, with a focus on microcalcifications. The visibility of lesions is believed to be influenced by differences in the background mammary gland. Understanding these factors is crucial for improving the effectiveness of DBT in breast imaging.

Purpose: This study aims to quantitatively assess the detection performance of microcalcifications in DBT imaging. Utilizing the TORMAM-Phantom, the investigation focuses on variations in swing-angle and mammary gland density to determine their impact on the visibility of lesions.

Methods: The TORMAM-phantom, placed in PMMA at different distances, underwent imaging in standard-mode (ST-mode) with a $\pm 7.5^\circ$ swing-angle and high-resolution-mode (HR-mode) with a $\pm 20^\circ$ swing-angle. Dispersion ratios were obtained from DBT images in both modes. Mammary density was varied (0%, 50%, 100%) in ST-mode, and dispersion ratios were similarly derived from the resulting DBT images.

Results: In HR-mode, the dispersion ratio decreased with increasing thickness, and the ratio was larger compared to ST-mode. Notably, the dispersion ratio of 30 mm was smaller than that of 40 mm in HR-mode, attributed to the partial-volume effect. This effect did not occur in ST-mode due to differences in the reconstruction interval. Changing the background mammary gland density showed that higher mammary gland density resulted in larger dispersion ratios, impacting lesion detection. Importantly, DBT demonstrated superior lesion delineation compared to 2D-imaging, even with high mammary gland density.

Conclusion: A larger swing-angle improves depth resolution and enhances microcalcification detection. This improvement comes at the expense of increased radiation exposure. The study suggests that the detection performance of different background mammary glands is influenced by the size of the swing angle. Understanding these nuances is essential for optimizing DBT imaging protocols and ensuring effective lesion detection while managing radiation exposure.

Development and Implication of Virtual Reality Simulation in Computed Tomography Simulator Education for Radiological Technology Students

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Background: The operation of a computed tomography simulator (CT Sim) is a fundamental skill in radiotherapy. Nonetheless, the radiological technology students could not learn thoroughly with the machine due to the limitations. This study aims to develop learning materials in CT Sim education using virtual reality (VR) simulation technology and to compare academic achievement before and after using the learning materials.

Methods: The data including the operation of CT Sim, patient positioning and immobilization devices were studied. After that, the VR simulation technology learning materials were developed. The learning materials were evaluated by the experts, including the content appropriateness, technology acceptance model (TAM), and content validity index (CVI). Then the learning materials were used by 26 radiological technology students. In addition, they completed the test and satisfaction assessment form after using the learning materials.

Results: The result showed that the content appropriateness was 4.67 ± 0.26 , technology acceptance model (TAM) was 4.80 ± 0.19 , and content validity index S-CVI was 0.835. Moreover, academic achievement of students after using the learning materials (18.15 ± 2.31) was more than before using the learning materials (13.54 ± 7.60) at p value < 0.05 .

Conclusion: As a consequence of this study, VR simulation technology learning materials were designed. The students can use learning materials and gain knowledge about the operation of CT Sim, patient positioning and immobilization devices. Furthermore, academic achievement of students is enhanced after using the learning materials.

Construction and application of imaging technician competency

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Objective: To explore the construction and application of imaging technician competency.

Methods: Through literature review, job analysis and behavioral event interview, 410 imaging technicians from 8 cities in Guangdong province were surveyed, and the data obtained were statistically analyzed by SPSS22.0.

Results: There were two rounds of questionnaires with effective recovery rates of 96.1% (173/180) and 93% (221/230), respectively. The competency of imaging technicians was constructed by exploratory and confirmative factor analysis, consisting of 17 items, including comprehensive ability, image, values, characteristics and employment motivation of imaging technicians. Cronbach's α coefficient > 0.9 , the correlation between the four dimensions and the imaging technician competency model was comprehensive skills ($r=0.935$, $P<0.001$), characteristics and employment motivation ($r=0.921$, $P<0.001$), image ($r=0.706$, $P<0.001$) and values ($r=0.769$, $P < 0.001$).

Conclusion: The competency evaluation scale of image technicians constructed by factor analysis is scientific and reliable, and with good reliability and validity, it can provide objective evaluation tool for job selection, performance, training and assessment.

Occupational Radiation Dose to Undergraduate Students During Clinical Attachment in Radiology and Radiotherapy Departments: 5-Year Experience (2017 – 2022)

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Background: Monitoring radiation doses for undergraduate students during clinical attachment is essential to showcase radiation protection issues and instill awareness of safe practices for their future careers. This study aims to determine a baseline for the effective dose received by undergraduate students during their clinical attachments in radiology and radiotherapy departments.

Methods: A retrospective study was conducted to assess occupational radiation exposure for a total of 143 undergraduate trainees from 5 consecutive cohorts in terms of the whole-body dose or effective dose Hp(10) and the skin dose Hp(0.07). Each of them completed six cycles of radiology and radiotherapy clinical attachments. Reading of 858 optically stimulated luminescence dosimeters (OSLD) sourced from the electronic Secondary Standard Dosimetry Laboratory (e-SSDL) database was monitored and collected from 2017 to 2022. The mean occupational radiation exposures of each student and cohort were analyzed to determine the dose distribution.

Results: The mean annual effective dose per student for the 800-hour clinical workload was least in radiology and highest in radiotherapy with values of 0.168 and 0.184 mSv, respectively. The cumulative Hp(10) and Hp(0.07) values for clinical attachment in radiology and radiotherapy departments ranged from 0.05 to 1.30 mSv and 0.06 to 3.92 mSv, respectively. A majority of students (97% in radiology, 92% in radiotherapy) received a radiation exposure dose below 1.00 mSv. However, one student received a dose 13 times higher than the cohort's mean exposure.

Conclusion: The annual occupational radiation dose was well below the recommended limit set by national legislation and international standards for apprentices (6 mSv/year). The baseline for cumulative effective dose during clinical practices has been established. Despite the reported occupational doses are low, it is crucial to consistently minimize radiation exposure to the greatest extent possible through an effective protection program.

Quantification of Residual Errors in Intracranial Lesions: A Study Using a Frameless 6-Dimensional Positioning System.

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Purpose: This study aims to quantify the extent of residual errors associated with each pre-planned couch angle for intracranial lesions utilizing a frameless 6-Dimensional(6D) positioning system.

Methods: Couch data from 48 patients were used in this study. Initial correction and verification of patient positioning at a 0° couch angle were performed using two stereoscopic X-ray images obtained with the frameless 6D positioning system. Residual errors were quantified by taking a pair of stereoscopic X-ray images at the non-zero treatment couch angle.

Results: Total of 6048 verification X-rays analyzed, of which 2856 were Stereotactic Radiosurgery(SRS) verification X-rays and 3192 were Stereotactic Radiotherapy(SRT) verification X-rays. The magnitude of translational intrafraction motion was 0.32 ± 0.24 mm in the left-right direction, 0.72 ± 0.60 mm in the supero-inferior direction, and 0.20 ± 0.20 mm in the antero-posterior direction. Angular deviations were observed as $0.21 \pm 0.24^\circ$ in pitch, $0.21 \pm 0.99^\circ$ in roll, and $0.19 \pm 0.17^\circ$ in yaw. A total of 509 out of 2856 instances of residual position errors exceeded our institution SRS tolerance of 0.5mm in translation and 0.5 degrees. Additionally, 259 out of 3192 instances of residual position errors exceeded the institution SRT tolerance of 0.7 mm in translation and 1 degree were documented. The residual errors were much in conjunction with the findings of Winston Lutz tests performed by the physicist during commissioning phase. This shows that the residual error is due to the couch movement.

Conclusion: The residual position errors are much due to the rotation of the couch, and not much of the patient movement. Utilizing the frameless 6D positioning system is imperative to correct any residual positional errors exceeding couch tolerance values at each couch angle.

WSS and velocity changes of common iliac arteries in patients with abdominal aortic aneurysm: assessment using 4D flow MRI

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Background: One under-investigated area of abdominal aortic aneurysm (AAA) research is how changes in iliac arteries flow alter infrarenal aortic hemodynamics and aneurysm expansion. Therefore, the aim of this study was to investigate the hemodynamics of iliac arteries in healthy volunteers and AAA patients, further exploring the occurrence of auxiliary aneurysm.

Methods: Healthy volunteers and patients with abdominal aortic aneurysm were continuously included, and patients with other aortic diseases were excluded. All the subjects underwent MRI on a 3.0T MR scanner, and hemodynamic parameters, including total flow volume, peak velocity and wall shear stress (WSS) of left common iliac artery (LCIA) and right common iliac artery (RCIA) were recorded.

Results: Between December 2022 and May 2023, 16 volunteers (54.89 ± 14.55 years) and 22 AAA patients (68.73 ± 13.77 years) were included. There was no significant difference in flow volume between controls and AAA both in LCIA and RCIA. However, the WSS decreased in AAA patients both in LCIA (0.61 ± 0.19 vs. 0.34 ± 0.11 , $P=0.014$) and RCIA (0.57 ± 0.19 vs. 0.32 ± 0.18 , $P=0.025$). In healthy volunteers, there was good consistency of hemodynamic parameters between the left and right iliac artery. However, peak velocity between left and right common iliac arteries is significantly different in AAA (78.57 ± 22.76 vs. 58.31 ± 16.66 , $P=0.025$).

Conclusion: In this study, 4D flow MRI were used to evaluate the iliac arteries dynamics changes between healthy controls and AAA patients. In AAA patients, the WSS of both left and right iliac arteries was decreased, and the hemodynamic parameters between the left and right iliac arteries are asymmetrical. These changes are of great value for predicting the development of abdominal aortic aneurysms and even for predicting the occurrence and development of iliac aneurysms.

Focal edema associated with molecular subtype in breast cancer

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Background: Fat-suppression T2-weighted imaging (FS-T2WI), one of the key sequences in MRI, can clearly distinguish edema in the tumor surrounding environment. Peritumoral edema was a predictor for triple negative breast cancer (BC) and was related to Luminal A-like BC. However, there is currently limited research on the significance between different types of edema and molecular subtypes. This study aimed to explore the relationship between focal edema (including no edema, peritumoral edema, prepectoral edema, subcutaneous edema) and molecular subtypes.

Methods: A total of 206 women diagnosed with invasive BC were retrospectively enrolled and underwent MR scanning on a 3.0 T scanner. 34 were Luminal A-like, Luminal B-like [37 human epidermal growth factor receptor 2 (HER2)-positive and 51 HER2-negative], 53 HER2 overexpression, and 31 basal-like. Focal edema was defined on FS-T2WI. The comparison of classification variables was executed using chi-square or Fisher exact test.

Results: The rate of no edema in Luminal A-like was higher than that of Luminal B-like HER2 + and HER2 overexpression ($P = 0.002$, $P < 0.001$). The peritumoral and subcutaneous edema rates of Luminal A-like were lower than those of HER2 overexpression ($P = 0.043$, $P = 0.021$). The rate of no edema in Luminal B-like HER2 - and basal-like were higher than Luminal B HER2 + ($P = 0.001$, $P = 0.025$), as well as HER2 overexpression ($P < 0.001$, $P < 0.001$). The subcutaneous edema rate of Luminal B HER2 - was lower than that of HER2 overexpressing, $P = 0.002$.

Conclusion: Luminal A-like had a higher rate of no edema, while the rates of peritumoral edema and subcutaneous edema were lower. Luminal B-like HER2 + and HER2 overexpression (both HER2 statuses were positive) exhibited lower rate of no edema, higher rates of peritumoral edema and subcutaneous edema.

LEADERSHIP BEHAVIOR AND JOB SATISFACTION AS PREDICTORS OF TURNOVER INTENTION OF RADIOLOGIC TECHNOLOGISTS WORKING IN ACADEMIC INSTITUTIONS IN REGION XI, PHILIPPINES

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Turnover intention is the most prevalent issue nowadays in every organization. It is widely understood that recognizing and dealing with antecedents of turnover intentions is a good way to reduce real turnover. This quantitative study utilized the descriptive-correlational method. The selection of respondents was limited only to all full-time radiologic technologist instructors working in 5 higher education institutions of Radiologic Technology program in Region XI, Philippines. Moreover, sets of standardized questionnaires were used as instruments in gathering information from the respondents. Mean, Pearson Product-Moment Correlation, and Multiple Regression Analysis were the statistical methods used in the study. The findings showed that radiologic technology administrators' overall leadership behavior was high, radiologic technologists' job satisfaction was moderate, and radiologic technologists' intention to leave was moderate. Moreover, the results yielded for leadership behavior and job satisfaction had a negative correlation with the turnover intention of radiologic technologists. Increased leadership behavior and job satisfaction would reduce radiologic technologists' intention to leave. Furthermore, the results of regression analysis revealed that leadership behavior significantly predicts turnover intention while job satisfaction was not a significant predictor of turnover intention. This study discovered new information that will help researchers and policymakers in reducing turnover intentions of the employees.

MANAGEMENT SKILLS, EMOTIONAL COMPETENCE AND LEADERSHIP SKILLS OF CHIEF RADIOLOGIC TECHNOLOGISTS

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Today's educational landscape views radiologic technologists as a critical component of an organization. This makes sense when you consider a few things, such as the fact that the head is also an organizer, director, and planner. In accordance with demographic trends, changing attitudes towards work, and greater cultural diversity, the researcher aimed to determine the level of management skills, emotional competence, and leadership skills among the chief radiologic technologists at a selected hospital in Metro Manila. Descriptive correlation analysis was the research design employed in this study to determine the association between each variable. Research consistently shows a robust correlation between high-level management skills, emotional competence, and leadership skills. Organizations with leaders who possess a strong blend of these attributes tend to experience enhanced team performance, increase employee satisfaction, and improve overall organizational effectiveness. The synergy between effective management, emotional competence, and leadership fosters a positive work environment, contributing significantly to long-term success and adaptability in today's dynamic landscape of radiology. In conclusion, a high level and strong relationship exists between management skills, emotional competence, and leadership skills. Effective leaders demonstrate synergy among these elements, showcasing the ability to manage tasks effectively, navigate interpersonal dynamics with emotional intelligence, and inspire and guide teams toward success. This interconnectedness fosters a well-rounded leadership approach essential for thriving in complex and dynamic organizational environments.

Exploring the advantages of MRI enhanced scanning in the diagnosis of central airway lesions

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Objective: To compare CT and MRI images of patients with central airway lesions and explore the advantages of MRI enhanced scanning in the diagnosis and evaluation of treatment efficacy for central airway lesions.

Method: A total of 35 patients with central airway lesions were collected and underwent chest CT plain scan, enhanced, multi plane reconstruction, and MRI plain scan and enhanced scan. By comparing and analyzing the imaging data of two different scanning methods, the diagnostic advantages of MRI enhanced scan for central airway lesions were summarized.

Result : 1. Magnetic resonance imaging is significantly superior to CT in analyzing the internal components of lesions, especially in analyzing the internal mucus, necrosis, and other components of smaller tumors, which can avoid excessive and ineffective examinations caused by low CT soft tissue resolution to the greatest extent possible; 2. DWI can serve as a scout to identify the location of hidden lesions, which helps to locate the target lesion during bronchoscopy; 3. Clarify the depth and range of infiltration of central airway lesions, more accurately evaluate the relationship with surrounding tissues, accurately evaluate the depth of forceps before surgery, and avoid irreversible injuries such as trachemediastinal fistula and tracheoesophageal fistula; 4. It helps to evaluate the blood supply of the

lesion and avoid the risk of tracheal bleeding during bronchoscopy treatment due to misjudgment of blood supply.

Conclusion: MRI enhanced scanning is superior to CT enhanced scanning in identifying the location, range, composition, and blood supply of central airway lesions. It has clear auxiliary diagnostic significance for preoperative evaluation, diagnosis and treatment plan determination, and treatment efficacy evaluation of lesions.

Reducing radiation doses and improving image quality in myocardial delayed enhancement CT with low tube voltage and deep learning image reconstruction

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Purpose: To investigate the use of low tube voltage combined with a deep learning image reconstruction (DLIR) algorithm in myocardial delayed enhancement CT (MDE-CT) to reduce radiation dose and improve image quality, in comparison with the conventional 120kVp protocol and adaptive statistical iterative reconstruction (ASIR-V).

Methods: One hundred cardiac patients were prospectively enrolled for the diagnosis of main branch stenosis greater than > 50% underwent the conventional standard-dose coronary CT angiography (CCTA) with 120kVp, Smart mA for noise index (NI) of 25HU, and 50%ASIR-V for image reconstruction and low-dose MDE-CT. MDE-CT were acquired 10 min after CCTA using 70kVp (for body-mass-index (BMI) < 26kg/m²) or 80kVp (26kg/m² ≤ BMI < 30kg/m²), smart mA for NI of 36 HU, and DLIR with high setting (DLIR-H) for image reconstruction. The radiation dose, subjective image quality score, attenuation values, noise, signal-to-noise ratio (SNR), and contrast-to-noise ratio (CNR) between the two groups were compared.

Results: The low-dose group achieved a significant reduction in the effective radiation dose (0.86±0.45 mSv vs. 1.71±0.61 mSv, *P*<0.001) compared to the standard-dose group. The low-dose group with DLIR-H presented higher enhancement in LV blood pool, LV septum and lateral wall, lower noise, higher SNR and CNR and as well as higher subjective quality scores (4.18±0.45 vs. 3.83±0.37) than the standard-dose group with 50%ASIR-V (all *P*<0.001).

Conclusions: The application of low tube voltage and DLIR allows for significant radiation dose reduction while further improving image quality in myocardial delayed enhancement CT.

Quantitative Evaluation of Left Ventricular Myocardial Strain in Hypertrophic Cardiomyopathy by Cardiac Magnetic Resonance Tissue Tracking Technology

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Objective: Hypertrophic cardiomyopathy (HC) is the most common cause of sudden death in young people. Therefore, early diagnosis, cardiac structural evaluation and myocardial function are crucial. This study explored the diagnostic value of cardiac magnetic resonance tissue tracking (CMR-TT) technology in quantitatively evaluating left ventricular myocardial strain in patients with hypertrophic cardiomyopathy (HC).

Method: CMR examinations were performed on 25 patients (experimental group) and 11 healthy volunteers (control group). The differences between left ventricular End Diastolic Volume (EDV), left ventricular End Systolic Volume (ESV), Stroke Volume (SV), left ventricular Ejection Fraction (EF), Left Ventricular Mass (LVM) and Global Radial Strain (GRS), Circumferential Strain (GCS), and Longitudinal Strain (GLS) of the left ventricle were compared between the two groups, and statistical analysis was done.

Result: There was no statistically significant difference in EF, EDV, ESV, and SV between HC and the control group ($P>0.05$); the LVM of the HC group was higher than the control group ($P<0.05$); The left ventricular GRS, GCS, and GLS of the HC group were lower than those of the control group, with statistically significant differences ($P<0.05$); The areas under the ROC curve of GLS, GCS, and GRS in the diagnosis of HC were 0.83, 0.78, and 0.75, respectively, all $P<0.05$.

Conclusion: CMR-TT technology can quantitatively evaluate the myocardial strain of HC patients and has significant diagnostic value for HC.

GEOGRAPHICAL DISTRIBUTION, HISTOLOGICAL TYPES AND CLINICAL PRESENTATION OF PEDIATRIC MALIGNANCIES AT BUGANDO MEDICAL CENTER MWANZA, TANZANIA

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Background: Childhood cancer incidence is on the rise and are most often underreported. However, children are vulnerable to suffer most from the adverse consequences. There is limited information geographical distribution, histological types and clinical presentation of pediatric malignancies at Bugando Medical Center (BMC), in MWANZA, Tanzania.

Methodology: Retrospective hospital-based study was conducted among pediatrics cancer patients attending BMC from May to July 2023 using a cancer registry from 2018 to 2023. A checklist was used to collect socio-demographic, clinical laboratory data from hard copies and and electronic patients' files. Analysis was done using STATA version 15.0 software according to the study objectives.

Results: A total of 199 patients were enrolled with median age (IQR) of study population was 7.7 (4.3 – 11.3) years. The majority of the participants were male 115(57.8%). Most of the patients were from Mwanza region 47(23.6%) followed by Mara region 40(20.1%). The most common histological types of pediatric malignancies were nephroblastoma, 31 (15.6%); rhabdomyosarcoma, 30 (15.1%), and retinoblastoma, 28 (14.1%). Approximately 70 (35.5%) had complete remission, 48 (24.2%) were lost to follow up and 20(10.1%). The deaths were more in Katavi, Tabora and Simiyu; and also deaths were more in Non-Hodgkin's lymphoma, Acute lymphocytic leukemia and Retinoblastoma, although the differences were not statistically significant for the association between deaths with region and histological types (p -values = 0.332 and 0.065, respectively).

Conclusions: Pediatric malignancies are commonly in the Mwanza and Mara regions with the most common histological types being nephroblastoma. Approximately 1 in 10 of children with pediatric malignancy died, with death occurring mostly in the Katavi, Tabora and Simiyu. Targeted outreach screening programs from BMC are recommended to be focused in the two regions with the highest burden, and three regions with high mortality.

Using Virtual Environment of Radiotherapy Training (VERT) system to improve technical skill and knowledge in radiotherapy for Radiological Technology Student

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Radiation Therapy is one of the treatment procedures that involves usage of high energy radiation to kill cancer cells. This requires radiation therapists to have expertise, knowledge, and technical skills to operate advanced equipment which are continuously refined through technological advancements to provide improved medical benefits. The Virtual Environment for Radiotherapy Training (VERT) system can offer a realistic simulation of a Linear Accelerator room in a three-dimensional context. Chulabhorn Royal Academy is the first institute in Thailand that install the VERT software and utilized with the 4th year Radiological Technology undergraduate student combined with a lecture classes. The purpose of this study is aimed to assess the improvement of radiation therapy competencies in students who used VERT system. The effectiveness of VERT is evaluated by analyzing from self-evaluation questionnaires to represent the self-confident level and MCQs exam to reflect the knowledge of two groups of Thai Radiological Technology students which are comprising of using VERT and non-using VERT. The results show that the using VERT group demonstrated a significantly improvement in skills and knowledge in radiotherapy studies compared to the non-using VERT group. Moreover, the result shows the exam score of the using VERT group before radiotherapy internship is significantly higher than non-using VERT group in same condition and comparable to the non-using VERT group after passing the internship course. Therefore, it can be concluded that the VERT system is capable in enhancing skills and especially knowledge in radiotherapy education and comparable with radiotherapy internship course. However, VERT system is not the real situation in the hospital and have limited functionality and equipment. But VERT system is such a good education tool to enhance students' skills and knowledge in radiotherapy courses.

A Study on the Angle of the Glenohumeral Joint Using CT 3D Reconstruction Techniques in the Grashey Method of Traumatic Shoulder

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Background: The purpose of this study is to determine the most useful x-ray angle during the shoulder x-ray exam (grashy method) in traumatic shoulder patients using a three-dimensional image reconstruction method on CT.

Purpose: This study aims to find out the most useful angle of the x-ray tube in patients with traumatic shoulder when they cannot turn their body during the Grashy method (Shoulder Oblique) examination by using the 3D image reconstruction method from the CT of the patient.

Methods: In 100 patients, the ideal angle was measured using 'AW VolumeShare on Advantage Workstation' using horizontal and vertical lines of the glenohumeral joint in the cross-section where the glenohumeral joint is most visible. The measured results were analyzed using SPSS.

Results: The results showed that setting the angle of the x-ray tube from 34.9° to 37.3° was the most useful angle when examined by the Grashey method (shoulder tilt) ($p>0.05$).

Conclusions: Three-dimensional image reconstruction methods of CT can be used to reproduce optimal examination images when using guide angles for grasps examination of traumatic shoulder patients.

MR Imaging research in large populations versus the clinical setting: a radiographer experience from the Generation R study

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Background/Purpose: The Generation R (GenR) Study is a population-based study, focusing on the comprehensive development of Rotterdam's children from fetal life through adulthood. The role of the radiographer is to help acquire high quality, standardized MRI data to uncover crucial health insights.

Methods: The radiographers conduct repeated-measures MRI on a diverse participant cohort at different ages. This image technique can unveil developmental milestones, organ maturation and potential health anomalies. The ethical compliance, safety and participant well-being, as well as data quality are the most important factors to ensure successful (longitudinal) data collection.

Results: Acquiring data with a constant standard is a crucial aspect throughout the whole study. To achieve that, we offer a standardized safety training in both Dutch and English, which includes documentation for reading, videos, and an exam. When passed there will be a standardized on-the-job MRI training, led by radiographers. Msc and Phd students are trained and eventually certified to use the system. We use a standardized research protocol and offer yearly at least once but preferably twice a refresher training. Finally, we have MRI safety measures in place, including a pre-screen over the phone, a screen at the center, and a final screen and check before entering the MRI. These measures ensure that the MRI is used safely and effectively, and that the safety of the patient is always a top priority.

Conclusion: We highlight the important role of radiographers in imaging data collection in population-based studies which aim to unravel links between early markers and later outcomes and enhance the understanding of early-life health determinants in different demographic groups.

INNOVATIVE TRAINING FOR FUTURE RADIATION THERAPISTS: DESIGNING A STUDENT-CENTRIC PSYCHOSOCIAL AND SUPPORTIVE CANCER PATIENT CARE [PSOSC] MODULE IN MALAYSIA

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Background: A cancer diagnosis is undeniably life-changing for the individual. Patients will then often seek various treatments, and one prevalent option is radiation therapy (RT). RT plays a pivotal role in cancer management, with 52.3% of cases requiring it. (Delaney et al., 2005). However, the inherent challenges of cancer treatment, notably the potential for substantial toxicities leading to significant short- and long-term side effects, present formidable hurdles. These effects manifest across multiple dimensions of life, impacting physical, cognitive, emotional, social, and overall psychosocial well-being (Weis, 2015). Despite radiation therapists being crucial in providing psychosocial support during treatment, the absence of specific guidelines for therapists in Malaysia impedes their ability to provide necessary support to cancer patients.

Methods: The study comprises 2 Phases. Phase 1 involves the systematic development and refinement of the module. A panel of experts, including radiation therapists, oncologists, psychologists, and social workers, collaboratively contributes to this phase. In Phase 2, the module is distributed along with a questionnaire assessing content validity and reliability. Utilising Google Forms, the distribution targets radiotherapy academicians and students at UKM. The aim is to validate the module's content and assess its reliability for future application in clinical practice.

Results: The evaluation process showed a good and impactful finding. The validity and reliability tests highlight components with high Item-Content Validity Index (I-CVI) and Cronbach's alpha, affirming the module's content validity and reliability for application in clinical practice

Conclusion: The module's effectiveness and relevance in addressing cancer patients' psychosocial and support needs were assured through a rigorous scientific approach and expert input during its development. As such, it has the potential to significantly improve the level of cancer care provided by Malaysian radiation therapists and enable a more patient-centred and holistic approach to cancer care.

AI-assisted Compressed Sensing MRI in Temporomandibular Joints: A Feasibility Study

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Purpose: To investigate the feasibility of accelerated MRI protocols with AI-assisted compressed sensing (ACS) technique in temporomandibular joint (TMJ), and compare its performance with parallel imaging (PI) protocol and standard protocol.

Methods: Participants with symptomatic TMJ disorders were enrolled. MRI examinations were performed on the 3T MRI scanner with 32-channel head coil. Each protocol included sagittal/coronal T2 weighted imaging and sagittal/coronal proton density weighted imaging in the closed-mouth position, as well as sagittal proton density weighted imaging in the open-mouth position. Qualitative and quantitative analysis were conducted by two independent radiologists in a blind manner. For qualitative analysis, a 4-point Likert scale (4-excellent, 3-good, 2-moderate, 1-poor) was used to rate overall image quality and visibility of clinically relevant structures, including TMJ disc, mandibular fossa, mandibular condyle, lateral pterygoid muscle condyle (LPM). For quantitative analysis, the signal-to-noise ratio (SNR) of TMJ disc, condyle and LPM were measured.

Results: A total of 44 participants (10 male and 34 female, 23.32 years \pm 3.24) with 88 TMJs were included. The acquisition time was 6min8s, 10min57s, and 13min28s for ACS protocol, PI protocol, and standard protocol, respectively. Among the analyzed TMJs, joint effusion, sideways disc displacement and anterior disc displacement were diagnosed in 61, 53 and 43 joints, respectively. For qualitative analysis, the overall image quality and most structures visibility of ACS protocol were significantly higher

than standard protocol, and similar to PI protocol. For quantitative analysis, ACS protocol demonstrated significantly higher SNR than standard protocol in the TMJ disc, condyle and LPM (all $P < 0.05$), and ACS protocol showed similar SNR to PI protocol except for the TMJ disc in sagittal T2 weighted imaging.

Conclusion: Accelerated MRI with ACS technique can greatly reduce acquisition time of TMJ, while providing superior or equivalent image quality with PI and standard protocols.

Dosimetric comparison between two dose calculation algorithms in SBRT treatment of lung cancer in ring-based and c-arm linear accelerators

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Purpose: To compare the dosimetric variances between the dose calculation algorithm of Convolution (CA) and Monte Carlo (MC) in ring-based and c-armed linear accelerators for stereotactic body radiotherapy (SBRT) treatment of peripherally located primary lung cancer or lung metastasis. The study will identify an optimal combination of dose calculation algorithm and treatment machine for precise and effective delivery of SBRT in patients with peripheral lung tumor.

Methods: Twenty patients with peripherally located primary lung cancer or lung metastasis in the upper or middle lobes will be included in the study. Volumetric Modulated Arc Therapy (VMAT) technique will be utilized for re-planning each patient on both ring-based and c-armed linear accelerators. Dosimetric parameters and doses to organs at risk (OARs) will be compared based on the Radiation Therapy Oncology Group (RTOG)-0915 lung SBRT protocol as benchmarks for plan quality evaluation. Statistical analysis will be conducted to determine significant differences among the lung SBRT treatment plans generated by CA via MC algorithm and ring-based via c-armed linear accelerators. Dosimetric differences with p-values less than 0.05 will be considered statistically significant.

Results: Convolution algorithm may produce treatment plans with significantly higher conformity index compared to MC due to potential overestimation of target coverage. The difference in target coverage and OARs sparing may show non-significant statistically. MC may yield the most favorable outcomes in dose prediction accuracy and treatment delivery precision using either a ring-based or a c-armed linear accelerators. However, more efficiency in treatment delivery when using a ring-based linear accelerator.

Conclusions: The results of this study provide valuable guidance for clinicians in selecting the most appropriate dose calculation algorithm and treatment platform, ultimately improving the efficacy and precision of SBRT for better patient outcomes.

Self-development app introduced into education for medical radiography students

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Background: Medical radiography students in Taiwan are required to complete internships at hospitals before taking the national examination. During the internships, students understand theoretical

knowledge, the latest technologies, and become familiar with operating different imaging equipment. This practical experience aims to enhance their practical skills and medical decision-making abilities, as well as provide insights into industry trends and future challenges.

Methods: Self-development App was used to integrate education information system. Competency-based medical education (CBME) was used to assess operational ability, we recorded and track daily learning status in the examination room.

Results: Self-development App improved students' learning effect, the scores were improved in post-test by 10 %-50 %. The average student satisfaction score was 4.86. Most teachers (84.6 %) agree that “Self-development App” will be an essential tool.

Conclusion: Our study provided an easy education App to improve students' learning effect efficiently and reduce teachers' workload.

Developing Capacities in Nuclear Medicine in Lao People's Democratic

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Background: Lao People's Democratic Republic (Lao PDR) currently has no nuclear medicine diagnostic equipment; however, it is expected to be installed in the near future. Educational content and teaching methods should be developed at an early stage; however, there are limited resources and less opportunity to learn and train in nuclear medicine within the country. The aim of this study is to assess the current knowledge and assess the potential effectiveness of simulator-based training.

Method: In August 2023, a special seminar was conducted for the first time in the country. The seminar included mini-lectures and hands-on training. In January 2024, a pilot trial of simulator-based training in PET/CT incorporating with mini-lectures was implemented in four-month interval towards university teachers. Learning contents included radiopharmaceuticals, nuclear medicine imaging equipment, and clinical nuclear medicine imaging. Basic knowledge was measured before and after each implementation.

Results and Discussion: Forty-five medical staff and students participated in the special seminar. The average correct answer rate for the pre-test of the special seminar was 68.3% (14.3% -100%), and that for the post-test was 89.2% (0.00% -100%). In particular, the correct answer rate for questions regarding radiopharmaceuticals and nuclear medicine imaging equipment was low. Similarly, nine university teachers participated in the pilot trial. The average correct answer rate for the pre-test of the pilot trial was 40.0% (20.0% -60.0%), and that for the post-test was 77.8% (40.0% -100%).

Conclusion: The results of the special seminar pre-test suggested that nuclear medicine education was insufficient. However, our effective training indicates that a certain level of learning has been achieved. In the future, we believe that it is important to continue educational support activities while considering the situation of nuclear medicine introduction in Lao PDR.

Interpretable machine learning model based on DCE-MRI for predicting Ki-67 expression in breast cancer

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Purpose: To establish an interpretable machine learning model based on DCE-MRI to predict the Ki-67 expression status of breast cancer and identify interpretable radiomics features and clinical features.

Methods: We retrospectively enrolled 205 patients with 210 lesions between May 2021 and April 2023, who underwent breast MRI examination in our hospital. The patients were randomly divided into the training set (n = 147) and the test set (n = 63) at a ratio of 7:3. In the second phase of DCE-MRI, the lesions were manually segmented and the radiomics features were extracted. The clinicopathological and imaging features of the patients were collected according to BI-RADS lexicon. The radiomics features were selected by univariate analysis and Recursive feature elimination (RFE). Univariate analysis and multivariate logistic regression were used to select the clinicopathological and imaging features. Based on the optimal radiomics features and clinical features, the XGboost classifier was used to construct the radiomics model and clinical-radiomics model. The performance of the model was evaluated by area under the ROC curve (AUC), accuracy, sensitivity and specificity, and The Shapley Additive explain (SHAP) technique was used to explain the model by assessing the global and local effects of predictors on the model output.

Results: ER expression and gland type are independent predictors of early Ki-67 expression. The prediction performance of the clinical-radiomics model based on clinical features and the 8 best radiomics features was better than that of the clinical and radiomics models, with an AUC of 0.833, accuracy of 0.861, sensitivity of 0.756, specificity of 0.773, and F1 of 0.805.

Conclusions: Interpretable machine learning models based on DCE-MRI can effectively predict the Ki-67 expression status of breast cancer, and this method can provide guidance for clinicians to formulate systematic treatment plans for breast cancer patients.

Radiation risk communication: a study to evaluate radiographers' knowledge, proficiency and patients' perception in some selected hospitals in Ghana

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Background/Purpose: Radiation risk communication is an essential aspect of radiological services, as patients need to be adequately informed about the risks associated with diagnostic and therapeutic procedures involving radiation. In Ghana, there is limited research on radiation risk communication, and it is not clear whether radiographers have sufficient knowledge and proficiency in communicating radiation risks to patients. Additionally, patients' perceptions of radiation risks and their communication with radiographers regarding these risks are not well established. The study thus aimed to investigate radiographers' knowledge of radiation dose, risk, and radiation risk communication and assess patients' perceptions and awareness about radiation risk communication.

Method: The research involved a cross-sectional survey conducted in four selected hospitals in Ghana. Data was collected from 12 radiographers and 200 patients through structured questionnaires. The study assessed demographic characteristics, knowledge levels, communication methods, patient perceptions, and challenges faced by radiographers.

Results: Findings revealed a diverse range of knowledge levels among radiographers, with a strong positive Pearson's correlation ($r = 0.721$, $p < 0.04$) between knowledge scores and years of work experience. While radiographers expressed high confidence in their communication abilities, patients

reported varying degrees of satisfaction with risk communication. Language barriers emerged as a primary challenge in effective communication.

Conclusion: The study underscores the importance of continuous education and targeted training for radiographers to bridge knowledge gaps. It highlights the need for tailored communication strategies to address patient concerns and challenges, particularly in diverse linguistic contexts. By implementing recommended interventions and enhancing communication techniques, healthcare practitioners can foster a more patient-centric approach, ultimately improving patient care and safety in radiology.

The Study of Detector Exposure Index regarding Chest PA examination with Auto Exposure Control

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Purpose: To evaluate the usefulness of Detector Exposure Index (DEI) regarding Chest PA examination with Auto Exposure Control (AEC) by analyzing patient's dose and image quality when DEI is within the appropriate range.

Methods: From November 1 to November 30, 2023, mAs and Dose Area Product (DAP) from DICOM header were investigated among the people who exceeded the appropriate range (0.2~0.6) of DEI. Find the tube voltage that can lower DEI within the appropriate range through phantom experiment, and the change in mAs according to AEC was also predicted at the relevant voltage. Varying the examination conditions by gender, DEI and DAP were analyzed and the difference of image quality was evaluated.

Results: Using AEC with the conditions of 125kVp and 320mA, recommended by equipment company, 43.6% of patients exceeded the appropriate DEI range, which was 36.3% of male and 51.2% of female, respectively. Changed the tube voltage into 113kVp and the tube current into 320mA for male and 200mA for female, with consideration of the differences in thickness and density of chest according to gender, the exceeding rate of DEI could be lower to 22.8%, decreased to 26.2% for male and 20.3% for female, respectively.

Conclusions: Dose Creep can be prevented if the conditions were varied by gender, in Chest PA examination with Auto Exposure Control, and Detector Exposure Index can be appropriate means for comparing the patient's dose and evaluating the image quality.

Realizing sub-mSv in radiation dose and 25mL in contrast dose in coronary CT angiography in normal size patients using 70kVp tube voltage and deep learning image reconstruction

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Objective: To explore the use of 70kVp tube voltage combined with high-strength deep learning image reconstruction (DLIR-H) in achieving sub-mSv in radiation dose and 25mL in contrast doses in coronary CT angiography (CCTA) for normal size patients (body mass index < 25kg/m²).

Methods: A total of 60 patients required to undergo CCTA were prospectively enrolled and a new scan protocol was applied: 70kV, Smart mA for noise index of 40HU, contrast dose of 0.4ml/kg, images were reconstructed using DLIR-H algorithm. The contrast injection rate was adjusted for 10s injection duration. The subjective image quality was assessed in terms of image noise, vessel enhancement and

edge sharpness using a 5-point system (5=best, 3=acceptable). Image noise, contrast-noise-ratio (CNR) and signal-noise-ratio (SNR) for vessels were measured to compare with historical values in CCTA for diagnostic adequacy.

Results: The average contrast dose was 23.56 ± 4.61 mL and radiation dose was 0.62 ± 0.23 mSv for this group of patients with BMI value of 23.87 ± 1.05 kg/m². The subjective image quality scores were 4.13 ± 0.32 , which fully met or exceeded the diagnostic requirements; The background image noise was low at 16.69 ± 3.15 HU and the SNR values (35.78 ± 12.23 , 34.51 ± 11.48 , 34.79 ± 11.91) and CNR values (47.43 ± 13.94 , 46.16 ± 13.07 , 46.44 ± 13.56) in RCA, LAD and LCX, respectively were adequate for imaging vessels.

Conclusion: Sub-mSv in radiation dose and 25mL in contrast doses in CCTA for normal size patients can be achieved with full diagnostic image quality using 70kVp tube voltage combined with high-strength DLIR.

Feasibility of accelerated 3D isotropic high-resolution T2-weighted bladder magnetic resonance imaging using the deep learning-constrained compressed sensitivity encoding technique (SENSE)

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Objectives: This study aimed to evaluate the clinical value of deep-learning algorithm reconstruction in 3D T2-weighted imaging (T2WI) for bladder cancer.

Methods and Materials: Sixty-seven patients with bladder cancer (muscle-invasive bladder cancer /non-muscle invasive bladder cancer= 12/42) underwent T2WI at 3.0T MR (three directions, 4 mm; 3 min 32 sec per direction) high-resolution 3D T2WI with and without the deep-learning reconstruction algorithm (DLA) (6 min 33 sec; CS = 10x vs. 4 min 25 sec; CS = 15x). The pathological results were used as the gold standard for diagnostic evaluation. The Wilcoxon signed-rank test was performed to compare image quality score acquisition between T2WI images, and the independent t-test was used to quantitatively assess the signal-to-noise ratio (SNR) and contrast-to-noise ratio (CNR) ($p < 0.05$ indicate statistical significance).

Results: Regarding the diagnostic efficiency, the AUCs of the two 3D T2WI groups, with the assistance of the DLA, compressed SENSE(CS), and the compressed 32.5% scan time, were 0.895 and 0.888, respectively. The two groups' SNR and CNR differences were not statistically significant. In addition, 3DT2WI CS=15x with DLA had higher scores for bladder wall continuity (3.72 vs. 4.18, $p < 0.01$), minimization of artifacts (3.52 vs. 4.06, $p < 0.05$), and overall image quality (3.11 vs. 3.46, $p < 0.01$) than 3D-T2WI (CS = 10).

Conclusions: DLA reconstruction with the compressed SENSE cloud helped high-resolution 3D T3WI decrease the scan time, meet the diagnostic requirements, improve image quality at the bladder wall continuity and decrease artifacts in bladder cancer.

Application value of POWER PICC as venous access in contrast enhanced CT scanning

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Objective: The purpose of this study was to explore the differences in scan and image quality between the use of high pressure resistant PICC and peripheral venous indwelling needle as contrast agent access in enhanced CT.

Materials and Methods: Ninety-six patients with high pressure tolerance PICC venous access and 73 patients with peripheral venous indwelling needle access were included for chest and abdominal enhanced CT scan. Scanning trigger time was recorded, image quality was divided into objective parameter evaluation and subjective grading evaluation, and the two groups were compared SPSS Statistic 22.0 was used for statistical analysis.

Results: The monitoring trigger time of patients in the two groups was tested by Student's t-test. The mean trigger time of patients in the PICC group was 24.24s (S5.18), and that of the control group was 31.85s (S7.61), $P < 0.05$, the difference was statistically significant. The two groups were injected with the peak pressure for two independent sample T test. The mean peak pressure of contrast agent in the PICC group was 206.67 (S52.249), and that in the control group was 133.76 (S34.797), $P < 0.01$, the difference was statistically significant. There were differences in image quality between the two groups.

Conclusion: Enhanced CT using high pressure resistant PICC as venous access triggered early, the pressure in the catheter was higher than that of conventional venous catheterization, the effect of abdominal aortic mass injection was stronger, and there was no significant difference in the venous stage.

RESULTS OF A STUDY EVALUATING POST-CONTRAST INJECTION RESPONSE IN CLIENTS UNDERGROUND FOR CECT

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Objective: To evaluate the reaction after the injection of contrast material in clients undergoing CT scan with contrast material.

Materials and methods: The study was conducted retrospectively. The study was conducted on 3,300 clients who were referred for CT scan with contrast, who attended the Department of Internal Medicine of Seoul Hospital It was observed 30 minutes after the test. In normal clients, the response after the injection of 1kg-1.7% of the body weight with an auto-syringe was evaluated according to the Anisole criteria.

Considerations: Xenetics contrast was stored in a heat sink, and tests and examinations were performed with the contrast agent. The warranty period of the contrast agent was checked 3 times, a single-use needle syringe was used, and the injection was not performed in infected, damaged, bruised, hairy, mole, swollen, or tumor areas. Results: A total of 3,300 clients aged 18-95 participated in the survey. In terms of gender, 59% (n=1934) were male and 41% (n=1366) were female. 9.2% of the surveyed customers were grade-1, 82.4% grade-2, 8.1% grade-3, and 0.3% grade-4.

Conclusion: 9.2% of all clients did not report any reaction, 91.6% had a mild reaction or Hot flashes 96.4%, anxiety 98.7%, 8.1% of clients had a weak reaction or increased pulse 80 98.5%, nausea 84.3%, vomiting 25.6%, heart palpitations 18.9% Severe reactions in 0.3% of clients or laryngeal swelling 95.6%, Pulse 1 min 30 count 82.4%, oxygen supply to peripheral organs 89% less 70.5% and 33.3% had fainting symptoms. Evaluation of Allergy Test-2,3,4,5 Clients with CKD, Renal dysfunction, Multiple organ failure, and egg allergy are likely to have a high contrast response, so there is a need to have guidelines for emergency imaging with contrast-enhanced CT scan.

Reducing Radiology Carbon Footprint - A Single Centre Experience

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Introduction: Combating climate change is a global endeavor, requiring participation from every industry including healthcare. A team comprising of radiologists, radiographers and administrators from the National University Hospital Department of Diagnostic Imaging came together to examine key contributors of carbon emission in a radiology department.

Three contributors, namely high electrical consumption from reporting workstations, excessive paper usage and insufficient recycling were identified through data logging and workflow process reviews.

Methods: Given the high electrical consumption of reporting workstations, automatic shutdown via IT control was implemented after office hours. Educational posters were placed in various locations to remind end-users to shut down their workstations when not in use.

Paperless workflow was introduced by implementing electronic documentation through a functionality upgrade of the current Radiology Information System (RIS), procurement of mobile workstations and transitioning staff towards electronic documentation and consent-taking.

Lastly, recycling was introduced to bring down the volume of disposed general waste. Clean plastic waste such as expended contrast syringe packages were consolidated for recycling; coupled with end user education, inculcating a culture of reuse, reduce and recycle within the department.

Results: End results were measured and compared to baseline readings before implementation. The green solutions implemented brought about a 50% reduction in electrical consumption of reporting workstation, 30% reduction off paper usage and approximately 20 Tonnes in reduction of CO₂ carbon footprint emission. Secondary benefits include monetary savings from reduction in paper procurement and energy cost and improved patient safety from paperless workflow.

Conclusion: We must continuously review established workflow and processes to drive sustainability. Apart from using a top-down approach for green practices, the concept of sustainability should be infused into the department culture for positive change to combat climate change.

RADIATION DOSE OF NON-CONTRAST HEAD SCAN IN MULTI SLICE COMPUTED TOMOGRAPHY

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Background: There is an increased concern toward the health risk associated with radiation exposure and proper parameter related to radiation dose while performing CT scan. Therefore, we aim to evaluate the radiation dose received for Non-Contrast CT head scan and compare it with European commission reference dose level.

Methods: Data were collected over the period of 3 months from June to September 2018, in 16 slice CT scan, National Trauma Center, Kathmandu, Nepal. Dose descriptors were calculated for each scan. Effective doses (ED) for each patient were calculated from the reported volume CT dose index (CTDI_{vol.}),

dose length product (DLP) and CTDI-to-effective dose conversion factors. The findings were compared to the reference dose values set by the European Commission (EC).

Results: A total of 76 patients, 34 female (45%) and 42 male (55%), mean age 34.42 ± 16.06 years, range 18-75 were included in this study. The mean CTDIvol for routine head protocol was 65.01 ± 1.92 mGy, DLP was 1122.355 ± 63.657 mGy-cm and ED was 2.58 ± 0.145 mSv respectively. The 75th percentile of CTDIvol, DLP and ED for routine head scan was 65.90 mGy, 1166.90 mGy and 2.68 mSv respectively which were higher in comparison to the recommendation of EC.

Conclusion: Since the radiation dose descriptors were higher than the reference set by EC, we recommend application of dose optimization to reduce the radiation dose to the patient and subsequently decreasing the potential adverse deterministic risk of radiation.

ESTIMATION OF GENDER FROM 3D CT OF FORAMEN MAGNUM USING ARTIFICIAL NEURAL NETWORK

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Purpose: Gender determination is a crucial technique in forensic medical science. In this research work, we aim to determine gender from foramen magnum measurements using Artificial Neural Network (ANN).

Methods: Sixty-two male and 62 female patients referred for computed tomography (CT) scan of the brain at Department of Radio-Diagnosis & Medical Imaging, Universal College of Medical Sciences (UCMS), Bhairahawa, Nepal from May till August 2018 were included in this study. 16 slices multi-detector GE Brivo CT scanner was used to obtain CT images of the foramen magnum. Sagittal diameter (SD) and transverse diameter (TD) were measured in 3D CT images after postprocessing in CT workstation. Teixeira's area (AT) and Radinsky's area (AR) were also calculated. ANN model was built in Spyder, a scientific python development environment, using "Keras", a neural network library. "Scikit-learn", a machine learning library, "pandas", an open-source data analysis and manipulation tool and "Matplotlib" plotting library were used before ANN modelling. Data were split into 60% training, 20% validation and 20% test data respectively. "Adam" optimizer was used for optimizing the model. Learning rate 0.01, epochs 100, and batch size 32 were used. Accuracy, receiver operating curve (ROC) - area under the curve (AUC), precision, recall, Cohen's kappa score and F1-score were calculated from test and predicted data from the training.

Results: The accuracy of the ANN was 68%. The AUC was 0.7, which was acceptable. The precision was 0.8, recall 0.57, Cohen's kappa was fair at 0.375 and the F1-score was 0.66 respectively.

Conclusion: ANN could be used to estimate the gender from the CT scan of the brain.

COMMON SITE OF URETERIC CALCULI AMONG NEPALESE POPULATION

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Introduction: Ureteric calculi are essentially a kidney calculus that has passed into the ureter. We aim to determine the common site of ureteric calculi using computed tomography (CT) scan.

Methods: Patients referred to CT department for non-contrast CT scan of kidney, ureter and bladder (KUB) were scanned from July to September 2018 in 16 slices MX CT scanner, Philips Medical System. Patients identified with ureteric calculi and age ≥ 16 years were included in the study. The data were analyzed using SPSS statistics version 27.0. Chi Square test (χ^2) test was applied to determine the association between ureteric calculi and demographic variables. Binary logistic regression (BLR) analysis was performed. Hosmer and Lemeshow test were performed before BLR modelling. Multicollinearity was calculated for demographic variables by using Pearson's Chi-square test for independence.

Results: 76 patients, 58 male and 18 female, mean age 39.67 ± 15.69 , range 18 to 82 were included in the study. Calculi were identified in both ureters, 53.9% in right ureter and 46.1% in left ureter respectively. 60.5% of calculi were noted at pelvic-ureteric junction (PUJ) and 39.5% at vesico-ureteric junction (VUJ). χ^2 test showed the location of ureteric calculi were independent of both gender and age groups, $p > 0.05$. Both gender and age groups did not add significantly to the BLR model, $p > 0.05$. Females were 2.63 times more likely to have VUJ calculi than males. Age groups < 30 and 30-60 years were 3.52 and 2.15 times more likely to have VUJ calculi than > 60 years age group.

Conclusion: Ureteric calculi are a major health concern in Nepal and is most common in right PUJ. Adequate precaution and preventive measures should be adopted as soon as possible.

EVALUATION OF IMAGE QUALITY IN 1.5 TESLA MRI SCANNER IN NEPAL

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Introduction: Image quality is the clarity of structures in an image and is essential for providing an accurate diagnosis. We aim to evaluate the image quality in the 1.5 Tesla MRI Scanner. Geometric distortion, signal-to-noise ratio, percentage intensity uniformity and ghosting are evaluated.

Methods: A 40 cm diameter cylindrical electroclinical correlation (ECC) performance phantom was scanned in T2W spin-echo pulse sequence at the coronal plane by using 32 phased-array coils in a 1.5 Tesla Philips Achieva MRI imager, Department of Radiology & Imaging, National Academy of Medical Sciences (NAMS), Kathmandu in June 2019. Four parameters, namely Geometric distortion (GD), Signal-to-Noise Ratio (SNR), percentage intensity uniformity (PIU) and ghosting-to-signal ratio (GSR) were measured in RadiAnt DICOM viewer. Data were analyzed using SPSS Statistics software, version 27.0. The calculated values of these parameters were compared with standard references.

Results: The range of GD was 0 - 3.9 mm. SNR was 113.96 for small ROI and 99.71 for large ROI. The PIU was 97.73% and 72.33% for small ROI and large ROI respectively. The GSR was 0.0011 for small ROI and 0.0039 for large ROI respectively.

Conclusion: The image quality assurance was over the limit for GD, PIU (large ROI). The SNR and GSR were adequate. Regular QA tests are required to obtain optimal image quality.

DIAGNOSTIC EFFECTIVENESS OF MAMMOGRAPHY IN EVALUATION OF BREAST LESIONS WITH HISTOPATHOLOGICAL CORRELATION

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Introduction: Advancement in breast imaging is increasing. This advancement has made xero-mammography and film-screen mammography almost obsolete. The most commonly performed and well stabilized for reporting is digital mammography in breast imaging. Digital mammography is considered as a primary modality of choice for early detection and reduce mortality due to breast cancer. The effectiveness of digital mammography varies and various studies have found it to be comparable to histopathological findings. So, the aim of the study was to evaluate the effectiveness of mammogram in comparison to histopathological findings.

Methods: A cross-sectional study was conducted in Department of Radiology and Imaging, and Department of Pathology at National Academy of Medical Sciences, Bir Hospital. The patients referred for either screening or diagnostic mammography, also underwent subsequent histopathological investigations. The lesions were categorized according to BI-RAD classification. Sensitivity and specificity were calculated using software SPSS version 23 and kappa agreement was employed to establish the correlation between mammographic findings and histopathological results. Receiver Operating Curve (ROC) and Area Under Curve (AUC) were calculated to determine the accuracy.

Results: A total of 48 patients, mean age 49.48 ± 12.08 was included in this study. 47.91% had mammographic features of benign lesion and 52.08% had features of malignancy. However, histopathological analysis revealed 39.58% of the lesions to be benign and 60.41% to be malignant. Mammographic findings exhibited no false negatives but showed three false positives (17.4%). The sensitivity and specificity of mammography were determined to be 100% and 86.2%, respectively. The results demonstrated a high level of agreement between the two diagnostic tests (kappa- 0.832), which was statistically significant at p value < 0.001 .

Conclusion: Mammography could be used as a non-invasive alternative bioimaging marker for breast imaging as compared to invasive histopathology.

Developing a Traffic Light Protocol for Nasopharyngeal Carcinoma CBCT Escalation: To Improve Radiation Therapists' Accuracy Rate of CBCT Escalation to Radiation Oncologists

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Background: Cone Beam Computed Tomography (CBCT) is pivotal in image-guided radiotherapy (IGRT). It allows Radiation Therapists (RTs) to assess anatomical and positioning variances before treatment delivery. Variances include tumour or normal tissue displacement, bone mismatch and changes in body

contour. Currently, there are different perspectives as to what constitutes as an acceptable variance in IGRT matching between the RTs and the Radiation Oncologists (RO). This resulted in multiple CBCTs raised up for the RO's review. If a post review action plan is required, the CBCT is deemed as an accurate escalation as both the RT's and RO's assessments are in congruence. A six-month retrospective analysis comprising of 28 CBCTs demonstrated a congruence rate of only 7% between RTs and ROs during CBCT escalation. This indicated a mismatch between the RTs and ROs assessment criteria for CBCT matching. To increase congruence rate, a traffic light protocol (TLP) was developed to establish common assessment criteria for CBCT matching.

Methods: To develop the TLP, a matrix incorporating all ROs' matching criteria and accepted tolerance range was created for nasopharyngeal carcinoma (NPC). Different categories within the matrix corresponded to different alert levels with different associated action plans. A pilot test, conducted over a six-month period, utilized this matrix.

Result: A total of 11 CBCTs were escalated to the ROs and 7 required post review action plans. Congruence rate between RTs' and ROs' assessment of CBCT matching increased from 7% to 63.6%.

Conclusion: The TLP aids in increasing the accuracy of correctly identifying patients' CBCT which required further action. This is promising in ascertaining which patient requires escalation for timely action plan to be taken. Additional benefits include standardizing matrix for CBCT matching, streamlining CBCT review workflow and reducing the number of CBCTs requiring ROs' review.

Improving Radiography Students' Comprehension of Mammographic Positioning with an In-House Developed Mammography Phantom

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Background/ Purpose: A mammography phantom is crucial for teaching mammographic positioning to radiography students due to limited opportunities for hands-on practice with real patients. This study aims to create an in-house mammography phantom and evaluate students' knowledge and satisfaction after incorporating it into mammographic positioning training.

Methods: The mammography phantom, shaped like half a body, was created using silicone, thermoreversible gel, and polyurethane foam. This custom phantom was utilized for instructing proper positioning in standard mammographic views. To assess its impact on students' knowledge enhancement, a nine-item questionnaire was administered in a one-group pre-post design involving 63 radiography students. Feedback on satisfaction with the phantom for training purposes was collected using a five-point Likert scale.

Results: This research successfully created a mammography phantom using silicone, thermoreversible gel, and polyurethane foam. The utility of this phantom notably enhanced students' understanding of mammography positioning, as evidenced by a significant increase in knowledge scores from 5.35 ± 1.61 points (pretest) to 7.32 ± 1.20 points (post-test) after training (p -value < 0.001). The students highly appreciated the training aid, with an overall satisfaction rating of 4.49 ± 0.58 points.

Conclusion: The in-house mammography phantom serves as a valuable educational tool for teaching and enhancing the understanding of mammographic positioning among radiography students. However,

additional research is needed to develop more sophisticated phantoms and explore alternative experimental approaches for enhancing teaching methods.

Performance of high-resolution type deep learning reconstruction

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Background: In recent years, the deep learning reconstruction (DLR) has emerged as an image reconstruction method that utilizes AI in X-ray CT. However, those were noise reduction type DLRs. The precise IQ engine (PIQE) was developed as a new DLR for high-resolution AI reconstruction. In this report, we present the results of an experiment to improve the spatial resolution in the X-Y plane and Z-axis direction for high-resolution DLR reconstruction.

Methods: Two CT machines were used in our study. The conventional CT is Aquilion ONE. Conventional reconstruction and PIQE reconstruction were performed on this CT. The other is the Aquilion Precision, an ultra-high-resolution CT. A spiral metal wire phantom made of metal wire with a diameter of 0.1 mm was used in the experiment. The MTF in the X-Y plane, the effective slice thickness in the Z-axis direction, and the peak CT value of metal wire were evaluated.

Results: As the results of the experiments, the MTF of conventional CT image reconstructed using PIQE was improved compared to conventional image reconstruction, but was slightly inferior to ultra-high-resolution CT. The effective slice thickness was 0.63mm for conventional CT, 0.453mm for PIQE conventional CT, and 0.378mm for ultra-high-resolution CT. The peak CT value was 579.2HU for conventional CT, 893.1HU for PIQE conventional CT, and 1540.0HU for ultra-high-resolution CT.

Conclusions: Our experiments revealed that high resolution type DLR reconstruction (PIQE) works not only in the X-Y plane but also in the Z-axis direction. The increase in peak CT value due to PIQE means that the ability to visualize small blood vessels has improved. In addition, it was found that the spatial resolution improved by PIQE means that even conventional CT equipment has a spatial resolution close to that of ultra-high-resolution CT.

Reliability and Validity testing of the LEADS Capability Framework on the Singapore Diagnostic Radiographers Sample

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Objective The study aims to measure the reliability and validity of the LEADS Capability Framework in assessing the leadership capabilities of the Singapore DR. The LEADS Capability Framework consists of 20 items organised into five domains (Lead self, Engage others, Achieve results, Develop coalitions and Systems transformation).

Methods State-registered diagnostic radiographers were surveyed through an online self-report structured questionnaire, which consisted of the LEADS Capability Framework. Exploratory factor analysis (EFA) on the 20 LEADS items was performed to test the construct validity of the LEADS Capability Framework. The evaluation of the LEADS items' reliability is measured using Cronbach's α . The internal consistency of the items was evaluated using Spearman-Brown and Guttman Split-Half.

Results: A total of 42 unique responses were received from April to June 2020. The EFA favoured a two-factor structure as opposed to the original five-factor structure. Furthermore, the Cronbach α coefficient reflected higher reliability considerably when the items were constructed into two factors, 'Sensemaking

and Visioning' and 'Relating and Empowering', with Cronbach α coefficients 0.846 and 0.833, respectively.

Conclusion The LEADS Framework provide a competency profile that may be useful for assessing, developing, and improving leadership capability in healthcare leaders.

Ultrasound Assessment of Portal Vein Diameter and It's Doppler Hemodynamic in Apparently Healthy Adults in Northern Nigeria

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Background: Portal vein enlargement was initially considered the main sign of portal hypertension. But angiographically, the portal vein caliber does not increase and may even decrease with increasing porto-hepatic venous pressure. Hepatofugal flow &/or portosystemic shunts developments also decrease the portal vein caliber, thus making the portal vein size alone a non reliable indicator of portal hypertension.

Objective: To determine the portal vein diameter (PVD), peak systolic velocity (PSV) and pulsatility index (PI) and their relationships in apparently healthy adults based on age, gender and anthropometric variables.

Methods: A cross sectional prospective study was conducted among 196 apparently healthy adults in ATBUTH, Bauchi metropolis. An ultrasound machine "SIEMENS G50" with 3.5MHz transducer and Doppler capability was used. Following an overnight fasting, subjects were examined in supine and right anterior oblique positions for portal vein diameter, PSV and PI measurements. Anthropometric variables were measured prior to the examinations. Data obtained were analyzed using SPSS (22.0) and descriptive statistics.

Results: A total of 196 {Males=106(54.07%), Females=90(45.92%)} apparently healthy adults were enrolled in the study. The mean portal VD, PSV and PI were 11.15 ± 1.81 mm, 22.19 ± 7.08 cm/s and 0.59 ± 0.07 for both genders respectively and also found a weak negative correlation between portal vein pulsatility index and portal vein diameter, age & body mass index. However, these associations were not statistically significant.

Conclusion: This study has established reference values for normal portal VD, PSV and PI in a Northern Nigerian population with their corresponding relationships based on age, gender and anthropometric variables.

Diagnostic Reference Levels in PET Imaging at Chulabhorn Hospital, Thailand

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Background / Purpose: Diagnostic Reference Levels (DRLs) are important for monitoring radiation exposure and ensuring safety in medical imaging. The National Cyclotron and PET Scan Centre at Chulabhorn Hospital, Thailand, produces several radiopharmaceuticals to provide various PET/CT and

PET/MRI scans. This study aims to investigate the amount of radiopharmaceutical activity given to patients during oncology, neurology, and cardiology imaging procedures at Chulabhorn Hospital, with a focus on improving the current information about DRLs in medical imaging.

Method: The 7,631 retrospective PET imaging studies at Chulabhorn Hospital's National Cyclotron and PET Scan Center using 12 protocols and 11 radiopharmaceuticals, including ^{15}O -Water, ^{18}F -FDG, ^{18}F -FDOPA, ^{18}F -Florbetaben, ^{18}F -PI2620, ^{18}F -FES, ^{18}F -NaF, ^{18}F -PSMA, ^{68}Ga -DOTATATE, and ^{68}Ga -FAPI were used for this study. The mean and the 75th percentile values were conducted to determine DRLs according to the ICRP guidelines.

Result: The most administered activity in oncology and neurology examinations was ^{18}F -FDG with DRLs values of 182.41 ± 38.31 MBq and 135.42 ± 14.27 MBq, respectively. These values were lower than the reports of other studies, almost twice as low. For cardiology, the ^{15}O -Water was used for investigation of the cardiovascular disease. The DRL values in the stress and rest imaging studies were 570.26 ± 126.26 MBq and 564.99 ± 103.09 MBq, respectively.

Conclusion: The DRL value comparison data for PET imaging at the National Cyclotron and PET Scan Center at Chulabhorn Hospital, Thailand, with other studies has some limitations because several radiopharmaceuticals were recently used and are not widely known. However, the lower DRLs for ^{18}F -FDG point out the importance of continuous research to determine the specific reference levels for ensuring the use of radiation in nuclear medicine to be safe and useful.

Post-mortem computed tomography (PMCT) and the forensic autopsy in determining a cause of death - Why PMCT should remain a supplementary examination

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Background: Post-mortem computed tomography (PMCT) has seen a gradual introduction into forensic pathology institutions the last two decades. Many researchers started to measure the degree of concordance between PMCT and the forensic autopsy for establishing a cause of death and injuries sustained. Some researchers also explored whether this imaging modality can replace the forensic autopsy in some cases. Based on the results of a comparative post-mortem imaging study, this presentation will advance arguments whether PMCT can replace the forensic autopsy in unnatural child deaths.

Methods: Whole-body PMCT's were acquired in 30 children (<18 years) who died as a result of unnatural, sudden or unexplained deaths before undergoing a mandatory forensic autopsy. PMCT results were independently reviewed by two paediatric radiologists and compared to the forensic autopsy results. Both groups were blinded to the findings of the other study.

Results: The results showed that the forensic autopsy was superior at diagnosing haemorrhagic, large blood vessel, solid organ and soft tissue injuries. PMCT was superior at diagnosing skeletal injuries and gaseous collections. PMCT was unable to identify:

- Organ pallor
- Measurement of free fluid/blood
- Skin injuries
- Mucosal assessment
- Establishing entrance and exit wounds
- Estimation of foetal age
- Establishing organ weight (each point will be argued)

Conclusion: Based on the above findings, PMCT is unable to conduct all assessments used to compose a cause of death or injuries sustained. PMCT in conjunction with the forensic autopsy does improve the overall number of injuries identified. However, this study showed that PMCT should serve as a supplementary examination to the forensic autopsy in children who succumbed to unnatural, sudden or unexplained deaths.

Experience of Brilliant Hospital in performing Liver Donor Magnetic Resonance Cholangiopancreatography (MRCP) for patients undergoing living donor liver transplantation (LDLT)

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Objective: To diagnose Liver Donor MRCP in patients undergoing living donor liver transplantation. Focus on LDLT where the right lobe of a donor's liver is transplanted into the patient after volumetric studies.

Material and Methods: Data collected from 163 MRCP cases diagnosed between Jan.2023 and Jan.2024. 1.5Tesla Siemens Magnetom Essenza MRI scan used. Patients referred to MRCP on a 1.5T scanner. MRCP requires at least four-hour fasting before the examination. Administration of per-oral pineapple juice 20-30minutes before the study for better visualization of anatomical details. Standard MRCP sequence protocol with specific parameters (TR:8500ms,TE:800ms,Matrix:256×256, FOV:30×18mm,Thickness:3mm,Bandwidth:31.2,ET:13,NEX:3).

Results: A total of 163participants were involved, consisting of 69 females (42.3%) and 94 males (57.7%). The participants had a mean age of 43.5±13.2years. From the 163 MRCP cases, Various contrast agents were utilized for liver MRI, including Extracellular-contrast-agents (Gadobenate-dimeglumine), Gadolinium-based contrast agents, and Hepatobiliary contrast agents such as Gadoxetate-disodium.

Conclusion: The success of liver imaging is primarily dependent on optimizing techniques and pulse sequences. Routine use of fast breath holds for T1 and T2sequences with smaller slice thicknesses and high-resolution matrices in liver imaging. These scans are crucial due to their high sensitivity and specificity for detecting and characterizing focal hepatic lesions. During the hepatobiliary phase, contrast-enhanced T1weighted scans selectively increase liver signal intensity, aiding in the detection of small tumors. Biliary excretion during this phase enables biliary ductal mapping, achievable through post-contrast MRCP or functional MRCP using 3D T1 weighted fat-saturated GRE images. In summary, the study underscores the importance of specific imaging techniques, particularly the use of contrast-enhanced T1weighted scans during the hepatobiliary phase, for effective liver imaging. The ability to detect and characterize hepatic lesions, along with biliary ductal mapping, is highlighted as key advantages of the described approach, especially in the context of potential liver donors.

QUANTITATIVE ANISOTROPY DIFFERENCES BETWEEN HEALTHY ADULT AND CHILD BRAIN

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Background: Quantitative Anisotropy (QA) is a robust diffusion Magnetic Resonance Imaging (MRI) metric. Like Fractional Anisotropy (FA), QA provides information about the degree of anisotropy, with higher accuracy of microstructure differentiation.

Methods: We used open-source datasets of 6 healthy adults and 11 healthy children available at <https://openneuro.org/datasets/ds003416/versions/2.0.2>. The dataset consists of 319 diffusion scans acquired at 3T MRI from b-value 1000 to 3000 s/mm², among which dataset with b-value 0 and 2000 s/mm² was taken for our study. All the acquisitions per scan were preprocessed, and QA was calculated with the Generalized Q-space Imaging (GQI) algorithm in DSI Studio. The obtained QA images were statistically analyzed using TBSS commands from the FSL package. The QA images were first registered non-linearly to create a mean subject template. Then, the mean QA image was threshold by 0.2 to obtain a white matter tracts skeleton image. Each participant's QA image was projected onto this skeleton image. Regression analysis was performed with 10,000 permutations using a randomized tool. P-value was set at a 5% level of significance.

Results: The statistical analysis of TBSS showed statistically significant differences between healthy adult and child brains. We obtained higher QA values among children than in adults.

Discussion: Our results revealed significant differences between the white matter microstructure of healthy adults and children, likely attributed to undergoing development, and myelination in the child's brain. The QA values were found to be higher in the white matter of the brain in children compared to adults which implies ongoing brain development in children.

Conclusion: The diffusion is more anisotropic in children compared to the adult brain. The QA could be used as a non-invasive bioimaging marker for differentiating adult and child brains.

In-MRI Safety Briefing: A patient education video to reduce repeat acquisitions during MRI examinations

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Background: Magnetic Resonance Imaging (MRI) produces detailed images of specific anatomical regions without the use of ionising radiation. It is an examination which takes approximately 30 minutes to an hour. Due to the long duration, patients may move, leading to poor quality images obtained, hence affecting radiologists' interpretation of them. In Sengkang General Hospital (SKH), patients are routinely given a verbal explanation of their examination during positioning. Between October to December 2021, MRI radiographers encountered 90 cases where patients were noncompliant, resulting in multiple repeated acquisitions of images. The prolonged scan time led to operational inefficiency.

Methods: Root-cause analysis was performed using the "cause and effect" diagram, and the "5 Whys" analytical technique identified poor patient awareness as the root cause. The study team came up with the idea of creating an MRI patient education video as an intervention to improve patient awareness. The Plan-Do-Study-Act (PDSA) quality improvement tool was subsequently selected to test the intervention. Plan - brainstorming on the creation and content of an MRI patient education video; Do - creating the video with emphasis on patient's cooperation and showing the final product to patients;

Study - data collection and analysis of pre and post implementation of the patient education video; Act - reassess the suitability of implementing the patient education video for a long term.

Results: With the implementation of the patient education video, the percentage of patients who were noncompliant during their MRI examination fell significantly by 80%.

Conclusion: The result suggests that by implementing an MRI patient education video, patients become more aware of the MRI examination requirements, leading to a reduction in repeated image acquisitions.

Usefulness of nerve root delineation using the subtraction method in cervical spine MRI

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Background/Purpose: There have been many cases of nerve root findings in the spine. Therefore, recent advances in equipment and imaging technology have enabled short-term imaging, and an increasing number of institutions are incorporating coronal sectioning and nerve root delineation into routine imaging. However, the problem of magnetic field inhomogeneity in the cervical spine region has made stable nerve root delineation challenging. Therefore, we examined the usefulness of subtraction images with T1W-Dixon (fat image) and STIR-SPACE for nerve root delineation.

Methods: Nerve root delineation images using STIR-SPACE and nerve root delineation images using subtraction images with T1W-Dixon (fat image) and STIR-SPACE were obtained in two volunteers, and the following studies were performed.

1. The signal strength and standard deviation (SD) of the vertebral body, nerve root, and muscle area were measured, and the signal-to-noise ratio (SNR) and contrast were obtained and compared.

2. Two orthopedic surgeons and a radiologist visually evaluated the nerve roots and brachial plexus.

Results: No decrease in signal intensity and SD was observed for nerve roots, but the vertebral bodies and muscles showed a decrease in signal on the subtraction images. The results showed that the contrast between vertebral bodies and nerve roots and between muscles and nerve roots improved. Upon visual evaluation, the subtraction image was superior in the brachial nerve region, whereas no significant difference was observed in the nerve root region.

Conclusion: Subtraction imaging with T1W-Dixon (fat image) and STIR-SPACE is useful for nerve root delineation of the cervical spine.

Assessment of Radiation Dose and Image Quality in Computed Tomography Angiography for Transcatheter Aortic Valve Implantation

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Background / Purpose: Treating patients with aortic stenosis using transcatheter aortic valve implantation (TAVI) is an effective method. Prior to TAVI, patients have to undergo computed tomography angiography (CTA) for planning, in which the size of annulus is assessed. TAVI CTA protocol is uncommon procedure in routine clinical practice that require the evaluation of both radiation dose and image quality. Therefore, this study aims to estimate the pre-TAVI CTA's effective dose and image quality.

Methods: All consecutive 65 participants who were diagnosed with aortic valve stenosis and examined with CTA before TAVI were retrospectively included in this study. TAVI CTA protocol was utilized and its parameters were recorded. The effective dose was calculated from the multiplication of dose length product and conversion coefficient ($k = 0.026 \text{ mSv}/[\text{mGy.cm}]$). The CT number, image noise, signal-to-noise ratio, and contrast-to-noise ratio of aortic root and aortoiliac pathway were quantitatively measured for image analysis. Additionally, qualitative evaluation of image quality was assessed by experienced radiologists.

Results: The whole-aorta CTA phase received the highest dose, followed by the coronary CTA and coronary artery calcium scoring phases (16.67 ± 4.51 , 4.23 ± 1.95 , and 2.01 ± 0.95 mSv, respectively). Spearman rank correlation analysis showed that the three variables correlated with an effective dose were BMI, total mAs, and kVp. Concerning image quality, the quantitative assessment was good, and the qualitative assessment ranged from good to excellent.

Conclusion: This study demonstrated that the pre-TAVI CTA protocol using multi-row multi detectors CT in our institute had an average effective dose of 22.91 ± 5.03 mSv with acceptable image quality. This finding provided baseline information to establish a local diagnostic reference level and adjust the scanning techniques further.

Development of an interpretable machine learning model for predicting luminal and non-Luminal breast cancer based on DCE-MRI semi-quantitative parameters

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Purpose: To develop an interpretable machine learning model based on DCE-MRI semi-quantitative parameters and clinical features to predict luminal and non-Luminal breast cancer.

Methods: A total of 196 patients with breast MRI examination in our hospital from May 2021 to April 2023 were retrospectively enrolled, including 6 patients with bilateral breast cancer, and a total of 202 lesions were included. The patients were randomly divided into the training set ($n = 141$) and the test set ($n = 61$) at a ratio of 7:3. The enhanced lesions were delineated for post-processing, and the time-intensity curve (TIC) were obtained for semi-quantitative perfusion analysis. The clinicopathological and imaging features of the patients were collected according to the BI-RADS lexicon. Semi-quantitative parameters and clinicopathological and imaging features were screened by univariate analysis. The XGboost classifier was used to construct the model, and the area under the receiver operating characteristic (ROC) curve (AUC), accuracy, sensitivity, and specificity were used to evaluate the performance of the model. Shapley Additive explain (SHAP) technique was used to evaluate the global and local influence of predictors on the model output to explain the model.

Results: Compared with non-Luminal breast cancer, luminal breast cancer had lower washout and ADC values and higher SER. Patients with low HER-2 expression, smaller maximum tumor diameter and no tumor necrosis were more likely to be expressed as luminal breast cancer. The interpretable machine learning model based on the above features had an AUC of 0.842, accuracy, 0.680; sensitivity, 0.944; specificity, 0.360; and F1, 0.791.

Conclusions: Interpretable machine learning models based on DCE-MRI semi-quantitative parameters and clinical features can effectively predict luminal and non-Luminal breast cancer and provide a basis for the treatment decision-making of early breast cancer patients.

Diagnostic Evaluation of MR Foot MIP Angiography: Focusing on occlusive peripheral arterial disease in diabetic foot patients.

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Purpose: To evaluate diagnostic usefulness of 3D contrast-enhanced images reconstructed by the maximum intensity projection (MIP) method, it will be compared with Angio DSA and Low Extremity CTA images during the MR Foot Contrast examination.

Subject and Method: Among the patients who underwent "the MR FOOT with contrast" from September 2020 to October 2022, 40 patients who simultaneously performed Low extremity CTA and Angio DSA were targeted. To evaluate the image, ATA, PTA, and Peripheral artery were classified. Angio DSA and Low Extremity CTA images were compared and analyzed qualitatively based on the MR Foot MIP 3D image. SPSS 26.0 Ver. was used as a statistical program.

Result: 3D MR MIP was compared with Angio DSA image to qualitatively analyze anatomical reproducibility. There was no statistical difference between ATA and PTA ($p=0.542$), whereas Angio DSA image was superior in Peripheral Artery($p<0.05^*$). Comparing with MR MIP ANGIO and Low Extremity CTA, MR MIP ANGIO images were superior in ATA, PTA, and Peripheral Artery($p<0.01^*$).

Conclusion: The 3D MR MIP ANGIO image was superior compared to the Angio DSA and Low Extremity CTA images for the images below the ankle. Therefore, when evaluating blood vessel below the ankle, it is possible to obtain a blood vessel map with high reproducibility with a small amount of contrast medium compared to Low Extremity CTA and Angio DSA. Thus, MR MIP Angio image could be useful as a supportive image in the treatment planning stage.

Dose comparison of EOS and DR in scoliosis monitoring of adolescent patients

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Purpose: Full-length spine radiography is necessary for monitoring the progress of adolescent scoliosis patients. The radiation dose is an issue for them. This study explored the difference in radiation dose between the ultra-low dose scanning system and conventional DR in whole spine radiography for patients with scoliosis.

Method: A retrospective analysis was conducted on 20 adolescent scoliosis patients aged 9-20 with DR and EOS whole spine anteroposterior and lateral imaging taken within one to four years. The requests of the examinations were the same, such as Cobb Angle measurement, observation of vertebral pelvis rotation angle, and spinal physiological curvature. Images of both methods could meet the standard diagnostic needs. The radiation dose management system was used to collect the dose area product (DAP) data of the whole spine in the anteroposterior and lateral views, and the paired t-test was used for statistical analysis.

Result: In the EOS group, the average DAP values of the whole spine in the anteroposterior, lateral, and anteroposterior + lateral views were 0.25770Gy.cm², 0.33735Gy.cm², and 0.59470Gy.cm², respectively.

In the DR group, the average DAP values of the whole spine in the anteroposterior, lateral, and anteroposterior + lateral views were 2.65670Gy.cm², 3.28650Gy.cm², and 5.93895Gy.cm², respectively. The average DAP values of the DR group were significantly higher than those of the EOS group (P<0.05). The EOS imaging system's DAP was 10% of DR's.

Conclusion: The radiation dose of the EOS system is one-tenth of the conventional technique and provides sufficient image quality to meet clinical needs. The ultra-low dose full-length scanning system is safe for adolescent scoliosis patients who have regular X-ray follow-ups and monitor the progression of scoliosis.

Clinical application of deep learning combined with compressed perception in breath-hold 3D MRCP

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Purpose: To explore the optimal acceleration factor for breath-hold 3D MRCP based on deep learning (DL) combined with compressed sensing (CS) technology and its clinical application.

Methods: Sixty-eight patients who underwent 3D MRCP of the upper abdomen were prospectively included in the 3D MRCP sequences, including the CS group, with an acceleration factor of 24 (CS-24); and the DL-CS group, with an acceleration factor of 24 (DL-CS-24) and 33 (DL-CS-33), respectively. The signal-to-noise ratio (SNR), contrast ratio (CR), and contrast-to-noise ratio (CNR) of the images in the 3 groups were measured, and the overall image quality, background suppression, artifacts, and visualization of bile ducts and pancreatic ducts at all levels of the images were subjectively evaluated. The number of diagnostic images with unsatisfactory subjective and objective indicators was statistically analyzed for each of the 3 groups of sequences.

Results: The scanning time of the DL-CS-33 group was 30% shorter than that of the CS-24 group and the DL-CS-24 group. The images of the DL-CS-33 group satisfied the clinical diagnostic requirements in 68 patients, the images of the CS-24 group did not satisfy the diagnostic requirements in 7 patients, and the images of the DL-CS-24 group did not satisfy the diagnostic requirements in 4 patients. SNR, CR, CNR, overall image quality, artifacts, visibility scores of bile ducts and pancreatic ducts at all levels were not statistically significant in the DL-CS-33 and CS-24 groups (P> 0.05), and the DL-CS-24 group's SNR, CR, CNR, intrahepatic bile ducts, main pancreatic duct, and overall image quality were better than those of the CS-24 group, and the differences were statistically significant (P < 0.05).

Conclusion: The application of DL-CS technology improved the quality of screened 3D MRCP images without changing the image scanning time compared with CS technology. DL-CS technology combined with a high acceleration factor 33 reduces the time of a single scanning session while ensuring the overall image quality and provides an efficient screened scanning solution.

Teaching patient-centred care in Radiography through interactive clinical simulation

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Background: It is a pre-requisite of radiographer education globally that students learn to apply theoretical knowledge during clinical placements. This is essential for the development of competence and confidence in the emerging graduate. The number of undergraduate radiographers in training poses challenges to placement capacity in many countries, which in turn impacts the quality of the clinical education experience. Within constrained placement periods, teaching and learning can tend to focus on the technical aspects of an examination. Solutions are needed to ensure that teaching and learning remain patient-centred and address all elements of the patient imaging pathway.

Methods: FORCE (Framework for Online Radiographer Clinical Education) is a web-based Virtual Learning Environment (VLE) containing simulated clinical cases that encourage learner interaction and problem solving. Each case includes content pertaining to patient care; performance of the examination or therapy treatment; patient safety; image interpretation and radiographer responsibilities. A key feature of each case is the complex patient story that invites the learner to consider the comprehensive care of the whole person.

Under approval of University College Dublin's Ethics Committee, multi-national users (Radiographers and students) of the FORCE VLE were invited to give feedback on the cases in an online questionnaire containing Likert scale questions and opportunity for open text additions.

Results: Feedback on the interactive video-based format of the case simulations was very positive. One theme drawn from the open comments was the value of the learning interactions related to patient care and communication. Participants offered that the patient perspective materials were insightful into real practice and a great asset in learning how to interact with patients.

Conclusion: Interactive clinical simulation can be a useful tool for teaching patient-centred care across all stages of the patient imaging or therapy pathway.

Student radiographer's experiences with an inter-disciplinary, collaborative online international learning linked to SDG 4

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Background: The Sustainable Development Goals were developed and adopted by several countries and South Africa is one of the signatories. They are a universal collaboration to end poverty, protect the planet and improve the lives of everyone around the globe. Sustainable Developmental Goal Number Four seeks to ensure inclusive and equitable quality education. We used SDG number four in a Collaborative Online International Project between the Durban University of Technology and the Amsterdam University of Applied Sciences, to explore the impact of Covid-19 on access to education. Hence the need to explore students' perspectives on access to education and COIL experiences.

Aim: The study aimed to explore students' perspectives on access to education during the COVID-19 pandemic error.

Methodology: A qualitative retrospective record review of students' experiences that was written on their reflective reports. Students' reflective reports from both the participating institutions were reviewed for content and thematic analysis was conducted.

Results: students felt that there was good communication between their counterparts from the Netherlands and that there was good group cohesion. Also, the stereotypes they had about their counterparts from the Netherlands were proven to be not true. The student's negative experiences were related to the completion of tasks that were assigned to them, as they felt that their counterparts did not pull their weight. In addition, students also expressed a limited amount of time to execute their tasks because of work-integrated learning.

Conclusion: Both groups enjoyed the interaction and they felt the COIL project was educational in terms of the education of the education systems in both countries and the general knowledge obtained during the group discussions. There could have been better oversight by the facilitators of the research project to ensure equitable distribution of the workload.

The Implications of the Occupational Specific Dispensation for Radiographers Employed in Public Hospitals in South Africa

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Background: In 2010, an occupational-specific dispensation (OSD) was introduced for therapeutic, diagnostic and allied health professionals. The objectives of the OSD were: to introduce career pathing opportunities based on competencies, experience and performance; provide grade progressions within the limits of the relevant grades; recognise appropriate experience for the purpose of grade progression; the recognition of performance for accelerated progression to higher grades and pay progression within a salary grade; and remuneration structure.

Aim: The aim of the study was to explore radiographers' perceptions of the implementation of the OSD policy by the Department of Health.

Methods: A qualitative, primary exploratory research design was used for the study. The target population were five disciplines of radiographers employed by tertiary hospitals in the Gauteng province. The five disciplines included were diagnostic radiography, mammography, nuclear medicine, radiotherapy and sonography. Data collection was done through focus group interviews and one-on-one interviews. Thematic analysis was used to analyze the data.

Results: There were split views on the implementation of the OSD policy, they were those who believed that there was a significant improvement in radiographers' salaries. There were those participants who were of the view that the OSD policy failed to adequately recognize the different disciplines of radiography. For instance, mammography radiographers were categorized as diagnostic radiographers and the salary progression was not consistently applied across the different disciplines.

Conclusion: The objectives of the OSD policy were noble, but its implementation stands to divide the profession as it has not been consistently applied across the disciplines of radiography. The different disciplines of radiography have not yet be recognized as independent disciplines as they still reported to the diagnostic radiography manager.

3D MR derived CT-like images of pelvic region from The Generative Adversarial Network (GAN)

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Background: Although bone pathologies and lesions can be detected via CT images, patients may be exposed to radiation exposure. In contrast to CT, MRI does not subject the patient to radiation exposure; however, it is incapable of detecting cortical bone. CT-like images, on the other hand, can circumvent this limitation. GAN and U-net were utilized to generate CT-like images from 3D MR images for the purpose of comparing them to actual CT images.

Objective: This study aims to generate CT-like images from MRI images in three dimensions using fundamental deep learning methods.

Materials and methods: The pelvic region real CT images and MR images of the same patients were obtained from the GOLD atlas public data set. A total of 6,236 images were utilized to train the model using the Python-based Spyder program. The model was then evaluated using 332 images to compare the quality of CT-like images to that of real CT images and to establish a comparison between the two models

Results: The cGAN model generated CT-like images with smaller mean absolute error (MAE) and mean square error (MSE) values (0.0244 ± 0.0197 and 0.0032 ± 0.0040 , respectively), and larger Pearson correlation coefficient (PCC) and peak signal-to-noise ratio (PSNR) values (27.1221 ± 3.9920 and 0.9283 ± 0.0389 , respectively).

Conclusion: This research illustrates the capability of GAN to produce CT-like images from MR data, which could potentially serve as a substitute for authentic CT images when assessing bone morphologies.

A phantom study on the influence of CT imaging parameters on quantitative assessment of cancellous bone

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Background/Purpose: Quantitative computed tomography (QCT) is a bone mineral density (BMD) quantification technology that relies on CT values. However, it has a limitation in that it requires a tube voltage of 120kV, which restricts its application. The calculation basis of QCT technology is the CT value, which is useful in understanding the relationship between tube voltage and CT value. By enabling the conversion of CT values under different tube voltage conditions, it becomes possible to achieve quantitative analysis of BMD. This study aims to explore the influence of imaging parameters on the CT value with phantom.

Methods: A thoracic vertebral phantom was scanned 10 times under 6 groups of tube voltage (80/90/100/110/120kV, Sn100kV), different layer thickness/spacing and kernel algorithm (Br40/Bl40/Bv40/Br32/Br64) were applied for image reconstruction. The CT value of cancellous bone at thoracic vertebra 6 (T6) and 8 (T8) were measured to explore the relationship between tube voltage, reconstruction layer thickness/spacing, kernel algorithm and CT value.

Results: 1. The best fitting curve between CT value (Y) and tube voltage (X) for T6 and T8 was a quasi-linear regression function, with the regression equation $Y=678.532-2.378X$ ($R^2=0.969$, $P<0.05$). 2. The average CT value difference between each 10kV was $(25.60\pm 2.22$ HU, $p>0.001$). 3. CT_{100} VS CT_{Sn100} is $(436.22\pm 2.49$ HU VS 364.28 ± 2.93 HU, $p<0.001$) 4. Under the same voltage conditions, CT value of different layer thickness/spacing, kernel algorithm has no difference ($p>0.05$)

Conclusion: The CT value exhibited a quasi-linear decreasing trend with changes in continuous tube voltage. After adding Sn pre-filter, the CT value decreased significantly under the same tube voltage conditions, but the CT value will not change with the change of layer thickness/spacing and kernel algorithm, which possible to quantify bone density under different tube voltage conditions.

Optimizing Prone Positioning in Breast Cancer Radiation Therapy: Analyzing the Impact of Patient Age, BMI, and Treatment Site on Setup Times

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In breast cancer radiation therapy, the widespread preference for supine positioning is primarily due to its operational simplicity and the comfort it affords patients. However, the anatomical benefits of prone positioning, particularly its potential to significantly reduce radiation doses to organs at risk (OAR), are not fully leveraged in clinical practice. This underutilization stems from several difficulties, including compromised patient comfort, stability and precision of setup, and notably, increased setup times. 36 breast cancer patients treated with the VARIAN iX Linac between February and November 2023 were analyzed. The study recorded patient information, including age, BMI, and measurements of average setup times (from entry into the treatment room to beam-on) and total treatment times. The findings indicated a notable variance in setup times, with an average of 7.84 minutes, a median of 7.295 minutes and a standard deviation of 1.61. Upon grouping patients by age (30-50, 51-60, and 61 years and above), statistical analysis revealed significant age-related differences in both setup ($P<0.05$) and total treatment times ($P<0.05$), especially between patients aged 51-60 and those over 61 ($P<0.05$), indicating longer durations for the latter group. Furthermore, while BMI did not significantly affect setup times, it was linked to longer total treatment times for patients with higher BMI. Treatment side analysis showed no significant statistical difference in setup times between left and right-sided treatments, though a trend towards longer durations for left-sided treatments was observed. This study confirms longer treatment times for patients over 61 and those with higher BMI. No significant difference was found between treatment sides but left-sided treatments tend to take longer. These findings suggest that further research other factors like mobility, psychological state, and comfort to improve treatment quality.

Problem and Countermeasures of Medical Informed Consent in Enhanced CT Scanning

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Enhanced CT scanning is of great significance in the diagnosis of diseases. However, when patients sign the informed consent form of enhanced CT examination, there are medical risks and ethical problems in this process. From the perspective of medicine, law and medical ethics, this article discusses the problems of misunderstanding and informing defects existing in the process of signing informed consent between patients and doctors and puts relevant measures and suggestions on this basis. At present, there is no unified CT enhanced informed consent form paradigm adopted nationwide. Developing a unified, detailed, and comprehensive informed consent form for CT contrast agent injection is a prerequisite and foundation for patients to make correct decisions. The amendment and improvement of the "Consent after Notification" rule in the Civil Code highlights the patient-centered medical service purpose and also demands professional ethics for medical personnel. This rule is not only a legal norm, but essentially an ethical command, which is conducive to clarifying the rights and responsibilities of doctors and patients, as well as building a harmonious doctor-patient relationship. We suggest reengineering the process of signing informed consent forms. The process includes pre notification of the signing process and the establishment of a dedicated window for contrast agent injection and consultation. Integrate the image registration system with the HIS system to achieve data sharing. In addition, the promotion of informed consent can be strengthened by creating an atmosphere. In summary, only by further standardizing and improving the content and procedures of CT contrast agent notification and striving to improve the awareness and understanding of patients' right to informed consent, can we eliminate the lack of coordination between existing regulations and ethics, as well as between medical staff and patients.

Using automatic phantom-less quantitative computed tomography system based on routine CT to evaluate osteoporosis and predict hip fracture

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Background/Purpose: The diagnosis of osteoporosis remains a paramount concern for orthopedic surgeons worldwide. We aim 1) to validate the consistency of a novel automatic phantom-less quantitative computed tomography (PL-QCT) with phantom-based QCT (PB-QCT) and Dual-energy X-ray absorptiometry (DXA) in measuring bone mineral density and 2) to evaluate the clinical value of automatic PL-QCT in predicting osteoporosis and hip fractures.

Methods: 625 patients were enrolled with available lumbar or hip DXA and CT or phantom based QCT data from January 2021 to January 2024. Hip CT of 315 patients and lumbar CT of 310 patients were analyzed with automatic PL-QCT. The consistency of bone mineral density (BMD) measured by DXA, PB-QCT and automatic PL-QCT was assessed through Linear regression and a Bland-Altman plot. The effectiveness in the automatic PL-QCT for diagnosing osteoporosis and predicting hip fracture was evaluated with receiver operating characteristic (ROC) curve.

Results: The correlation coefficients between the PL-QCT and DXA were 0.93 and 0.91 for the femoral neck (FN) and the total hip (TH), respectively. The linear regression analysis revealed an r value of 0.98 between PB-QCT and PL-QCT. Bland-Altman analysis demonstrated that the differences in BMD between automatic PL-QCT and DXA were 0.021 (95%CI 0.015-0.027) g/cm² and 0.039 (95%CI 0.032-0.047) g/cm²

for FN and TH, respectively, The BMD differences between PL-QCT and PB-QCT were 4.056(95%3.086-5.025) mg/cm³. The area under curve (AUC) of automatic PL-QCT for diagnosis of lumbar vertebrae and hip osteoporosis were 0.903 and 0.902. The AUC of femoral neck BMD measured by PL-QCT for predicting hip fracture was 0.863.

Conclusion: The automatic PL-QCT was more effective in predicting hip fractures in comparison with DXA. As for predicting osteoporosis, the novel PL-QCT has similar performance in comparison with PB-QCT.

Enhancing Paediatric Radiology Experiences: Integrating Play and Child Life Therapy Techniques for Optimal Patient Cooperation

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Background: The significance of creating positive and stress-free environments during paediatric radiology examinations should not be overlooked. This presentation explores the role of play and Child Life Therapy in fostering a child-friendly atmosphere, encouraging patient cooperation, and ultimately enhancing the diagnostic quality of radiology imaging examinations (specifically X-ray, CT and Ultrasound). By recognizing and acknowledging the inherent anxiety associated with radiology procedures in children, incorporating play-based techniques becomes crucial for healthcare professionals in obtaining successful examinations.

Methods: This assessment employed a comprehensive approach, reviewing recent journal publications and collaborating with Child Life Specialists to develop tailored play interventions that engage the patients in ways that allow the examination to be achieved in the least challenging way possible. Various examples such as interactive games, sensory activities, visual aids and comfort holding positions were implemented to ease patient anxiety, build rapport and achieve cooperation with patients.

Results: A significant increase in patient cooperation and overall satisfaction was appreciated when play and Child Life Therapy techniques were incorporated into paediatric radiology examinations. Patient's engaging in play or distraction techniques led to visibly reduced distress levels, ultimately resulting in increased diagnostic accuracy and improved image quality. Implementation of these play techniques not only resulted in a positive medical experience for patients and parents, but also contributed to a more efficient workflow for healthcare providers.

Conclusion: This presentation highlights the importance of incorporating play and Child Life Therapy techniques in paediatric radiology examinations. By enabling an encouraging and supportive environment, healthcare professionals can implement a variety of strategies to minimize procedural anxiety, allowing for increased patient cooperation, patient care and diagnostic outcomes. This holistic approach to paediatric healthcare recognizes the wellbeing of children alongside diagnostic responsibilities.

Design and Invention of Radiation Shielding Apparatus for Radiography in Neonatal Intensive Care Units

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In this study, researchers created a radiation shielding apparatus for incubator warmers to reduce scatter radiation exposure during portable x-ray diagnostics in neonatal intensive care units (NICU). The covering, which is made of 0.6 mmPb lead sheet, is intended to envelop the incubator. Its efficacy was tested using a PMMA phantom positioned in the incubator's the center and subjected to x-rays from a portable x-ray. The scatter radiation levels were measured inside and outside the incubator, before and after the radiation shielding was applied, using a RaySafe X2 solo tool. The results showed a considerable reduction in scatter radiation, with drops ranging from 63.30 to 97.82%, and a significant attenuation of backscatter inside the incubator, with reductions ranging from 8.57 to 60.52%. It suggests that staff positioned at least 200 cm distant and 180 degrees from the exposure site may get reduced radiation exposures. Furthermore, using shielding on exposed and nearby incubators allows for safe operations at any distance while successfully reducing scatter radiation both inside and externally. Calculations of the yearly occupational effective dose using a typical NICU setting of 60 kVp and 2 mAs showed exposures less than 0.1 mSv/year. A satisfaction survey of thirty radiological technicians and NICU nurses revealed that the products received high acceptance, with an overall average satisfaction score of 4.59 out of 5. The equipment received an average rating of (4.87±0.43) for effectively reducing dispersed radiation. Respondents were less concerned about radiation risks (4.73±0.45) and more likely to start using the device with newborn incubators (4.67±0.48). Safety ratings averaged (4.77±0.43). Tensile tests on lead and vinyl sheets also indicated maximum forces of 3166.8 MPa and 652.1 MPa, demonstrating the longevity and efficacy of the lead sheet material applied in the shielding device.

The Development of Learning Materials for Preparing Virtual Patients for Magnetic Resonance Imaging Study Using Virtual Reality Technology for Students of Radiological Technology

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Focusing on evaluating learning outcomes prior to and subsequent to the study, this research endeavors to develop educational resources utilizing virtual reality (VR) technology that can be employed to prepare patients for MRI examinations. 28 second-year radiological technology students were selected for the study via purposive random sampling from the Faculty of Medicine at Prince of Songkla University. The educator created instructional materials that emulated the functional elements of an MRI scanner by utilizing virtual world technology. Accessible in the Metaverse via Oculus Rift S spectacles and the Spatial.io application, this entailed the production of a 360-degree video utilizing Adobe Premiere Pro to prepare for an MRI assessment. Consensus among experts placed a mean score of 0.95 on technology acceptability and innovation, suggesting that content validity was a critical

determinant, with an average score of 4.67 ± 0.24 , the assessment of the appropriateness of the learning media and content was found to be highly satisfactory. Students demonstrated a substantial enhancement in their academic achievements after employing the educational resources. The average score improved to 16.93 ± 1.86 from 10.57 ± 3.06 prior to the study. A mean score of 4.78 ± 0.16 for the MRI examination simulation and 4.46 ± 0.55 for learning media incorporating VR technology indicated that students were extremely satisfied with the VR-based learning materials. As a result, radiological technology students' comprehension of MRI examination preparation is ultimately improved by means of this educational platform. It encourages students to comprehend the material by simulating the actual MRI scan environment, which is advantageous for educating patients about the magnetic field during examinations. Practical restrictions regarding time, location, and instructional equipment are also taken into account by the platform utilized in the pre-MRI preparation of patients. Address concerns about small areas and noise in examination process

Value of MRI radiomics in predicting molecular subtypes of invasive breast carcinoma of no special type

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Purpose: To investigate the clinical value of MRI radiomics in predicting Luminal and non-Luminal subtypes of invasive breast carcinoma of no special type (IBC-NST).

Methods: A total of 149 cases with pathologically confirmed IBC-NST from April 2021 to December 2022 were retrospectively collected according to the inclusion and exclusion criteria, and all of them underwent non-contrast MRI scanning and contrast-enhanced scanning before treatment. Clinical and pathological data of all enrolled patients were collected. Patients were classified into Luminal subtype (n=90) and non-luminal subtype (n=59) based on the expression of estrogen receptor (ER) and progesterone receptor (PR). They were divided into training group (n=104) and test group (n=45) in a ratio of 7:3, randomly. Screened the optimal features of radiomics from the extracted data, and three prediction models were established based on the random forest method, namely DWI model, DCE model, and combined model. The prediction performance of the models was evaluated by receiver operating characteristic curve (ROC) and the area under the curve (AUC). The DeLong test was used to compare the prediction performance of different models.

Results : There were no significant differences in the clinicopathological features (age, ER status, PR status, menopausal status, lymph node metastasis) between Luminal and non-Luminal groups, training group and test group ($P > 0.05$). The AUCs of DWI model, DCE model and combined model were 0.838, 0.854 and 0.859 in the training group. In the test group, the AUCs were 0.761, 0.765 and 0.821 respectively. The DeLong test showed that the prediction performance has no significant difference among the three models ($P > 0.05$).

Conclusion: The models constructed based on MRI radiomics can better predict the luminal and non-luminal subtypes of IBC-NST, and can help the decision-making of clinical treatment options for IBC-NST.

Research on Simulation in Radiography Education: A Scoping Review

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Background: Learning about patient safety through hands-on experience and simulation is recommended. Reviews addressing the use of simulation in radiography are lacking.

Aims: We aimed to explore, map and summarize the extent, range, and nature of research on simulation in radiography education.

Methods: We followed Arksey and O'Malley's framework for scoping reviews, and searched MEDLINE, Embase, Epistemonikos, The Cochrane Library, ERIC, and Scopus on January 9, 2020. Publications from academic and clinical settings within any radiography specialization were eligible for inclusion. Two review authors independently screened abstracts and titles and conducted data extraction. The PRISMA Extension for Scoping Reviews reporting guidelines was followed.

Results: The search yielded 10492 records; 6585 were screened for title and abstract, whereof 156 reports were read in full text and 78 studies were included. Included studies were published between 2003 – 2023, and the majority were conducted in the United Kingdom (n=21), Australia (n=17) and the USA (n=15). Most studies (n=51) employed quantitative designs, including 11 randomized controlled trials. The most frequently used data-collection methods were questionnaires (n=54), proficiency tests (n=22) and qualitative inquiry (n=22). Included studies comprised 3600 participants with the following specializations: radiography (n=26), radiation therapy (n=21), radiology technology (n=9), medical imaging (n=6), sonography/ultrasound (n=8), medical radiation sciences (n=2), and mammography (n=1). Simulation topics reported included: procedural training, patient care, interprofessional collaboration, patient safety, patient communication, optimization of image parameters, interpretation of diagnostic images and optimization of treatment parameters. One fourth of the studies involved interprofessional collaboration. Equipment/support included: virtual reality, simulator, computer, live model, simple model and mannequin. Results from the updated search (January 3, 2024) will be presented at the conference.

Conclusion: This review provides a thorough overview of research on simulation interventions used in radiography education and a guide for future research.

Radiation Shielding Apparatus Design and Invention for Portable X-Ray Radiography in the Orthopedic Ward

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In the orthopedic ward, this research aims to develop a radiation protection device for X-ray imaging using a mobile X-ray equipment. This research is an investigation into the design of a radiation protection device intended for use in an orthopedic ward during radiographic imaging with a mobile X-ray equipment. Phantom assets replicate the mobile X-ray apparatus's scattered radiation dose configurations Chest AP Supine, Pelvis AP, L-S Spine AP/Lateral, Femur AP/Lat, and Knee AP/Lat and quantify scattered radiation dose in eight directions around the patient bed at angles of 0°, 45°, 90°, 135°, 180°, 225°, 270°, and 315 degrees, respectively and distances of 50, 100, 150, 200, and 250 cm. from the

bed, with Raysafe 452 radiation survey meter position elevated from The floor is 120 cm. At the Prince of Songkla University Faculty of Medicine, thirty individuals, twenty radiological technologist and ten orthopedic ward nurses, participated in a satisfaction survey regarding the utilization of the apparatus, in order to determine their level of satisfaction with the radiation protection device that was developed. According to the study, a 0.6 mmPb mobile radiation shielding consisting of three movable sections It measures a total width of 210 cm and a height of 180 cm when unfolded from the floor. Lead sheets measuring 100 cm in length, 66 cm in width, can effectively reduce scattered radiation by as much as 99.81%. Moreover, this shielding can decrease the annual radiation doses received by personnel. Additionally, it improves the capacity to manage increased job responsibilities. The survey found that orthopedic ward nurses and radiological technologists were satisfied with the radiation protective equipment, averaging 4.51/5 ,The device that decreases scattered radiation.

Enhancing Chest X-Ray Report Generation in Radiology through Deep Learning: Leveraging Keywords from Existing Reports and Multi-Label Classification

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Introduction: Chest X-Ray is a crucial imaging modality for diagnosing lung diseases, relying on radiology reports. However, manual report crafting demands experienced radiologists and consumes valuable time. As deep learning progresses, automated radiology report generation gains improvement. Traditional approaches, utilizing image encoders and text decoders, face challenges such as incoherent keywords and achieving human-style writing.

To address these issues, our deep-learning framework proposed to adapt keywords from existing radiology reports in clinical scenarios and integrated multi-label classification to refine the process by filtering non-related information from chest X-Ray images.

Methods: Our framework utilizes multi-label classification for predicting keywords from chest X-Ray images and employs a language model for report generation. During multi-label classification, keyword settings align with existing radiology reports, adapting to clinical scenarios. Predicted keywords are then input into a pre-trained language model, leveraging general language materials to generate radiology reports. ConvNeXt serves as the multi-label classification network, and Text-To-Text Transfer Transformer (T5) functions as the report generation network. Training and validation were conducted using IU-XRay and MIMIC-CXR datasets, with performance evaluated using Bilingual Evaluation Understudy (BLEU) metrics.

Results: In experiments, our framework consistently outperforms state-of-the-art models. For IU-XRay, it achieves BLEU-1, BLEU-2, and BLEU-3 scores of 0.6266, 0.5162, and 0.4404, surpassing a leading model with scores of 0.4732, 0.3039, and 0.2242. Similarly, in MIMIC-CXR, our framework outperforms with scores of 0.4624, 0.3350, and 0.2568 against 0.3928, 0.2478, and 0.1713.

Conclusions: In conclusion, our proposed framework proposes a new idea in chest X-Ray radiology report generation, elevating diagnostic capabilities. By streamlining the report writing process, our framework enhances radiologist efficiency, contributing to reduced diagnosis turnaround times and improved patient outcomes. The adaptation of medical knowledge from existing reports represents a trend in tailoring radiological diagnostics to specific clinical scenarios.

CONSTRUCTION OF T1 WEIGHTED MRI BRAIN TEMPLATE AMONG NEPALESE POPULATION

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Background: Magnetic Resonance Imaging (MRI) brain template represents a precise anatomical representation of structures of brain with finer anatomical details. The template provides basic standard anatomical reference population-based assessment of brain structure and function. During pre-processing step, spatial normalization is used for aligning the MR brain images to common standard space. For this, a template image is required to which each subject image are to be registered. However, template image varies according to different human brain features such as volume, shape and size that can be affected by genetic, developmental, phenotypic and environmental factors. Hence, population specific brain template is required for accurate measurements, comparison and interpretation of results. This study aims to construct an adult T1-weighted MRI brain template among Nepalese population.

Methods: A total of 12 subjects (25-43 yrs) were scanned in 1.5 T Philips MRI scanner. 3D Turbo Field Echo pulse sequence was used. The data underwent bias field correction and were registered to a common voxel space. Data were averaged to construct a mean T1-weighted image (named as “Nepalese-12”). The Nepalese-12 image was registered to standard T1-weighted image provided by Neuromorphometrics, Inc (Demo version) using 3 stage ANTs registration: rigid, affine, and non-linear, and the standard labels were warped back to “Nepalese-12” voxel space. For evaluation of brain features, Anterior Commissure (AC) - Posterior Commissure (PC) distance, length (L), width (W) and height (H) of the whole brain were measured.

Results: We constructed Nepalese-12 MRI brain template. The AC-PC distance, L, W and H were 24mm, 160 mm, 141mm and 113 mm respectively.

Conclusion: This template could be used for spatial alignment, normalization and preprocessing for various types of population-specific MR studies among Nepalese population.

Patient Safety in Medical Imaging

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With evolving and advancing technology in medical imaging, seemingly the most challenging is ensuring patient safety as the main goal. Patient safety is the prevention of errors and adverse effects to patients whilst undergoing imaging procedures. Our role as professional Radiographers is to provide benefit to patients whilst maintaining their safety at all times by creating a safe environment.

The objective of my proposed presentation is to reduce the risk of harm to patients during diagnostic procedures and to reflect on how the staff can be trained in creating a safety culture within the department. The two main concerns in a Radiology department are Radiation Safety and MRI safety. Training in these areas is done extensively and is mandatory, however there are many other risks associated in healthcare that can impact a patient’s safety during an imaging procedure. Evidence was obtained through reports of incidents and near miss from the portal system in our hospital. Analysis of

these reports gave me an insight into the risks including patient misidentification, patient fall, inefficient communication in handover and lack of infection control practices. It was evident that staff are aware of these associated risks through the hospital policies and lacked effective training in these areas. Improvement plans implemented, included training and evaluation, creating a no-blame culture, continuous learning and education, effective communication and collaboration among the multidisciplinary team, clinical audits and forming an internal patient safety team. Sharing observations from my experience and lessons learned can be valuable to other healthcare professionals to minimize recurrence of incidents and provide optimum patient safety outcomes in an imaging department.

The impact of education on low-dose computed tomography lung cancer screening results in Taoyuan City

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Background: Lung cancer has consistently been one of the leading causes of cancer-related mortality in Taiwan. Since 2023, Taoyuan City has initiated the "High-Risk Population Low-Dose Computed Tomography (LDCT) Lung Cancer Screening Project" with the aim of early detection and treatment, ultimately increasing the five-year survival rate. This study aims to investigate the impact of participants' educational background on lesion detection rates.

Materials and Methods: Data were collected from LDCT screenings conducted at a specific hospital in Taoyuan city from 2023 March through November 2023. The study included a total of 1,412 participants (612 male, 800 female with a mean age 50.6 ± 8.7 years), consisting of 681 individuals with a lower educational background (elementary to high school) and 731 with a higher educational background (college to postgraduate). The data analysis was performed using t-test, and the significance level for statistical analysis was set at $p < 0.05$.

Results: There was no significant difference in the detection rate of positive lesions based on educational background ($p = 0.331$). Additionally, no significant differences were observed in both the number of detected lesions ($p = 0.391$) and the indeterminate tissue types of the lesions ($p = 0.257$). Lung-RADS grading indicated that participants with a lower educational background had a higher severity level compared to those with a higher educational background, showing significant differences ($p < 0.05$).

Conclusion: The study demonstrated that individuals with a lower educational background had higher severity level in Lung-RADS grading compared with those with a higher educational background. These results provide valuable insights for refining early lung cancer screening strategies, particularly targeting high-risk populations.

Disparity in LDCT Lung Cancer Screening among Family History of Lung Cancer and Heavy Smoking

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Background: Lung cancer ranks as the leading cause of cancer-related deaths in Taiwan. The Ministry of Health and Welfare initiated the Lung Cancer Early Detection Program, offering biannual low-dose computed tomography (LDCT) lung screening for heavy smokers and individuals with a family history of lung cancer. This aims of this study were to evaluate disparities in lesion detection rates between the two specified groups.

Methods: Between July 2022 and November 2023, data were collected from 799 participants at a northern hospital, including 426 with a family history of lung cancer and 373 with heavy smokers. The cohort consisted of 479 males and 320 females, with an average age of 58.7 years. LDCT screenings were performed using GE LightSpeed VCT and Revolution CT. Data analysis was performed using SPSS Statistics 22.0, with significance set at $p < 0.05$.

Result: Lung cancer was diagnosed in 69 (8.6%) of 799 participants. No significant difference in positive lesion detection rates was observed between those with a family history of lung cancer and heavy smokers ($p = 0.449$). Likewise, there was no significant difference in the number of positive lesions ($p = 0.598$). Based on Lung-RADS classification, no significant difference between the two groups was observed ($p = 0.433$). Additionally, individuals with a family history of lung cancer demonstrated a significantly higher incidence of non-solid lesions compared with heavy smokers ($p = 0.01$).

Conclusion: LDCT is a recognized screening tool for the early detection of lung cancer and has the potential to reduce the mortality rate among high-risk populations. This study suggested that the elevated incidence of non-solid lesions is more prevalent in individuals with a family history of lung cancer compared with heavy smoking.

Barriers to Radiotherapy Access in Sub-Saharan Africa: A Systematic Review

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Background / Purpose: Cancer management heavily relies on radiotherapy. This treatment method employs high-energy radiation to eradicate cancer cells and shrink tumours. Unfortunately, accessing radiotherapy services in sub-Saharan Africa poses a considerable challenge due to various obstacles. The region is grappling with a surge in cancer cases, and radiotherapy is pivotal in enhancing patient prognosis. A systematic review endeavours to pinpoint and scrutinise the factors responsible for these challenges and formulate effective interventions to address these hurdles.

Methods: The researchers will conduct a comprehensive literature search and report on published scientific articles and grey literature (academic theses not published, reports on government websites) between 2013 and 2023. The following search engines (PubMed, MEDLINE, SAGE, CINAHL, ScienceDirect, Springer, and Google Scholar) will be used as sources of data. Database searches will be conducted between October 13, 2023, and February 28, 2024. Title, abstract, and full-text screening of articles will take place. Publications will be analysed for information about things that make it hard to get radiotherapy. The information will then be put into subcategories such as financial, geographical, and technological barriers. The analysis will also include identifying any trends or patterns in the data to provide a comprehensive understanding of the challenges associated with accessing radiotherapy. Additionally, relevant statistical analyses will be conducted to quantify the prevalence and impact of these barriers in different populations and regions. The findings from this research will contribute to the development of targeted interventions and policies aimed at improving access to radiotherapy services.

Possible Outcomes/Conclusions: The findings from this research will contribute to the development of targeted interventions and policies aimed at improving access to radiotherapy services. The findings

from this research will contribute to the development of a framework aimed at improving access to radiotherapy.

Achieving comparable DXA results for patient's mobility in NHG primary healthcare

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Purpose: The project was intended to bring all NHGD DXA machines a state of cross-calibration to allow patients to have follow up scans done at different scanners and still have comparable DXA results. DXA machines are measurement instruments which are high internal accuracy but poor external precision when compared against other DXA machines. Cross-calibration between DXA machines are performed to ensure that DXA results obtained from different DXA machines can be compared for comparison study, while allowing flexibility for patients with increased access to wider range of DXA machines without compromising on their DXA results within primary healthcare.

Methods: The Cross-Calibration exercise was performed according to the guidelines in ISCD Official position 2019 for cross-calibration of DXA scanner of same make and model for 20 days. The NHGD identified "Gold Spine Phantom" was transported in a shockproof case by appointed courier service between the DXA machines during the exercise period. The DXA values obtained during the period were recorded and mean DXA was calculated. Subsequently, Quality Control (QC) plots were reviewed monthly for monitoring after the cross-calibration exercise.

Results: The percentage difference of all new DXA scanners to index scanner in NHGD is 0.01%, 0.19% and 0.11% respectively, within 0.5% difference. The QC Plots are stable within limits (0.12%, 0.05%, 0.18% and 0.13% respectively).

Conclusion: All 4 unit of NHGD DXA machines were observed to be within cross-calibrated limit, indicating results obtained on the DXA scanners can be used interchangeably, allowing comparing of DXA results within the acceptable limit. This allows flexibility and accessibility of DXA scanners to the community at risk of osteoporosis. This study may provide an insight and could potentially be an initiator for the cross-calibration exercise among multiple DXA facilities within cluster or nationwide.

IMPACT OF COVID 19 ON STRESS LEVELS AND COPING MECHANISMS AMONG GHANAIAN RADIATION THERAPISTS

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Background: The COVID-19 pandemic has brought changes in all health professions including radiography. Radiation therapists, a branch of radiography profession continued to give daily treatment to cancer patients in the midst of the pandemic. As a result of this, radiation therapists are experiencing an increase in their stress levels due to several factors.

Aim: The aim of this study is to investigate the impact of COVID-19 on Ghanaian radiation therapists stress levels and their coping mechanisms.

Method: A cross-sectional online survey of practicing radiation therapists in Ghana was conducted using a Google Form document. Data was analyzed using the Statistical Package for Social Sciences (SPSS).

Recorded responses were tallied from the collected data and the frequencies and percentages calculated based on the raw data. Bar graphs and charts was used to present findings. A paired sample T-test was used to compare the level of stress before and during the covid-19 pandemic. Bar graphs and charts was used to present the findings.

Results: A response rate of 89.7% was obtained during the study. 80% of the participants reported to have felt stressed at work due to the covid-19 outbreak. 74% of the respondent reported about fear of getting infected with the covid-19 virus as their major stressor during the study period.

Conclusion: Fear of contracting the covid-19 virus was rated as a higher stressor. Increasing workload, increase in the number of patients, shortage of staff also contributed to stress levels of radiation therapists.

Predicting the Aortic Time-to-Peak in Contrast Enhanced Computed Tomography using Statistical Analysis and Machine Learning

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Contrast Enhanced Computed Tomography (CECT) is a common imaging method that uses iodinated contrast to highlight specific anatomy or pathology in the body. The aortic Time-to-Peak (TTP) is the time it takes for the contrast to reach its peak value in the target vessel, and it's an essential factor in CECT that helps radiographers predict the arrival time of the contrast and ensure accurate diagnosis. However, the contrast arrival time can vary significantly between patients, particularly pediatric patients, depending on patient-specific characteristics like cardiac function, and body size. The current methods to obtain TTP values include the contrast bolus tracking method or the test bolus technique, which requires repeated tomographs to be taken over the region of interest. Unfortunately, this can expose the patient to additional radiation. This study proposes that the patient's TTP value can be predicted by Statistical Analysis and Machine Learning (ML) methods with the contrast injection regime and body composition data as input features. For the model fitting, the study collected and analyzed about 300 exams from Hong Kong Children's Hospital. The features used to train the ML models were body weight, height, age, contrast injection rate, and contrast volume. The linear correlation between these variables was examined using the variance inflation factor, and the features with the greatest independence, which were weight and contrast injection rate, were selected as the input features in the proposed model. The study results are not conclusive in using the model trained by existing data. The dataset has several limitations, including a scarce quantity of valid data and a high variance inflation factor among features. Therefore, a statistical method is selected as an alternative. This method uses the proximity in the feature matrix, i.e., Euclidean distance between each data, to give a reference to the TTP of the patient.

Navigating Diagnostic Reference Levels in the UAE: A Roadmap for the Present and Beyond

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Radiological imaging plays a pivotal role in modern healthcare, offering invaluable diagnostic insights while balancing the need for patient safety. Within this context, Diagnostic Reference Levels (DRLs) represent a critical benchmark for optimizing radiation doses and ensuring the highest standard of care. In the United Arab Emirates (UAE), a dynamic healthcare landscape has evolved, reflecting the nation's commitment to excellence in medical imaging. This presentation embarks on a journey through the past, present, and future of DRLs in the UAE. We explore the historical development of DRLs in the UAE healthcare system and their integration into clinical practice. We discuss the achievements and challenges faced by radiological practitioners in adhering to DRLs, reflecting on the significant progress made to enhance patient safety and image quality. As we look to the future, we delve into the anticipated advancements and innovations in radiology and medical imaging technology, addressing how these developments may impact DRLs. With an eye on international best practices and emerging trends, we outline a comprehensive roadmap for the UAE's radiological community, aimed at ensuring the continued optimization of radiation doses, while embracing cutting-edge technologies and protocols. This presentation invites healthcare professionals, policymakers, and stakeholders to engage in a vital dialogue about the role of DRLs in shaping the future of radiological healthcare in the UAE. By collectively charting a course that balances patient safety, diagnostic accuracy, and technological progress, we aim to navigate the complex landscape of DRLs in the UAE, forging a path toward a brighter and safer future for all.

Advancing Radiography Practice in the UAE: A Comprehensive Overview

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Aim: This study explores the evolution of radiography practice in the UAE, focusing on the challenges of role advancement, the perceptions of healthcare professionals, and the future needs of radiographers.

Background: The UAE healthcare system is undergoing significant transformations, with advanced practice roles for radiographers emerging as pivotal. These changes necessitate a deeper understanding of the current landscape, the challenges faced, and the readiness of healthcare professionals to embrace new roles.

Methods: A mixed-methods approach was utilized, combining qualitative interviews with quantitative surveys among radiographers, radiologists, and healthcare administrators across UAE healthcare facilities. This methodology provided a comprehensive perspective on the transition towards advanced practice.

Results: The findings indicate a positive perception toward advancing radiographer roles, highlighting an increasing readiness among mammographers and other radiography specialists. However, challenges related to regulatory frameworks, professional recognition, and educational pathways were identified.

Conclusions: The advancement of radiography practice in the UAE is marked by significant potential and enthusiasm among healthcare professionals. Addressing the identified challenges through policy reforms, targeted educational programs, and stakeholder engagement is crucial for successfully integrating advanced practice roles, ultimately enhancing patient care and healthcare delivery in the region.

Evaluation of radiation protection and catheterization laboratory safety in Nepal

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Background: Owing to the elevated radiation exposure of patients and personnel, the catheterization laboratory is particularly in need of optimal levels of radiation protection and safety protocols. Developing safe radiation procedures improves the safety of patients and personnel. This study aims to determine the necessary modifications to enhance the quality of care and implement safety and radiation protection measures for catheterization laboratories throughout Nepal.

Methods: An online descriptive cross-sectional survey was emailed to all catheterization laboratory of Nepal. The questionnaire consisted of 32 questions focusing on radiation protection and safety in the catheterization laboratory. Results were analyzed using Microsoft Excel, and frequencies and percentages were calculated and summarized.

Results: Survey findings demonstrated a 70.42% adopted radiation protection and safety among 28 catheterization laboratory across Nepal. 32.1% respondents were unaware of the Radio-absorbent patient drapes, and 50% reported systematically using real-time radiation dose monitoring. Most of the survey respondents (92.9%) had updated emergency crash cart and 21.4% don't have clearly apparent radiation hazard indicator. 78.6% catheterization laboratory segregated waste according to National HealthCare Waste Management Standard Operating Procedure. 56.4% lacked personnel radiation dose monitoring devices. All participants are oriented for six steps of handwashing, wearing gloves, donning and doffing of Personal Protective Equipment; despite 78.6% only received at least Basic Life Support training.

Conclusion: Physicians, Radiographers, Physicists, Nurses and hospital administration should work together to establish a radiation protection and safety program for the catheterization laboratory. The findings will be utilized to pinpoint shortcomings and create strategies for enhancing radiation protection and safety in catheterization labs across Nepal. Key stakeholders, including the Nepal Radiological Society, will need to continue collaborating with other organizations in order to enhance patient care and better promote, integrate, and drive resourcing of radiation protection and safety at all catheterization laboratories.

Wire-Guided and Non-radioactive inducible Magnetic seed system for Preoperative localization

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Introduction: Breast cancer is the leading cause of death amongst women in Singapore. Wire-guided localisation (WGL) is a conventional yet effective technique to provide intraoperative guidance for excision of impalpable breast lesions. However, it is associated with scheduling inflexibility and distal wire displacement. Magnetic seed localisation (MSL) is a recently established alternative to WGL that eliminates the aforementioned drawbacks. This study aims to compare and assess the efficacy and implications of both methods in providing intra-operative guidance.

Materials and Methods: Following the Preferred Reporting Items for Systematic Review and Meta-Analysis Protocols, a systematic literature search was performed on the following databases: PubMed-MEDLINE, Cochrane Library, CINAHL and ScienceDirect. A total of 57 articles were included and critically evaluated.

Results: 427 and 328 subjects with various breast densities underwent WGL and MSL respectively. All seeds were detectable transcutaneously at all depths. Placement accuracy, lesion retrieval and re-excision rate, along with reported adverse events were not significantly different between both techniques ($p>0.05$). However, higher pain levels were reported for WGL during movement and rest ($p<0.001$). Targeting, tissue excision time and skin incision to tumor extraction time did not differ statistically between both groups ($p>0.05$).

Conclusion: Surgical complexity and efficacy of GWL and MSL are comparable in facilitating lesion excision with acceptable cosmetic outcomes. MSL enables seed embedment in lesions for days prior to tumour excision, which could increase capacity for new patient referrals albeit its higher cost to GWL. MSL is also associated with higher patient comfort and easier access for targeted axillary node dissection.

Free-breathing motion corrected cardiac cine MRI with compressed sensing real-time imaging : biventricular volumetric assessment in routine clinical practice

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Objective: To validate free-breathing motion corrected cardiac cine MRI with compressed sensing real-time imaging and retrospective motion correction (RTCSCineMoCo) in assessing left and right ventricular systolic function, scan time and image quality.

Methods: The study prospectively included 47 patients with various cardiovascular diseases who were scanned on a 3.0T MR scanner (MAGNETOM Vida, Siemens Healthcare, Erlangen, Germany). Cardiac cine images of the same long-axis and short-axis stacks were acquired using two techniques: (1) SegBH: routine segmented cine with breath-hold; (2) RTCSCineMoCo. Overall Image quality (IQ) was scored using a qualitative 5-point Likert scale. The biventricular volumetric parameters including the left ventricular (LV) and right ventricular (RV) end-diastolic volume (ED), end-systolic volume (ESV), stroke volume (SV), ejection fraction (EF), cardiac output (CO), and myocardial mass were measured by both methods. The IQ, contrast-to-noise ratio (CNR), scan time and biventricular volumetric parameters between the two sequences were compared.

Results: There was no statistical difference in the subjective evaluation of image quality between RTCSCineMoCo group and SegBH group (3.83 ± 0.73 vs 3.98 ± 0.82 , $P=0.189$). There was no statistical difference between the biventricular volumetric parameters in RTCSCineMoCo group and SegBH group (all $P > 0.05$). The scan time of RTCSCineMoCo sequence [150.43 ± 28.27]s was significantly shorter than that of SegBH total imaging [397.92 ± 42.64]s. Linear regression showed a strong positive correlation between RTCSCineMoCo and SegBH, and Bland–Altman plots showed very small errors between the two techniques.

Conclusion: RTCSCineMoCo is a feasible and accuracy free-breathing CMR cine imaging technology in clinical routine practice.

MRI and Ultrasound in the early detection of Rheumatoid Arthritis in Hand and Wrist: A Meta-Analysis

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Introduction: Rheumatoid arthritis (RA) is a debilitating autoimmune disease that includes exacerbations with gradual disability. Diagnosis within the first 12 weeks of disease onset is vital for optimal treatment outcomes. Magnetic Resonance Imaging (MRI) and Ultrasonography (US) are often employed to diagnose early-stage hand and wrist RA. However, there is a lack of consensus on the standardized imaging method for early clinical detection. As such, we aim to examine the diagnostic accuracy of MRI and US in detecting three commonest signs in early RA; bone erosions, synovitis and tenosynovitis in the metacarpophalangeal, proximal interphalangeal and wrist joints. Biological risks, operator dependency levels, inherent artefacts and imaging costs will also be discussed.

Materials and Methods: Following the Preferred Reporting Items for Systematic Review and Meta-Analysis Protocols (PRISMA-P) methodology, systematic literature search from databases: PubMed-MEDLINE, Cochrane Library and ScienceDirect resulted in 122 articles, of which 43 included studies were critically evaluated.

Results: A total of 489 patients with RA were included in our study. The pooled sensitivity of MRI in detecting bone erosions, synovitis and tenosynovitis were 68%-80.7%, 77.8%, and 24%-60% respectively while pooled specificities were 96%-99.4%, 49.7% and 73%-88%. Conversely, the pooled sensitivity of US in detecting bone erosions, synovitis and tenosynovitis were 27%-75%, 50%-95.2%, and 15%-52% respectively while pooled specificities were 46%-98%, 49%-100%, and 83-99%.

Conclusion: Multiplanar and multisequence of MR imaging provides significantly higher reliability in detecting bone erosions and tenosynovitis, with a comparable diagnostic accuracy for synovitis in early RA. Whilst biological and hazardous effects are comparable in both modalities, higher cost of MRI in developing countries may render US as a viable option for early RA detection.

Prioritizing Person-Centered Care: The Significance of Collimation in Managing Cancer Risk

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Introduction: The introduction of digital radiography has revolutionized medical imaging practice with increased efficiency of operational workflows, image quality, and patient care. However, concerns in relation to inadequate collimation practices have been reported. Studies exploring radiation-induced cancer risks to patients due to poor collimation practices during diagnostic imaging are limited. The purpose of the present study was to evaluate the radiation-induced cancer risk associated with increased radiation field size when imaging the chest of neonates, with the rationale to encourage effective collimation in clinical practice.

Methods: A computer-based Monte Carlo program was used to simulate the dose profile of a newborn phantom. In the simulation, the phantom was positioned for an anterior-posterior (AP) chest X-ray, and the image field size was set to include just above the lung apices to T12/L1. Subsequently, the field sizes were varied at different distances, and the impact of the extra field coverages in terms of cancer risk was estimated for a number of key anatomical organs with reference to the combined absolute and relative risk models of the BEIR VII Committee.

Results: The result showed that increasing the radiation field size by 2cm in all directions, or head-to-foot, doubles the risk of colon cancer in both genders. Moreover, the risk of bladder cancer tripled in males and increased by 64% in females when the radiation field size increased by 1cm in the head-to-feet direction.

Conclusion: The use of optimal field size is a key factor in reducing patient dose and the potential risk of radiation-induced cancer. Clear standard operating procedures and policies relating to best practices for collimation in clinical practice should be encouraged among the clinical radiology workforce and enforced through periodic audits, education, and training.

CREATING A FA TEMPLATE AMONG NEPALESE POPULATION

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Purpose: Brain atlases play a crucial role in neuroimaging. They are used for studying various anatomical, functional, and micro structural changes. Till date, there is no Nepalese population-specific Diffusion Tensor Imaging (DTI) template. We aim to create a Fractional Anisotropy (FA) template among the Nepalese population.

Methods: A total of 19 participants were included in this study. All the participants underwent DTI sequence in a 1.5 T MRI Philips imager. The DTI data was acquired at Echo Time (TE) 0.068 s, Repetition Time (TR) 7.01 s and slice thickness 2.5 mm. The DTI images were acquired at 15 diffusion encoding directions and 1 b0 image at b value 0 and 800 s/mm². All the data were denoised, Gibbs artifact removed, EPI distortion corrected using non-linear registration, and bias-corrected. The FA was generated after fitting the data into the diffusion tensor. All FA images were registered into a common voxel space using antsRegistrationSyN.sh and the template mean image was named “FA Nepalese-19”, in short, “FAN-19”. The JHU FA template was registered with “FAN-19” using ANTs registration suite, and the JHU labels were warped back into “FAN-19” voxel space. The volume of genu, body, and splenium of the corpus callosum were calculated and compared with the JHU template.

Results: We successfully obtained an FA template among the Nepalese population, named “FAN-19”. The volume of genu, body, and splenium of the corpus callosum in “FAN-19” were 7852, 15170, and 13240 mm³, and that of the JHU template were 8851, 13,710, and 12,730 mm³ respectively. There was variation in the volumes of the different regions of the corpus callosum.

Conclusion: In summary, the “FAN-19” could be used for imaging studies specific to Nepalese populations that require a brain atlas.

BRAIN MICROSTRUCTURAL CHANGES AMONG THE CONQUERORS OF THE HIMALAYAS, THE SHERPAS

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Background: Sherpas have captivated the world’s imagination with their extraordinary mountaineering prowess and remarkable adaptation to their high-altitude lifestyle in the Himalayas. We hypothesize this

adaption could potentially have microstructural changes in their brain. So, we aim to determine microstructural changes among them.

Methods: The study involved a total 19 individuals, comprising 10 normal controls and 9 Sherpas. The mean age of the participants was 31 years, with ages ranging from 24 to 41 years. Controls are the participants who are living in low-altitude place, Kathmandu whereas Sherpas are the active mountaineers who have more than 5 years of experience. All the participants underwent Magnetic Resonance Imaging (MRI) scan in a 1.5 T Philips imager. A diffusion tensor imaging (DTI) pulse sequence was applied using two-dimensional echo planar imaging (EPI) at Echo Time (TE) 0.068 s, Repetition Time (TR) 7.01 s and slice thickness 2.5 mm. The DTI images were acquired at 15 diffusion encoding directions and 1 b₀ image at b value 0 and 800 s/mm². All the data were denoised, Gibbs artifact removed, EPI distortion corrected using non-linear registration and bias corrected. Fractional Anisotropy (FA) and Mean Diffusivity (MD) was generated after fitting the data into the diffusion tensor. All FA and MD images was registered into a common voxel space using antsRegistrationSyN.sh. A region of interest (ROI) was drawn at the genu of the corpus callosum in that common voxel space.

Results: Reduced FA and increased MD was noted among the Sherpas compared to controls. We demonstrated statistically significant difference in FA (p=0.009) and MD (p=0.043) at the genu of the corpus callosum.

Conclusion: In conclusion, the Sherpas exhibited distinct microstructural changes compared to controls which implied their exceptional adaptation to low oxygen environment and high altitude.

MOTIVATION, JOB SATISFACTION AND RETENTION AMONG RADIOLOGIC TECHNOLOGISTS IN SELECTED HOSPITALS IN LAGUNA

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Health managers in decentralized health systems usually have a prolonged space that allows positive impact to health workers when it comes to motivation and job satisfaction, it influences on retention and performance of the health worker. Motivation and job satisfaction have been documented as key factors for health worker retention. This study has its primary attempt to determine the degree of motivation, work satisfaction, and retention of Radiologic Technologists in private hospitals in Laguna's 1st and lone districts using a descriptive correlational research design. It gave a comprehensive overview of the concerns surrounding the subject, both theoretically and practically. The findings indicate that Radiologic Technologists in the hospital exhibit a high level of motivation, particularly in delivering high-quality services. This underscores the significance of motivation as a key factor enabling health professionals to uphold their professional competencies thus contribute positively to the work environment, leading to high levels of job satisfaction and promotes to substantial job retention, which is important for the institution's long-term success. These results highlight the importance of employee satisfaction and motivation in the overall success of an organization. It is conclude that when employees are satisfied, they tend to be more productive, creative, committed to work. Moreover, fostering a motivated and satisfied workforce, particularly among Radiologic Technologists, is essential for the success and sustainability of hospitals in the selected region. Addressing motivation and job satisfaction can lead to increased job retention, ultimately contributing to a positive and thriving work environment.

TEACHER’S RELATED-FACTORS, LEARNING STYLE AND BEHAVIORAL ENGAGEMENT OF RADIOLOGIC TECHNOLOGY STUDENTS IN A PRIVATE UNIVERSITY

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Academic success is governed not just by academic results but also by how students learn. Teachers’ effectiveness influences the students’ desire to learn, academic endeavors and educational pursuits. Teachers must be adaptable and flexible, considering the unique variances among students and acknowledging that each student learns uniquely. Students learn best and demonstrate high level of engagement when establishing one’s individual learning styles. This study explores a strong correlation between teacher-related factors, student learning styles, and behavioral engagement specifically among radiologic technology students. Utilizing a descriptive-correlation research design, the study underscores the significance of the teacher’s personality traits as highly valued by students as teachers’ factors. Most respondents were identified as visual learners, favoring a learning style characterized by visually engaging themes and creative formats, resulting in a high level of behavioral engagement since students were actively participating in class. Based on the gathered findings, it is concluded that educators demonstrating compassion are likely to leave a lasting impact on students that extends beyond the classroom, fostering a genuine love for learning and contributing significantly to the overall student learning experience. By creating a positive and empowering learning environment, facilitating students’ self-awareness and autonomy to manage one’s unique learning styles, educators actively enhance student behavioral engagement which enables the learning process not only more effective but also more enjoyable which heighten student’s academic performance and culminates a more fulfilling student’s educational experience.

Artificial Intelligence in Healthcare: Evaluating the Knowledge and Awareness Among Healthcare Professionals in a Hospital Setting in Malaysia

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At the forefront of this era of innovation, Artificial Intelligence (AI) is leading the way in transforming the future of medicine. Beyond image processing and diagnosis, AI has also been integrated into healthcare products, prognosis, therapy, and patient monitoring. However, studies regarding AI among various healthcare professionals are limited. Thus, this study was conducted to determine the knowledge and awareness of AI among healthcare professionals in a private hospital in Malaysia. A cross-sectional study was conducted using a validated survey comprised of demographic data and knowledge of AI. Descriptive analysis and a chi-square test were used to analyze the data. A total of 198 respondents consisting of allied health professionals, nurses, doctors, and other healthcare professionals have participated in this study. Most of the respondents (79.8%) have no hands-on experience with AI, however, the majority (61.6%) are aware of AI in healthcare. Overall, most of the respondents (73.7%) had poor knowledge of AI with only 49.0% of the respondents defining AI as the use of computer algorithms to perform tasks that require human intelligence. The respondents had concerned that AI may replace human healthcare workers (54.0%), and the possibility that AI could harm patients (55.1%).

Most of the respondents (81.8%) also believed that education on basic principles and training on AI should be implemented. There is a significant association between the level of knowledge of AI with gender and different groups of healthcare professionals ($p < 0.05$). In conclusion, this study sheds light on the current state of knowledge of AI among healthcare professionals. Their lack of knowledge and concern to adopt AI may result in significant issues, particularly considering its anticipated widespread utilization in the future. Thus, emphasizes the importance of educational interventions to enhance the understanding of AI among healthcare professionals.

Application of high-concentration contrast agent saline mixed with low-dose and low-flow injection scheme in whole-aortic CT angiography

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Purpose: To explore the application of high-concentration contrast agent-normal saline mixed with low-dose and low-flow injection scheme in whole-aortic CT angiography (CTA).

Methods: A retrospective analysis was conducted on 37 patients (observation group) who underwent whole-aortic CTA with Iomeprol. The contrast medium dosage was 45 ml and the flow rate was 3.5 ml/s. They were selected to receive iodixanol whole-aortic CTA during the same period. 22 patients were imaged (observation group). (Control group), the contrast agent dosage was 52-98ml (1.0ml/kg), and the flow rate was 3-3.5ml/s; there was no statistical difference in age and body mass index (BMI) between the two groups. The subjective scores, CT values, signal-to-noise ratio (SNR), and contrast-to-noise ratio (CNR) of the VR images and original images of the two groups of patients were compared.

Results: There was no statistically significant difference in the subjective scores of aortic imaging between the two groups ($P > 0.05$); at the renal artery bifurcation, there was no statistically significant difference in the SNR and CNR of the images in the observation group compared with the control group ($P > 0.05$). However, the average CT image value of the observation group was lower than that of the control group; at the bifurcation of the ascending aorta and common iliac artery, the CT value, SNR and CNR of the images in the control group were all higher than those of the observation group, and the difference was statistically significant ($P < 0.05$). , but the average value of CT at all levels in the two groups of images was greater than 251.74;

Conclusion: The high-concentration contrast agent-normal saline mixed small-dose low-flow injection scheme can meet the diagnostic

An artificial intelligence literacy framework for radiographers

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Background/Purpose: The imminence of artificial intelligence (AI) integration in radiography will change how radiographers' practices. This means radiographers need to be adequately enabled to perform optimally in an AI environment. However, limited structured educational opportunities exist. This rapid review aimed to develop an AI literacy framework for radiographers, using the Digital Literacy Global Framework (DLGF) as a premise of departure based on the views and knowledge of radiographers towards AI from current published evidence.

Methods: Twelve articles met the inclusion criteria and were analysed using a content analysis to ascertain the current perspectives and knowledge of radiographers towards AI. Inferences from this

information were then made to identify focal areas of educational interventions in line with the seven competencies areas of the DLGF to propose an AI literacy framework for radiographers.

Results: Studies demonstrate varying levels of knowledge about AI and its application in clinical practice. There is much apathy noted towards AI which could be ascribed to limited knowledge of AI. Notwithstanding, there are positive attitudes towards AI integration in clinical practice. Bespoke educational interventions targeting these gaps and apprehensions are recommended in the corpus of evidence. An AI literacy framework for radiographers is proposed focussing on enhancing radiographers' technical knowledge and understanding of AI and its use in clinical practice.

Conclusions: The Digital Literacy Global Framework was used as a premise of departure to conceptualise an AI literacy framework for medical imaging and radiation sciences professionals by drawing on the evidence base about radiographers' current knowledge and perceptions about AI use and integration in clinical practice. This framework could assist the development of educational interventions to enable radiographers to understand AI and its use to utilise this technology optimally in the clinical setting.

Working collaboratively to develop the next generation of radiography leaders from the Pacific Islands

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Background: As part of the International Atomic Energy Agency's (IAEA) Sub-regional Approach to the Pacific Islands (SAPI) framework for cooperation within the technical cooperation programme, the IAEA is partnering with Monash University, Australia, to host a series of training courses for radiographers from the Pacific Islands. The aim of this presentation is to share the education partnership and learning experiences of the Pacific Islanders as we worked collaboratively to develop the next generation of radiography leaders.

Methods: Two basic training workshops were conducted at Monash University in April and October 2023. These workshops focused on the basics of quality assurance, quality control, radiation protection, radiographic positioning and fundamentals of image interpretation. Following the success of the 2023 workshops, the education initiative was further extended to develop participants' leadership capabilities by empowering them to lead and be agents of change.

Results: There were 13 and 15 participants in the April and October workshop respectively. 93% of the participants in both workshops strongly agreed and agreed to the workshops being well designed, relevance of the content and that they were able to implement their learning in their home country. In respond to feedback from the April participants, more image interpretation sessions and visits to radiology departments were introduced in the October workshop. Due to the success of the 2023 workshops, a leadership workshop will be conducted in May 2024. Results of the May workshop will be shared in this ISRRT Congress.

Conclusion: The extension of a third workshop to include leadership development is timely as Pacific Islands radiographers work in isolation without a radiologist on site, thereby requiring them to assume more responsibilities and autonomy. This education partnership between IAEA and Monash University lays the foundation to support our Pacific Islanders to be change agents for the betterment of patients and the community they serve

Deep Learning For Diagnosing Liver Lesions in Ultrasound Images

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Background: Liver disease is a major health concern worldwide and is increasing rapidly. Early and accurate diagnosis is crucial for effective treatment and a better prognosis. Ultrasound imaging plays an important role in the initial examination and evaluation of the liver as it is non-invasive and widely available. However, the diagnostic efficacy of ultrasound imaging varies greatly due to subjective interpretation, the complex anatomy of the abdomen, and the low resolution and noise of the images. This study aims to develop an algorithm that uses deep learning to identify different liver diseases in ultrasound images. Our algorithm is designed to learn from an unordered sequence of data, reflecting real-world scenarios for diagnosis.

Methods: This study was a retrospective study in which images were collected from 932 patients. Four liver lesions – mass, fatty liver, cirrhosis, and cyst – were established by expert radiologists. We trained an EfficientNet-B5 model to process a sequence of ultrasound images. We used data augmentation strategies to improve the model's ability to generalise across different imaging conditions. We performed a comprehensive assessment of the model with different data inputs to replicate the diversity and characteristics of the imaging data at our institution.

Results: Our model achieved a mean average precision (mAP) for identifying mass, fatty liver, cirrhosis, and cyst of 0.7738, 0.7765, 0.5170, and 0.3495, respectively, in the test dataset. The ability of our model to learn from unordered image sequences provides a more realistic approach to diagnosing the disease in different clinical situations. The variability of mAP scores in different liver lesions highlights the opportunities for further refinement.

Conclusion: This study represents a step forward in applying deep learning to identify liver lesions from ultrasound images, aligning with the real-world conditions of clinical practice at our institution.

An Investigation Into the Effect of Different Static Magnetic Fields of 1.5-T and 3.0-T MRI on the Measurement of Tumor Diameters in Breast Cancer

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Objective: This study aimed to determine whether differences in the static field strength of 1.5-T and 3.0-T MRI systems affect the diagnostic results of tumor size measurement in breast cancer and to compare them with the results of tumor size in surgical pathology diagnosis.

Methods: We adopted a retrospective and case-control study design. We included patients with a suspected or confirmed diagnosis of breast cancer who underwent breast MRI at our hospital between January 2017 and March 2023. Diffusion-weighted imaging (DWI), gadolinium-enhanced T1-weighted (Gd-T1WI) MRI, and tumor size from surgical pathology were compared via a significance difference test and correlation analysis between the two groups.

Results: A total of 36 patients met the selection criteria (15 for 1.5-T and 21 for 3.0-T). The mean ratio of pathologic tumor length to diameter was not significantly different between groups for each device ($p=0.653$); for 1.5-T MRI, the ratio of DWI to pathology was 1.042 ± 0.361 and the ratio of Gd-T1WI to pathology was 1.107 ± 0.314 with no significant difference between the ratios ($p=0.345$). The correlation coefficient between the two groups was $r=0.730$ ($p=0.002$). 3.0T MRI showed that the ratio of DWI to pathology was 0.893 ± 0.197 , while the ratio of Gd-T1WI to pathology was 1.062 ± 0.177 , showing significant difference between the two ($p<0.001$). The correlation coefficient between the two groups was 0.695 ($p<0.001$).

Conclusions: While there was no significant difference in the ratios of tumor length diameter measured by 1.5-T Gd-T1WI and DWI compared to pathology, there was a significant difference in the ratios of tumor length diameter measured by 3.0-T DWI and Gd-T1WI compared to pathology. Hence, only 3.0-T DWI can lead to a potential underestimation of tumor length.

MYOCARDIAL TISSUE CHARACTERIZATION OF CARDIAC FIBROSIS AS AN EARLY MARKER OF HEART FAILURE IN DIABETIC PATIENTS

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Background Diabetic cardiomyopathy occurs following a systemic insult from diabetes. Medical imaging technology is evolving, enabling a direct quantitative assessment of myocardial tissue properties and function which can be used as an early imaging marker of heart failure in diabetic patients without coronary artery disease. This review aims to investigate the characterization of myocardial fibrosis and dysfunction using T1 Mapping, CINE MRI, and echocardiogram in diabetic patients.

Methods A systematic review was conducted by searching PubMed, MEDLINE Ovid, and citation searching for studies published between 2012 and 2022. This study followed the guidelines of the Preferred Reporting Items for Systematic Review and Meta-Analyses protocols. The risk of bias was assessed using the National Institute of Health Quality Assessment Tool.

Findings A total of 7 studies were included in the systematic review. The characterization of myocardial fibrosis using T1 Mapping was assessed by quantifying the native T1 time, post-contrast T1 time, and extracellular volume fraction (ECV). A significant difference in ECV between diabetic and control groups is reported in 3 studies ($30.4 \pm 2.9\%$ vs $27.1 \pm 2.4\%$, $33.27 \pm 2.68\%$ vs $29.90 \pm 2.35\%$, $27.4 \pm 2.5\%$ vs $24.6 \pm 2.2\%$) showing a higher sensitivity of ECV in quantifying increased fibrosis in the extracellular space. Myocardial dysfunction was assessed using left ventricular ejection fraction, mitral E/A ratio, and global longitudinal strain (GLS). A significant difference in GLS using speckle tracking echocardiography between diabetic and control participants is reported in two studies ($-16.1 \pm 1.4\%$ vs $-20.2 \pm 1.0\%$). Post-contrast T1 time showed a negative correlation with GLS ($r = -0.71$) indicating an increase in myocardial fibrosis is associated with impaired contractility of myocardium, causing diastolic and systolic dysfunction.

Conclusion Quantifying myocardial fibrosis and dysfunction using ECV and GLS can be used as early imaging markers of heart failure in T2DM patients.

DEVELOPMENT OF MRI E-LEARNING MODULE IN RADIOGRAPHY EDUCATION

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Background MRI radiographer plays a crucial role in MRI imaging, ensuring that high-quality images are obtained for accurate diagnosis. Hence, MRI education in radiography must contain both theoretical and practical knowledge to train the students before attending their clinical attachments and working as MRI radiographers. Current MRI education in radiography relies on conventional education using slides and photographs which is insufficient to deliver the complex physics concepts and abstract imaging principles in MRI imaging. Another challenge faced by radiography students is the gap between theory and practice due to inadequate exposure to certain specialized MRI procedures due to inadequate practical sessions as access to the facility is limited. Multiple MRI e-learning has been developed to enhance learning experiences in MRI education. However, most available MRI e-learning modules focus on the physics principles for MRI physicists and image evaluation for radiologists, which would be challenging for radiography students to grasp the content and apply it in the radiography field.

Methods e-learning MRI modules were developed specifically to meet the needs of radiography students using freely available software.

Results This module provides a comprehensive and interactive learning experience by making the complex concepts in MRI more understandable and providing a more immersive and interactive environment allowing radiography students to understand the principles, techniques, and applications of MRI. Students can learn through video-based animation of basic MRI scanning principles and scanning procedures, multiple MRI images, and case-based studies to equip them with the required theory and practical skills. This e-learning module also incorporates virtual reality (VR) technology to simulate real MRI environments, providing hands-on experience without physical MRI machines.

Conclusion This e-learning approach is in line with the needs of the current generation and the fast-approaching industrial revolution 4.0.

Musculoskeletal Sonography Fundamentals for the General Sonographer: Evaluation of Tendons in the Setting of Trauma

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Purpose: Inform sonographers about the practical application of musculoskeletal ultrasound scanning techniques for the evaluation of tendon injury with focus on ultrasound appearance, diagnosis of partial and complete tendon tears, tendinopathy, and treatment.

Materials and Methods: Presentation of the use of static and dynamic ultrasound imaging techniques to evaluate the structural integrity of tendons in the setting of trauma. Utilization of case studies to demonstrate the normal sonographic appearance of musculoskeletal anatomy, anisotropy, tendinopathy, low to high grade tendon tears, and complete tendon rupture in multiple joints throughout the body.

Results: Inform sonographers of the value of fundamental musculoskeletal ultrasound knowledge and scanning skills and the direct application of these sonographic tools to elevate the quality of patient care

with accurate imaging technique, diagnosis and treatment in cases of trauma and suspected tendinopathy or tendon tears.

Conclusion: Partial and complete tendon tears are common injuries which may be accurately assessed and diagnosed with the employment of both static and dynamic musculoskeletal ultrasound imaging methods. General sonographers benefit from acquiring basic musculoskeletal ultrasound knowledge and imaging skillsets and are able to expand sonographic imaging services for assessment of tendon injury in order to expedite treatment for positive patient outcomes.

Changes of topological properties of white matter network in schizophrenia with metabolic syndrome after risperidone and clozapine treatment

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Background: Metabolic syndrome (MetS) is one of the common side effects after antipsychotic treatment of psychosis, but its potential neural mechanism is still unclear. The purpose of this study was to explore the topological characteristics of white matter networks in schizophrenia patients with metabolic syndrome (SCZ-MetS) treated with risperidone and clozapine by graph theory.

Method: We obtained diffusion tensor imaging (DTI) data from 39 schizophrenia patients treated with risperidone and clozapine (including 19 patients with metabolic syndrome (SCZ-MetS) and 20 patients without metabolic syndrome (SCZ-nMetS)) and 25 healthy controls (HC). Network topology attributes were calculated using DTI-based graph theory analysis and ANCOVA was used to compare the differences of network topology attributes among the three groups. Correlation between brain regions and clinical metabolic indexes and scale scores

Result: The white matter networks of the three groups showed obvious small-world properties. Compared with the HC, bilateral thalamic nodal degree (DC) and nodal efficiency (NE) were decreased in both groups. In the SCZ-MetS, the global efficiency (Eg) and characteristic path length (Lp) were decreased, and the DC and NE of brain regions such as supra-occipital and angular gyrus decreased. Compared with SCZ-nMetS, SCZ-MetS had lower Eg, Lp, and NE in the left medial frontal gyrus and left gyrus rectus. The Eg and Lp, NE of significantly different brain regions were negatively correlated with BMI, waist, and hip circumference in the two groups.

Conclusion: There are differences in the topological properties of the brain white matter network between schizophrenia with metabolic syndrome and those without metabolic syndrome after treatment with risperidone and clozapine, which may provide new insights into the brain mechanism behind metabolic syndrome after treatment in psychotic patients.

Initial experiences with immobilisation for proton therapy: Strategies and Challenges

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Purpose: The unique physical characteristic of Bragg Peak allows proton therapy (PT) to deliver high conformal dose to the target with a sharp drop at exit dose. In PT, immobilisation serves not only the

purpose of reproducibility as for other radiotherapy techniques, but also to minimize the proton range uncertainty. This study aims to share our strategies and challenges encountered in PT setup.

Method: “Less-is-more” was our fundamental principle used in PT setup to mitigate the proton range uncertainty. Small shifts between patient and immobilisation device along the beam pathway can increase range uncertainty. To address this, we minimized the number of immobilisation devices used along the beam pathway. In breast and prostate PT, body Vaclok was avoided to clear the pathway for lateral beams. Wingboard with arm-only Vaclok was used for breast, while knee and foot support were used for prostate. Challenges arose, in head and neck(H&N) and craniospinal irradiation (CSI) cases, where Vaclok and thermocast were unavoidably used. The presence of sharp edges and non-uniformity in these immobilisation devices could significantly increase range uncertainty. Additional measures were taken, such as bevelling the edges of customized neck cushion for H&N case or avoiding folds in potential beam pass-through areas of Vaclok. In CSI cases, Vaclok-only CT was performed to assess its uniformity before patient’s planning CT.

Results: A total number of sixty-nine patients underwent PT successfully using these setups. Daily translational and rotational shifts, recorded from pre-treatment kV images, were well within acceptable ranges. No significant setup deviations required replanning.

Conclusion: PT immobilisation poses distinct challenges as it can have a negative impact on its depth dose distribution and range uncertainty. Our strategy addresses these challenges and achieves successful PT treatments. Further research and refinement of immobilisation techniques in PT are warranted to optimize treatment efficiency.

REJECT AND REPEAT ANALYSIS IN DIGITAL RADIOGRAPHY IN A KENYAN RADIOLOGY DEPARTMENT

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Background: Repeat-Reject Analysis (RRA) is a method of QA applied in the radiography department to determine the number of image rejects and repeats. Reject and repeat analysis is essential in reduction of radiation from double or multiple exposures to the patient. With adoption of digital radiography, periodical implementation of reject and repeat analysis has been neglected due to the assumptions that image rejects and repeats have been phased out with the correction of overexposure and underexposure of conventional Radiography. This study aims to evaluate reject-repeat analysis of radiographs in digital radiography (DR) and analyze its implementation at a radiology department in Kenya.

Methods: The study was conducted at a radiology Department over a period of 4 months. All rejected-repeated radiographs were collected during the study period. A Checklist was used to determine causes of image rejects and documentation of the reject analysis at the hospital while questionnaires were administered to radiographers to determine implementation of reject repeat analysis as a QA method. The obtained data was analyzed using tables and presented in form frequency tables, bar graphs and pie charts.

Results: 1293 images were analyzed. The overall reject and repeat rate was 25.7%. 80% of the radiographers had knowledge in reject and repeat analysis, only 27% carried it out periodically. The common reason for image repeats (41.2%) was anatomy cutoff and patient factors (19.1%)

Conclusions: The results demonstrated reject and repeat analysis in digital radiography is necessary in identifying areas for quality improvement to reduce radiation exposure to patients. The importance of reject and repeat analysis should be reinforced in radiographers to reduce unnecessary radiation

exposure to the patients. Future research could involve re-auditing the department following the implementation of improvement strategies to reduce unnecessary radiation exposure.

Stress profiles and coping mechanisms among clinical Radiography students in Ghana

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Background: A stress-inducing situation occurs when an individual's capacity to cope with stress is less than the demands of the circumstance, both physiologically and psychologically.

This study aimed to assess stress profiles and their associated factors among undergraduate radiography students. In addition, the study sought to determine stress-coping strategies adopted by students.

Methods: A cross-sectional study design was employed. Data was collected through structured questionnaires via Google Forms. Ethics was granted by the research and ethics committee of the University of Cape Coast. Data were analysed with SPSS software version 24.0. The study involved all public universities (4) offering a BSc in Radiography in Ghana. The majority of participants 75 representing 68.2% were males and 35 representing 31.8% were females.

Results: 110 responses were recorded with a response rate of 84%. The majority of participants (41.8%) indicated were moderately stressed, 20.9% and 19.1% of the respondents recorded high and low stress levels respectively. 10.9% and 7.3% of the respondents recorded very high and very low-stress levels.

Taking a break or vacation ($\mu=3.65$), spending time with family or friends ($\mu=2.54$), exercising, and meditation with mean (μ) values of 1.87 and 1.82 respectively were the stress coping strategies mostly used. Exercise (26.4%), sleeping (26.4%), and spending time with family/friends (20.0%) have proven to be the most effective coping strategies for participants.

Conclusion: The study concluded the stress profile for radiography students in Ghana is of concern and should be addressed. The major stressors included the number of courses, volume of study material, financial constraints, family pressure, inadequate time for relaxation, career uncertainty, and difficulty of study materials.

Study on the Effects of Frequency and Duration of Running on the Risk of Patellar Instability Using Magnetic Resonance Imaging (MRI)

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Background Running is well-known to have numerous health benefits. However, with improper running habits, running may be the risk factor for patellar instability. This study is to evaluate the main and interaction effects of running duration and frequency on TT-TG distance and therefore the risk of patellar instability.

Methods 18 participants were selected randomly and allocated into 6 different groups according to both running duration and frequency provided by them in the questionnaires. 0.2T MRI machine was carried out for each subject on both knees. Tibial tuberosity-to-trochlear groove (TT-TG) distance of each subject was measured by one observer, and average distance for both sides were calculated. A two-way

3x2 factorial design was used to compare TT-TG distances between runners with different running durations and frequencies. The regression between TT-TG distance and running frequency, and running duration per run, and running duration per week were assessed.

Results The significance level has been set at $p=0.05$. The TT-TG distance differed significantly in groups with different running frequency (one-sided $p=0.002$). The difference in TT-TG distance between groups with different running duration per day is insignificant ($p=0.213$). The TT-TG distance between Group A (low frequency, short duration) and Group F (high frequency, long duration) is significant ($p=0.044$). Regression showed positive results in running frequency and total duration per week.

Conclusions Running frequency and total running duration per week were proven to have significant effect on TT-TG, and hence, would increase the risk of patellar instability. Regression analysis suggested that frequency and total weekly duration could partially predict TT-TG distance.

Early Radiation Dose Warning System Improves Patient Safety And Radiation Dose Optimization In Neuro Interventional Procedures At Professor Ngoerah Public Hospital, Bali, Indonesia

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Purpose: The Indonesian Ministry of Health conducted a plan to develop more hospitals for heart disease, stroke, cancer, and urology, the four diseases that cause the highest mortality rate in Indonesia. This mission requires Interventional Radiology Modalities involving the use of ionizing radiation. Therefore, Radiation Dose Warning system is crucial for improving patient safety and radiation dose optimization, to detect and alert potential radiation dose in real-time, allowing for timely adjustments to be made to optimize radiation exposure use to the patient.

Materials and Methods: The system is designed to record patient dose into a Google Sheet that contains an application for calculating the reference values for Fluoro Time (FT), Dose Area Product (DAP), and Air Kerma (AK) based on examination and treatment to patient profile. The radiation dose is immediately displayed then conveyed to the Interventionist Doctor by the Radiographer during the Cerebral DSA interventional radiology procedure.

Results: During 2023, this System recorded 79 Neuroradiology patients, with 42 males and 37 females. An evaluation of the data revealed that the usage of Fluoro Time is 11:39, about 23% lower than the reference dose is 15:08. Dose Area Product is 45.5 mgycm^2 about 36% lower than the reference 71 mgycm^2 , and Air Kerma is 317mgy about 9.4% lower than the reference 350mgy.

Conclusion: The Early Radiation Dose Warning system provides an early detection, warning, and evaluation to the Radiographer to alert the Interventional Radiologist when the reference dose barely reached and the radiation dose is approaching.

Exploring the willingness of radiographers in Dubai Health Authority (DHA) to work in the Nuclear Medicine

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Purpose There is a shortage of radiographers working in Nuclear Medicine (NM) in the UAE. This is compounded by the lack of a local academic program to train radiographers in NM. We explore the willingness of radiographers within the Dubai Health Authority (DHA) to work in NM and what influences their decisions.

Methods A cross-sectional questionnaire-based study was used to explore the willingness of radiographers within the Dubai Health Authority (DHA) to work in NM. Quantitative data analysis was conducted employing both descriptive and inferential methods. Ethical clearance was obtained from the ethics and research committee of the DHA

Results: Radiographers working in the DHA were invited to take part in the study. Radiographers in NM were excluded from participating. Key findings of the study included 50% of the participants were willing to work in NM, the need for a specialized skillset to work in NM, and the willingness of most participants to pursue further education to prepare them adequately to join NM. We established the three major drawbacks to radiographers within the DHA joining NM to be, high radiation dose in NM, lack of knowledge in NM, and perceived excessive workload.

Conclusion: The most effective way of getting radiographers into NM is by first identifying and addressing the mitigating factors. We will outline measures and regulatory framework that will galvanize the required support from national stakeholders and thus increase radiographer interest in NM. We make a novel contribution to the evidence for radiographers' willingness to join NM in the DHA by mitigating factors against radiographers joining NM and proffering workable solutions in a setting, where professional NM structures are less mature.

A review of accuracy of optical surface imaging systems for setup verification during breast radiotherapy treatment

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Background: The use of optical surface imaging systems (OSISs) is increasingly becoming popular in radiotherapy practice, especially during breast cancer treatment. This study reviews the accuracy of the available commercial OSISs for breast radiotherapy.

Method: A literature search was conducted and identified the available commercial OSISs from different manufacturers which are integrated into radiotherapy practice for setup verification during breast radiotherapy. Studies that evaluated the accuracy of the OSISs during breast radiotherapy using cone beam computed tomography (CBCT) as a reference were retrieved and analysed. The physics and working principles of the systems from each manufacturer were discussed together with their respective strength and limitations.

Results: A total of five (5) different commercially available OSISs from four (4) manufacturers were identified each with a different working principle. Six (6) studies were found to evaluate the accuracy of the systems during breast radiotherapy in conjunction with CBCT as a goal standard. The studies revealed that the accuracy of the systems in terms of mean difference ranges from 0.1 to 2.1 mm. The

correlation between CBCT and OSIS ranges between 0.4 and 0.9. The limit of agreements obtained using Bland Altman analysis in the studies was also within acceptable range.

Conclusion:

The OSISs have an acceptable level of accuracy and could be used safely during breast radiotherapy. The systems are non-invasive, ionising radiation-free free, and provide real-time imaging of the target surface at no extra concomitant imaging dose. However, the system should only be used to complement rather than replace x-ray-based image guidance techniques such as CBCT.

Evidence based medicine to explore effects of a mindfulness-based interventions on nurses

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Stress in the medical environment can cause burnout, anxiety, and depression among caregivers. COVID-19 has put even more pressure on caregivers. In order to reduce the stress of caregivers so that patients can receive better care, this study studied the impact of mindfulness-based intervention on reducing caregivers' stress. In this study, Keywords were searched in Cochrane, PubMed, Embase, and Trip. The selected articles were Systematic Review, Meta Analysis, Controlled Clinical Trial, and Randomized Controlled Trial. A total of thirty articles were searched, and duplicate articles were eliminated. This article was evaluated with the CASP evaluation tool. Different depression rate scales were used in the included papers, so the pooled effect was estimated using the standardized mean difference (SMD) and its 95% confidence interval. The first SR included a total of 22 RCTs with a total of 807 participants. Using a random effects model, mindfulness-based was significantly associated with depressive symptoms and reduced caregiver anxiety significantly more than the control group (SMD:0.91) at 4 weeks (SMD:0.03), 8 weeks (SMD:1.43;) can significantly reduce anxiety levels. The second SR included 15 trials with a total of 1165 participants. (SMD:-0.81), anxiety (SMD:-0.30), depression (SMD = -0.24). This study used empirical methods to search for two documents. After rigorous review, the evidence level was Level 1 and above. It shows that using mindfulness intervention to reduce depression among nurses is statistically significant and can stabilize mood. Considering that mindfulness is a non-invasive, low-cost intervention with no side effects, in accordance with the spirit of GRADE, it is still recommended that clinical clinicians and nurses can design mindfulness programs together to create a sense of comfort, promote the nurse-patient relationship, and improve the quality of care.

Evaluation the Impact of Coronavirus Disease 2019 (Covid-19) on Cranial Nerves Using MRI Tractography Diffusion Tensor Imaging: Study on Fiber Tracking and Fractional Anisotropy

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Background / Purpose: Most recovered Covid-19 cases are among individuals aged 15-64, the productive working-age group. People in this age range are generally involved in finishing their education, pursuing jobs, advancing their careers, starting families, and contributing to community

development. There is growing evidence that Covid-19 can affect the cranial nerves. Several other studies conducted in various countries have identified complications in the brain and nervous system following Covid-19 infection. We investigated 30 recovered Covid-19 patients using MRI Tractography Diffusion Tensor Imaging.

Method: Researchers conducted a study from July 2020 to April 2023, selecting Brain MRI patient samples using purposive sampling. The study targeted patients aged 18 to 65 who had been infected with Covid-19, considering factors like age, weight, gender, comorbidities, Covid-19 test results, symptom severity, post-Covid-19 neurological disorders, and specific Brain MRI findings. Patients with underlying brain or head conditions such as cancer, metastasis, or psychological disorders were excluded. MRI imaging utilized a 1.5 Tesla 16-channel machine with T1WI, T2WI, 3D-FIESTA, and DTI. Image analysis was performed using Ready View DTI Fiber Tracking (FT), and Fractional Anisotropy (FA).

Results: Based on age categories, there is variation in the number of samples, where the age category with the highest number of samples is 26-35 years old, with 10 samples (33.3% of the total). The age categories with the second-highest number of samples are 36-45 years old and 46-55 years old, each with 7 samples (23.3% of the total). The age categories with the lowest number of samples are 17-25 years old and 56-65 years old, each with 3 samples (10% of the total). The data collected on the severity of Covid-19 symptoms in relation to pathological findings in post-recovery Brain MRI scans reveals significant differences. Among the samples, those with mild Covid-19 symptoms exhibited the highest number of pathological findings (12 samples). In contrary, samples without symptoms still showed a substantial number of pathological findings (9 samples), while samples with moderate symptoms had 8 samples with such findings. Remarkably, samples with severe Covid-19 symptoms exhibited a significantly lower incidence of pathological findings, with only 1 sample indicating such abnormalities. Samples experiencing neurological disturbances after recovering from Covid-19 are categorized into three indications: motoric, cognitive, and other neurological disorder indications. Out of the total samples, 16% exhibited cognitive disturbances, 25% experienced motoric disturbances, and 59% of the samples showed indications of other neurological disorders.

Conclusions: In this study, we demonstrated that diffusion tensor imaging can provide essential qualitative and quantitative information to the understanding of pathophysiology underlying neurologist disorders of the patients which can be used to improve the clinical outcomes and quality of patient's life after recovered from Covid-19. Brain MRI results revealed significant pathological findings in Covid-19 patients. Notably, 14% had right-sided brain pathology, 10% had left-sided pathology, and a striking 76% had bilateral brain pathology. Most of these findings (79%) were categorized as circulatory system lesions, while 21% fell into other categories. Overall, the study suggests that brain pathology is common in Covid-19 patients after recovery. Fiber Tracking analysis showed disruptions in nerve fiber pathways associated with affected brain areas, including the prefrontal cortex, corpus callosum, and corticospinal tract. This disruption correlated with anosmia (loss of smell) in Covid-19 patients, highlighting changes in brain connectivity and nerve fiber pathways. Fractional Anisotropy analysis indicated reduced FA values in white matter brain tissue, potentially signifying nerve damage or dysfunction in regions related to cognitive and emotional functions. However, it's crucial to note that not all pathological findings directly correspond to neurological symptoms. Further research is needed to fully understand Covid-19's neurological impact. In summary, Fiber Tracking and Fractional Anisotropy analyses provide valuable insights into nerve fiber changes in Covid-19 patients, linking them to neurological symptoms. While the direct relationship between these changes and Covid-19 requires more investigation, these techniques are useful for exploring the virus's neurological effects.

RADIOGRAPHER GENDER AND BREAST SCREENING UPTAKE: A SINGLE CENTRE STUDY IN GHANA

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Introduction: Breast cancer is the most frequent malignancy in women worldwide and its chances of being cured is dependent on detection. Advanced breast cancer with distant organ metastases is considered incurable with currently available therapies and the data are dire in developing countries like Ghana. Mammography is regarded as the gold standard for early detection of breast cancer. As a result, many countries offer routine periodic breast screening. A high level of breast consciousness, coupled with cultural considerations and the possibility of an unfavourable diagnosis can leave many women feeling anxious and uncomfortable having a mammography examination performed by a male radiographer.

Aim: The study aims to determine the impact of radiographer gender on breast screening uptake.

Methods: A questionnaire-based cross-sectional quantitative study was conducted in the Cape Coast metropolis. Women below the ages of 40 years were excluded because they are not eligible to for asymptomatic voluntary screening mammography in Ghana. The study was carried out over a 3-month period. Ethical approval was granted by the ethics and research committee of the University of Cape Coast

Results: Expression of embarrassment was the commonest reaction if the one conducting the mammogram was male, this was more common with younger women than older women (45 years and above). Fifty per cent would not have proceeded if the radiographer was male and 39.2% would only have proceeded with female chaperone present.

Conclusion: The study established that, radiographer gender affects breast screening uptake and in the absence of a female radiographer, a female chaperone is helpful.

Transformational Leadership for Personalised Care in Medical Radiations

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Introduction: Medical radiations s rapidly evolving and effective leadership is essential to navigate technological advancement and foster innovation while delivering personalised care. This presentation introduces a comprehensive transformational leadership framework tailored exclusively for the field of medical radiations. The purpose of this framework is to empower medical radiations leaders to lead with confidence and efficacy.

Methods: This framework consists of four pillars and it is based on scientific concepts, literature and informed by practical insights.

Results: Pillar 1: Leading Through Change: represents a proactive approach to adapt to the rapid changes and demands in the field of medical radiations. Leaders embark on changes with a clear vision,

initiate strategic plans and execute transformative actions. Leaders could cultivate a culture of innovation and continuous improvement by engaging actively with stakeholders.

Pillar 2: Distributed Leadership: emphasizes the collaborative nature of leadership. Leaders are encouraged to foster a culture of shared responsibility and open communication. By empowering team members through skills building, mentorship and trust-building initiatives, leaders can improve patient care delivery and drive organizational success.

Pillar 3: Research Scholarship: highlights the vital role of leadership in advancing research to enhance personalized care delivery. Leaders are responsible for building research capacity, securing research grants, and fostering interdisciplinary collaborations. Leaders can impact positively on patient outcomes by translating research findings into clinical applications.

Pillar 4: Exemplary Leadership: Leaders are encouraged to lead by example, maintain transparency, and cultivate and promote a culture of trust and accountability.

Conclusion: The proposed customized leadership framework provides a methodical approach to navigate challenges, drive innovation and cultivate a culture of excellence in medical radiations practice. By embracing change, fostering collaboration, advancing research and leading by example, medical radiations leaders can lead with confidence and further impact on personalised care delivery. Transformational leadership framework, leaders, medical radiations, personalised care.

Converting Varian LINAC plans to Elekta LINAC plans using Raystation fallback planning system in prostate cancers with Volumetric Modulated Arc Radiotherapy

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Background: In radiotherapy centers, there are various types of treatment machines for treating patients. Different machines have their respective treatment planning systems (TPS) but without interchangeability between the systems. Raystation TPS includes a function of fallback planning, providing an alternative way to solve the machine breakdown situation. The fallback planning system enables to generate plans of different radiotherapy techniques and treatment machines. The aim of this study is to demonstrate the feasibility and effectiveness of the fallback planning system in producing plans of two different L-shape linear accelerators (LINACs) using the volumetric modulated arc radiation therapy (VMAT) in prostate cancer.

Materials and Methods: 30 patients with localized prostate cancers who treated with VMAT were recruited. By using the Raystation fallback planning system, plans of the Varian LINAC were converted to plans of the Elekta LINAC. Dosimetric metrics in terms of the targets, organs at risk (OARs) and the monitor units (MU) were compared between the two VMAT plans.

Results: The dose coverage, homogeneity, and conformity of the targets in the converted Elekta plans were commonly inferior to the Varian plans. The rectum and bladder received higher dose in the Elekta VMAT plans, mean dose of the penile bulb, normal tissues and MU were lower, and the doses of femoral heads were comparable between the two VMAT plans.

Conclusion: All the converted Elekta VMAT plans were acceptable for treatment. The Raystation fallback planning was capable of producing backup plans under the circumstances of machine breakdown.

Brain functional alterations in patients with schizophrenia with comorbid metabolic syndrome treated with risperidone or clozapine: A resting-state functional magnetic resonance imaging study of regional homogeneity

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Background: Metabolic syndrome is one of the most common side effects of antipsychotic treatment in patients with schizophrenia. However, previous research has mainly focused on the efficacy of antipsychotic drug treatment, and there are few neuroimaging studies on its side effects on metabolic syndrome in patients with schizophrenia. The purpose of this study was to investigate the characteristics of brain function in schizophrenic patients with metabolic syndrome treated with risperidone or clozapine.

Methods: 43 schizophrenia patients treated with risperidone or clozapine were included and divided into schizophrenia metabolic syndrome group (SCZ-MetS, n=20) and schizophrenia non-metabolic syndrome group (SCZ-nMetS, n=23), and 28 normal controls (HC, n=28) were collected. All subjects underwent resting-state MRI scans and regional homogeneity (ReHo) was applied to assess brain activity. Analysis of variance (ANOVA) was used to obtain the brain areas with significant differences among the three groups, and then post hoc tests were calculated for comparison between groups.

Results: Compared with HC group, the ReHo of right postcentral gyrus, left superior parietal gyrus and left middle occipital gyrus decreased in both groups. In SCZ-MetS, the left calcarine fissure and surrounding cortex and the right angular gyrus decreased, while in SCZ-nMetS, the ReHo in the left superior occipital gyrus and right precuneus decreased, and the right orbital inferior frontal gyrus increased. The ReHo of the right orbital inferior frontal gyrus of SCZ-MetS was lower than that of SCZ-nMetS. There was a significant negative correlation between ReHo and BMI in the right orbital inferior frontal gyrus of schizophrenic patients ($r=-0.448$, $p=0.003$).

Conclusion: The intrinsic brain dysfunction of orbitofrontal lobe may be related to metabolic syndrome in patient treated with risperidone or clozapine. This finding provides a target for the development of antipsychotics with low side effects.

Building a scattered radiation dose profile using 3D Simulation Method for Paediatric Interventional Radiology

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Introduction: During Interventional Radiology (IR) procedures for paediatrics, multiple teams will be engaged in the IR suite to take care of the patient. Team members have to stay around the imaging equipment where the amount of scattered radiation varies at different location. By simulating common operative settings, the scattered radiation profile is become visualised. Information is then available for formulating necessary radiation safety measures.

Objectives: Setup common paediatric IR procedure scenarios and measure the scattered radiation with phantoms and dosimeters. Simulate a dose profile for visualisation.

Methods: Making use of Infant and Children Phantoms and Dose Measuring Detectors (RTI, Sweden), we simulate the common imaging scenarios for paediatric IR. Augmented reality (AR) system is a readily available program that can realistically simulate clinical environment. AR technology has been applied on the 3-D field of view of a real environment by overlapping radiation dose detected. This helps to project the scattered radiation profile in different clinical environment, which provides valuable information to radiographers to assess additional radiation risk to nearby healthcare staff or relatives of the patient.

Results: Making use of scintillation detectors and simulated clinical environment, several 3-D scattered radiation profiles are generated, this will help to improve the evaluation of radiation safety measures.

Conclusion: Making use of emerging technology including AR, VR and mixed-reality Intervention, radiation scatter profile can now be shown in a 3-D approach.

Implementing Automised Bone Age Assessment Tool in Department of Radiology of Hong Kong Public Hospitals

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Introduction: Bone age is an essential index for assessing the growth trend of a child. Traditionally the assessment is performed with manual comparison of the left-hand radiograph with an image atlas by radiologists. This is a time-consuming process and inter-rater variability is inevitable. The project team had investigated the feasibility of deploying AI tool determine the bone age from digital radiographs. After feasibility studies, trial run, validation test and evaluation, the tool started to be used in Department of Radiology of Hong Kong Children's Hospital (HKCH) in 2021. The tool had further implemented in all Radiology departments of public hospitals in Hong Kong in 2023.

Objectives: Identify a potential product in the market and implement to clinical use after trial run and validation.

Methodology: The team had gone through processes to select appropriate product in the market by understanding the technical requirements and functionalities. By consulting hospital IT on information security, a system setup is formulated for a trial study. A validation test was also performed to verify the consistency of the analysed result. The project was implemented in HKCH in 2021 with positive response during the trial run. The project was further rolled out in other Hong Kong hospitals.

Results: A product in the market was evaluated for the feasibility for deploying in clinical workflow of Hong Kong public hospitals. The implementation was completed in 2023.

Dose optimization in CXR after installation of new radiographic system, Carestream DRX evolution plus

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Background/Purpose: Chest X-ray (CXR) examinations, while individually associated with a relatively low radiation dose compared to other modalities, were frequently performed, leading to significant cumulative doses over time. Therefore, optimizing radiation dose in CXR imaging was crucial for a new

system during system commissioning to minimize radiation exposure while maintaining diagnostic image quality. This study aims to explore dose optimization techniques in CXR imaging using the Carestream DRX Evolution Plus system, with reference to the Diagnostic Reference Level (DRL) in the UK and Japan.

Methods: All CXR examinations were conducted using the Carestream DRX Evolution Plus system, with a flat panel detector (FPD) and VAREX X-ray tube. A total of 55 adult patients (35 female, 20 male, mean BMI 26.5) were recruited for the study, and data such as sex, age, height, weight, BMI, focus skin distance (FSD), Dose Area Product (DAP), Entrance Skin Dose (ESD), tube voltage kVp, tube current mAs, automatic exposure control (AEC), exposure indicator (EI), and bulky surface area were collected. DAP was obtained from the radiation dose structural report of the images and compared with the clinic's previous data and the DRL in the UK. The repeat rate of radiographs in the clinic was also analyzed. Additionally, an in-house phantom (13cm acrylic, modified ANSI phantom) was used to optimize radiographic parameters if necessary.

Results: The data analysis revealed the median DAP in CXR examinations exceeded the DRL set in the UK. However, both the median ESD estimated from DAP and the directly measured median ESD were lower than Japan's DRL.

Conclusion: By implementing optimization strategies, it is possible to reduce the DAP in CXR examinations, bringing them closer to the DRL in the UK, while ensuring diagnostic image quality and patient safety. These strategies include optimizing X-ray technique parameters, conducting regular quality assurance tests, providing training and education, and implementing monitoring and audit systems. These findings emphasize the importance of ongoing dose optimization efforts in CXR imaging to minimize radiation exposure while maintaining diagnostic efficacy.

Bridging the Gap: Understanding AI Awareness and perception among radiographers and radiology technologists in Cameroon

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Background: In today's world, Artificial Intelligence (AI) is significantly altering industries worldwide, and the healthcare field is not exempt. Specifically in radiology, AI technologies are taking a significant role in the interpretation of medical images, ultimately enhancing diagnosis, treatment planning, and improving overall patient care. However, the successful integration of AI into radiology practices heavily relies on the knowledge and perspective of healthcare professionals, notably radiographers and radiology technicians.

Methods: A 20-point structured questionnaire containing elements on demographic characteristics and assessment of awareness of, attitude and perceptions towards AI was administered to radiographers and radiological technologists in Cameroon from January to December, 2023. This cross sectional study explores the current state of AI awareness and perception among these professionals in Cameroon, shedding light on potential challenges and opportunities for AI implementation in the country's healthcare system.

Results: Of 768 participants 304 (44%) had never heard of the AI in radiography; however only 43 (13.5%) could mention specific application of AI. AI methods are known by only 33 (11.3%) while 12 (11.6%) are aware of its implication in radiology. Although 124 (16.1) perceived it as being advantageous tool for image quality and diagnosis, 252 (32.8%) were willing to study and use AI in their departments; 31 (4%) would refuse the study and application of AI even when available. Almost all the participants, 548 (71.3%), want AI to be part of education and available to use.

Conclusion: There is a low level of awareness of AI among Radiographers in Cameroon. Client education is necessary to address some concerns on the development and application of AI and its indications for the operation.

Clinical Insights from the Neuroanatomical Correlates of COVID-19 Infection: An umbrella Review

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Introduction: The early studies on the COVID-19 outbreak primarily focused on pulmonary effects, such as respiratory symptoms and lung damage. However, as the pandemic progressed, emerging evidence revealed that the virus could affect other organs, including the brain. This led to a significant increase in research on neurological manifestations and associated structural neuroanatomical features in acute and long COVID-19. Notable challenges involved the complexity and diversity of coronavirus neuroinvasion mechanisms and manifestations, along with methodological inconsistencies and limitations in existing studies. These challenges have impeded the acquisition of high-quality research evidence and hampered the implementation of effective management strategies and interventions to address neurological complications in patients with COVID-19.

Aim: To explore and integrate the existing literature on the neurological manifestations and associated neuroanatomical changes, aiming to gain an in-depth understanding of the actual role and impact of imaging in diagnosing and monitoring COVID-19 neurologic conditions.

Methodology: An umbrella review method was employed in accordance with the PRISMA framework. Data were systematically obtained from several databases (EBSCOhost, Web of Science, SCOPUS, and PubMed). The selected studies underwent rigorous quality assessment, data extraction, analysis, and synthesis to develop themes.

Results: This research included 19 articles addressing the structural neuroanatomical findings among a total of 74,293 COVID-19 patients who presented with neurological symptoms. The emergent findings are discussed under two main broad themes:

Theme 1: Clinical presentations of acute and long COVID-19 Infections.

Theme 2: Acute and long COVID-19 neuroanatomical findings from neuroimaging.

Conclusion: There is a degree of overlap between acute and chronic neurological clinical presentations, with neuroanatomic alterations being prevalent among older adults. Most perceived COVID-19-induced structural neurologic alterations are consistent with age-related neurovascular comorbidities. Therefore, careful selection of controls is recommended to establish causality. These factors are important for post-COVID clinical investigations.

Dosimetric comparison between three-dimensional conformal radiation therapy, hybrid intensity-modulated radiation therapy and volumetric modulated arc therapy for left-breast cancer with lymph node involvement using breath-hold technique

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Background. The three-dimensional conformal radiation therapy (3DCRT) is currently used in many centers; but is challenging in treating left breast tumour with internal mammary lymph nodes (IMN) involvement. For advanced cases, volumetric modulated arc therapy (VMAT) with breath-hold technique is favourable. Hybrid intensity-modulated radiation therapy (H-IMRT) was also adopted in many previous studies to treat left breast cancer without lymphatics involvement.

This study compares the dosimetric performance of 3DCRT, H-IMRT and VMAT for post-operation left breast cancer with IMN and SCF involvement under deep inspiration breath-hold (DIBH).

Materials and Methods. 20 stage III breast cancer patients undergone post-operation left breast radiotherapy using DIBH technique were selected. The dose indices including $V_{95\%}$, the conformation number (CN) and homogeneity index (HI) of the whole PTV₅₀, individual PTV_{IMN} and PTV_{SCF}, OARs including the heart, both lungs and the spinal cord were compared. Monitor unit (MU) was also analyzed.

Results. VMAT could achieve the best dose conformity and homogeneity to the PTV₅₀ with the highest CN (0.73) and lowest HI (0.12), followed by H-IMRT and then 3DCRT. $V_{95\%}$ of PTV₅₀ and PTV_{SCF} by 3DCRT were also significantly lower. For PTV_{IMN} coverage, $V_{95\%}$ with VMAT (95.9%) was significantly higher than H-IMRT (90.2%) and 3DCRT (57.2%).

For OARs sparing, 3DCRT was the best in sparing the heart and lungs from low dose bath with a significantly lower V_{5Gy} than the other two techniques. The maximum dose to spinal cord with 3DCRT was also significantly lower than H-IMRT and VMAT. H-IMRT required the highest number of MU (2020MU), significantly higher than VMAT (715MU) and 3DCRT (461MU), making it the least efficient in treatment delivery.

Conclusion. Both H-IMRT and VMAT are effective for PTV₅₀ and PTV_{SCF} coverage, but H-IMRT fell short for PTV_{IMN} while H-IMRT required an enormously high MU. VMAT appeared to be the treatment of choice.

Pre and postnatal imaging of thoracic aneurysm: the Case of a delicate balance between maternal and child health outcomes for a personalized care

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Background: Aortic aneurysm is a rare but potentially life-threatening condition that poses unique challenges when encountered during pregnancy. Pregnancy-induced physiological changes may affect the cardiovascular system and exacerbate the risk of aortic dissection or rupture in pre-existing aortic aneurysms. In this case, the etiology of aortic aneurysms is attributable to the comorbidity of pregnancy-induced physiological changes and chronic cardiac disease.

Method: Prenatal limited cardiac MRI and postnatal cardiac CT Angiogram were performed to diagnose and monitor thoracic aneurysm as part of prenatal care and pre-operative planning.

Results: Prenatal cardiac MRI showed a bovine arch with fusiform aneurysms of the aortic root up to the 1st part of the arch and the brachiocephalic artery. Two years later, the preoperative CT Angiogram showed a significant increase in the size of the aneurysm without dissection and contrast extravasation.

Discussion: Aneurysm is life-threatening and can complicate into dissecting aneurysm, rupture an even death. Brachiocephalic aneurysm is rare but clinically significant, accounting for 3% of all supra-aortic aneurysm. Justification of radiological examinations forms part of personalized care and a delicate balance between maternal and fetal well-being for improved health outcomes. However, certain pathological conditions are rare during pregnancy and treatment may be delayed due to the delicate

balance between maternal and child health, as well as socioeconomic and cultural factors, especially in the continent of Africa.

Conclusion: Medical imaging is the key component of personalized care to advance the 2030 Agenda for Sustainable Development. Proactive international collaborations are crucial to ensure better use of radiology resources to improve women's health in resource-constrained settings, especially during pregnancy, a crucial stage of women's health.

Inflammatory breast cancer: the case of a swollen arm mimicking deep vein thrombosis as the cause of inflammation

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Background: Breast cancer remains one of the leading causes of death among women. Socioeconomic and cultural factors are attributable to delays in seeking health care in developing countries.

Morphology of breast cancer also contributes to delays in seeking health care. For example, typical breast cancer commonly presents as a lump, while the rare form of breast cancer, inflammatory breast cancer (IBC), presents as a nonpainful swelling on the breast that can extend to the arm.

Method: A 38-year-old female with a history of stage 3B cervical cancer presented with a solid immobile mass on the left breast, with soft tissue edema extending to the distal arm.

Results: Mammogram showed normal tissue composition with skin thickening. An inflammatory breast cancer secondary to deep vein thrombosis (DVT) was suspected, and the patient was scheduled for a 6-month review, to resolve DVT. A follow-up mammogram showed similar findings. Nuclear medicine showed increased uptake. It was interesting to note at this stage that the diagnosis was now inflammation of the breast due to DVT. Biopsy was performed; however, the specimen was insufficient for histopathological analysis. MIR was requested to characterize the mass lesion.

Discussion: Inflammatory breast cancer is rare and aggressive with a median survival of less than four years. It invades the lymphatic vessels, presenting as a swollen and edematous area that extends to the distal arm and mimics deep vein thrombosis (DVT).

Conclusion: Unlike traditional breast cancer, IBC can present as swelling that extends to the arm, mimicking DVT, resulting in delayed treatment and poor health outcomes. Raising awareness about this rare aggressive breast cancer is crucial to empower women to seek health care early for improved health outcomes.

Does higher education hone academic and professional competencies to thrive in the present diverse and unpredictable life and dynamic future?

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Introduction: Interprofessional Education and Collaborative Practice (IPEP) occurs when two or more professions learn with, from and about each other; and work together with patients, families, caregivers and communities to deliver the highest quality of care for improved health outcomes. Health challenges transcend social determinants of diseases and national borders. Collaborative practice is necessary to create a safe space for each other, and to be able to share opinions and ideas on how the different professions can manage patients for improved health outcomes.

Method: IPECP was introduced to all the first-year students at the Sefako Makgatho Health Science University (SMU) during the rollout of its prototype program in 2023. Lecturers received training to facilitate the programs for the different year-levels. The theme for the first years was diversity, disparity and equity in health care. Post IPECP survey was conducted to assess the attainment of the IPECP competencies using the Interprofessional Collaboration Competency Attainment Survey (ICCAS) questionnaire. The variables were related to communication, collaboration, roles and responsibilities, collaborative patient/family-centered approach, conflict management and team functioning.

Results: Prior to the survey, over 60% of the students rated the variables as poor and fair. Post-IPECP survey showed great improvement across all variables with the rating between very good and excellent. IPECP is a promising tool to address challenges of compromised quality of healthcare that are attributable to ethics and negligence through collaborative practice.

Conclusion: IPECP should form part of work-integrated learning in the radiography curriculum, to equip our students to better respond to the socio-economic challenges in the present diverse and unpredictable life and the dynamic future for improved health outcomes. IPECP fosters teamwork, social cohesion, openness toward different worldviews, and to engage with others respectfully.

Evaluation of knee degeneration in people with regular hiking habits by magnetic resonance imaging – a pilot study

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Background: More people have developed regular hiking habits owing to the health benefits of enhancing cardiovascular and musculoskeletal health and lowering stress levels. However, structural changes in the knee joints of regular hikers are not well understood. This study aimed to identify the presence and degree of knee pathologies among people who perform habitual hiking exercises using magnetic resonance imaging (MRI), as well as their association with hiking patterns.

Methods: MRI scans of both knees of 10 subjects, 46 – 70 years old, with regular hiking habits were performed. Data on the subjects' hiking habits were collected by questionnaire. 11 features, including cartilage morphology, osteophytes, subchondral cysts, subchondral bone marrow abnormalities, synovitis and integrities of menisci and ligaments, were assessed based on the modified whole-organ MRI score (WORMS) of the knee. Cartilage and menisci thicknesses were also measured. Wilcoxon signed-ranks tests and Mann-Whitney U-tests were used to evaluate differences in the grading of knee structures.

Results: The thickness of the posterior part of the medial femoral cartilage between the left and right knees showed significant difference ($P = 0.011$). Significant differences were demonstrated in the thickness of the central part of the medial tibial cartilage ($P = 0.008$) and overall WORMS score ($P = 0.043$) of low-frequency and moderate to high-frequency hikers. No significant difference was identified between beginner and advance hikers.

Conclusion: Higher hiking frequency may pose greater threats to knee health, causing greater structural changes. Further studies are needed to investigate impacts of hiking on knee health.

Evaluation of the degenerative changes in lumbar spine X-ray Images from elderly patients in Hong Kong

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Background: The purpose of this study is to provide a more comprehensive and quick assessment of degenerative changes such as osteophytes, diffuse sclerosis, compression fractures and spondylolisthesis in plain X-ray. The correlation of degenerative changes with age and gender in the Chinese population was also investigated.

Method: A total of 318 cases were collected from 5 public hospital clusters randomly from local hospitals. Subjects that were above 50 years old, no previous spinal surgery or trauma were included in this study. The data were then assessed using Wike's model of disc degeneration, Meyerding Classification of spondylolisthesis, and Genant method of compression fracture.

Results: 159 cases were found eligible for the study with 94 females and 65 males. The descriptive statistics observed general trends of degenerative changes with age and gender. The study has found significant correlation between osteophytes, diffuse sclerosis, spondylolisthesis, and compression fracture with that of age in every measured lumbar level. The results however show weak or no correlation between the gender and the degenerative changes as only the osteophytes formation at T12/L1 and L1/L2 has significance ($p < 0.05$).

Conclusion: The osteophytes, diffuse sclerosis, spondylolisthesis, and compression fracture positively correlated with age and partially with gender. The overall trend of our study suggested that the Chinese population has similar correlation in degenerative changes with the studies using European and American population as database. This study also shows that the grading system is significant for a quick assessment of degenerative changes.

Effect of hot water foot bath on the venous haemodynamics in lower extremities - a feasibility study

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Background: Prolonged standing is one of the major factors that will cause venous hypertension and valvular incompetence which may lead to varicose veins. This study aimed to explore the effect of hot water foot baths on venous haemodynamics in lower extremities and cardiovascular function with the use of constant duration and water temperature.

Methods: It was a prospective pretest-posttest design study recruiting subjects who stand for four or more hours every day. The reflux time and flow velocity of great saphenous vein were measured by duplex ultrasound before and after the immersion while the venous diameter in transverse plane was measured by the manual use of electronic calipers of ultrasound unit. By vital sign monitor and USCOM, the heart rate, stroke volume, cardiac output, systolic and diastolic blood pressure (BP), system vascular resistance and mean arterial pressure were measured.

Results: 6 female subjects (mean age: 53.5) were recruited. After the hot water foot bath, the heart rate remained unchanged while the systolic BP, diastolic BP, mean arterial pressure and systemic vascular resistance decreased by 0.77%, 2.35%, 1% and 5.56% respectively. The oxygen saturation, stroke volume and cardiac output increased by 0.1%, 4.88% and 3.82% respectively. Regarding the venous drainage, the reflux incidence, reflux time and blood flow velocity were unremarkable. As to the venous diameter, the short axis increased in both dominant and non-dominant legs by 16.9% and 8.12% respectively,

while the long axis decreased by 1.86% in the dominant leg and increased by 18% in the non-dominant leg. The subjects also rated a high score (8.83) for the hot water foot bath.

Conclusions: Further studies are suggested with several amendments to confirm the effectiveness of hot water foot baths in enhancing venous haemodynamics, thus relieving varicose veins.