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Preface

The Abstract Book of the 24th Asia-Oceania Congress of Medical Physics (AOCMP) and the 22nd Southeast Asia Congress of Medical Physics (SEACOMP) 2024 consists of 313 abstracts, encompassing a diverse range of topics including radiation oncology, diagnostic radiology, nuclear medicine, radiation protection and safety, and education and training. The AOCMP-SEACOMP 2024 was held in Penang, Malaysia from 10 to 13 October.

The abstracts highlight innovative research and development in the fields, aligned with the congress theme "Revolutionising Patient Care Through Medical Physics". The compilation also includes emerging areas such as artificial intelligence applications in radiotherapy planning, advancements in dual-energy CT imaging, quality assurance automation, and integration of 3D printing for personalised dosimetry. The compendium reflects the scholarly contributions and collaborative efforts of professionals and researchers dedicated to advancing the field of medical physics in Asia-Oceania and beyond.

We extend our deepest gratitude to all authors and reviewers for their contributions. We hope this collection will serve as a valuable resource, inspiring innovation and collaboration within the global medical physics community.

Editors
Ahmad Taufek Abdul Rahman, Hafiz Mohd Zin, Norazrul Yahya, Hwee Shin Soh.

Monte Carlo Simulation-based dose calculation for Varian 2100CD Linac: a comparative study with clinical algorithms in homogeneous and heterogeneous media

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This study investigates dose calculations with Monte Carlo (MC) simulation for a Varian 2100CD Linac and then compare with other two clinical algorithms AAA and Acuros XB, evaluating their impact across diverse media–homogeneous and heterogeneous. Using BEAMnrc, a 6 MV photon beam's energy and Field Width Half Maximum (FWHM) are simulated, with DOSXYZnrc determining Percentage Depth Dose (PDD) and beam profiles. Virtual phantoms (40 cm × 40 cm × 30 cm) with voxel dimensions (1 cm × 1 cm × 0.25 cm and 1 cm × 0.2 cm × 1 cm) are created for homogeneous scenarios, compared with practical measurements. In heterogeneous media, an Eclipse (version 13.7) virtual phantom calculates PDD using AAA and AXB algorithms. A 3%/3 mm Gamma index evaluates the data. 6.3 MeV with FWHM 0.35 cm achieves optimal matching. In homogeneous media, both field sizes exhibit 100% gamma pass rates. In water, AAA and AXB align well with MC (100% pass rate). However, in air and lung, AAA deviates significantly (75.5% and 89.5%), while AXB and MC achieve 86.9% and 100%, respectively. This project aims to reduce dose calculation uncertainty. MC dose distribution aligns well with water medium measurements. In inhomogeneous media, AXB and MC surpass AAA accuracy, especially in air interfaces where AAA tends to overestimate doses. The findings emphasize the potential for improved clinical outcomes through accurate dose calculations. The study contributes valuable insights for refining radiation therapy planning.

Recalculation of iodine density from dual-keV CT images in dual-energy CT

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Dual-energy CT analyses require vendor-specific workstations. Therefore, we investigated the potential of the recalculations of the iodine densities for the analyses without using the workstations. Theoretical iodine densities of 2.0, 5.0, 10.0, and 15.0 mg/mL in multi-energy CT phantom were scanned by a rapid kV switching CT and a dual-layer detector CT. Forty and 200 keV of virtual monochromatic and iodine density images were obtained by the workstations for dual-keV CT images. The iodine density

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language generative AI. ChatGPT-4o (OpenAI) was used for language generative AI, and BrainHab based on Azure AI Search was used for RAG systems. Japanese medical physicist board examination (6 years) was used for evaluating the performance for answering. Japanese medical physicist board examination (1 year) was used for evaluating the improvement accuracy rate by RAG. The correct answers were determined by experienced medical physicists, since the correct answers for Japanese medical physicist board examination are not provided by the Japanese Board for Medical Physicist Qualification. The average accuracy rate was 75.7% ± 2.9%. The accuracy of answering questions related to Japanese laws and guidelines were lower than others. The accuracy rate of the medical physicist examination improved by RAG from 78.2% to 83.3%. This study showed differences in accuracy rate by category. On the other hand, the performance of language generative AI was improved by RAG. Based on the results of this study, we will develop an AI chatbot for radiotherapy patients.

Occupational radiation exposure to the thyroid in angiography procedures: single-centre study

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Healthcare professionals express significant concern regarding the potential occupational exposure to ionizing radiation in clinical settings. This study aims to measure and compare the radiation dose to the thyroid of angiography staff during two procedures: percutaneous transhepatic biliary drainage (PTBD) and central venoplasty. The procedures were conducted under the biplane angiography system at the Department of Radiology, Sultan Ahmad Shah Medical Centre @IIUM. The radiologist, medical officer, radiographer, and nurse placed the nanoDot Optically Stimulated Luminescent Dosimeters (OSLDs) inside and outside the thyroid shielding during the procedure. According to the findings, radiation exposure is highest outside the radiologist's thyroid shielding, with the maximum recorded dose being 1.139 mGy during the central venoplasty procedure. The medical officer received the lowest dose among the four healthcare professionals. The thyroid dose for different healthcare professionals varies significantly due to differences in their standing positions and the duration of the procedures. However, the radiation doses between procedures showed no significant difference ($\chi 2(2) = 3.000$, $p = 0.392$). In conclusion, these results emphasise the significance of implementing effective radiation protection measures, especially for radiologists who face the highest risk. Consistent monitoring and adherence to safety protocols are crucial to reducing occupational radiation exposure for all healthcare professionals.

Comparison of air kerma measurements between the IAEA Dosimetry Laboratory and the Medical Physics Laboratory, Malaysian Nuclear Agency for X-Radiation Qualities Used in General Diagnostic Radiology

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The air kerma calibration coefficients of a transfer ionization chamber were compared at the IAEA Dosimetry Laboratory Seibersdorf, Austria, and the Medical Physics Laboratory (MPL), Malaysian Nuclear Agency for 4 selected radiation qualities as used in general diagnostic radiology and computed tomography. The MPL performed its measurements in the period September 2023 to January 2024. The comparison results for the selected beam qualities expressed as the ratio of calibration coefficients were in the range (1.001–1.008) and consistent within the relative standard uncertainty of the comparison which ranged between 1.3% and 1.8%. The results show the calibration coefficients of both laboratories to be in good agreement.

Electron beam modification using dental wax to produce intra field variable spatial dose distribution

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Electron beam modification is usually done by blocking the part of the field inside the beam. Apart from changing the shape of the beam, this study shows a way to modify the electron beam which results in intra beam differential spatial dose distribution. There is a necessacity to modify the beam acording to the lesion so that more normal cells and organs at risk can be saved. Our department is equipped with Truebeam STX a multienergy linac with both electron and photons. This pilot study is done with 6 MeV electron beam. Dental Molding wax is used for electron beam modification. Dosimetry studies are done with parallel plate chamber in solid water phantom slabs. The linear attenuation coefficient (LAC) is calculated for each mm of wax. The chamber is placed at the reference depth in the phantom. The charge collected is calculated for open beam and beams with wax sheets placed on the surface of the phantom. Using the calculated LAC, the electron beam is divided into a matrix. As per the dose requirement in each matrix, the number of wax sheets placed also varies. The fabricated wax matrix is checked with film dosimetry. With this affordable method, the electron beam can be modified spatially in terms of dose and variable dose distribution can be achieved which will be helpful in achieving high dose to cancer cells, sparing more normal tissues and saving adjacent OARs effectively and efficiently.

Identification of biomarkers for predicting efficacy of cognitive impairment in schizophrenia based on biomedical informatics and machine learning

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Schizophrenia (SZ) is a severe mental illness with cognitive impairment as the core symptom.The efficacy of cognitive impairment is important for the long-term outcomes of SZ patients. Currently, there is a lack of objective biomarkers to predict the efficacy of cognitive