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Abstracts from the Irish Association of Physicists in Medicine: 10th Annual Scientific Meeting

Invited Speaker

Standardisation of Medical Physics training in Europe

Virginia Tsapaki

Medical physics has done much to advance medicine. We can be proud of our collective accomplishments. The development of our profession in Europe has been driven by the regulatory requirements for radiation safety initially of staff and lately of patients. European legislation acknowledged the importance of physics in radiation protection of patients in the 1980s by requiring a "qualified expert in radiophysics" to be available to "sophisticated departments of radiotherapy and nuclear medicine". In the 1990s the term "medical physics expert" (MPE) was introduced and the involvement of MPEs was foreseen also in "other radiological practices". The new European Directive (59/2013) expanded the MPE's role in patient radiation safety. It defines the roles and responsibilities of experts who should be involved in radiation protection. The role of the Radiation Protection Expert (RPE) and the Medical Physics Expert (MPE) is clearly defined. The requirements for information, training and education are also addressed in order to highlight the importance of education and training in radiation protection. According to article 14 member states must ensure the education training and retraining to allow the recognition of radiation protection experts and medical physics experts in the field. The new law which is now implemented in all Member States proves that medical physics has a lot more to offer and places our profession on a more profound ground and provides us with opportunities that we never had before. This is our big opportunity to evolve and make ourselves leaders in radiation protection within the hospital environment and beyond. In a number of European countries, binding regulations appear also on non ionizing radiation such as MRI, US and others. Artificial Intelligence and leaderships issues are also given a lot of attention. The presentation will provide the current information on education and training across Europe together with emerging challenges and opportunities.

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Diagnostic Session 11:25 – 12:55

The impact of the heel effect and lag on the uniformity of a-Se detector for mammography application

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Multiple studies have shown early detection of breast cancer through routine mammography screening can reduce mortality by up to 25% [1]. However, this reduction of mortality is possible only if the key goal of mammography related to the image quality is achieved. Detector uniformity is an important image quality parameter to measure as part of a routine mammography QA programme. Many problems with digital systems have been determined through this measurement, primarily as a result of incorrect flat-field calibration and artifacts caused by image receptor defects. The European guidelines [2] suggest a method for the image uniformity assessment based on measurement of Signal-to-Noise ratio (SNR) and Pixel Value (PV) across a uniform image. Nineteen mammography systems from the same manufacturer installed in our organisation incorporate an a-Se direct conversion detector. Since their installation, instability and inconsistency of image uniformity has attracted medical physicist attention. A number of different tests have been carried out in order to understand and establish reasons for this instability. In this work, we will present the impact of the heel effect and image lag on these uniformity tests. A test protocol involving a screening simulation has been adopted in order to quantify the variation of uniformity across the detector due the lag effect. Images have also been analysed before and after cropping the image to reduce the impact of heel effect. Results show increased non-uniformity ranging between 20% and 30% due to the lag effect and approximately 10% due to the Heel effect.

References

1. World Health Organization; IARC handbooks of cancer prevention: handbook 7: breast cancer screening. IARC Press; 2001.
2. EUREF; European guidelines for quality assurance in breast cancer screening and diagnosis. 4th ed. Luxembourg; 2006.

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Dose optimisation from CR to DR: A paediatric perspective

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In 2017, the first DR X-ray system was installed in the OPD of a Paediatric Hospital, where it was primarily used for extremity and orthopaedic work. A second was installed in 2018 when the main X-ray room in Radiology was upgraded from CR to DR. A preliminary dose audit from procedures conducted in the OPD DR room was undertaken and compared with values from another paediatric hospital. The audit concluded that the exposure parameters and protocols used required adjustment in order to improve dose optimisation for paediatrics. To achieve this, Medical Physics, from both hospitals, worked with the service engineer to calibrate the AEC system. They also liaised with radiographers and the application specialist to ensure protocols were set up to suit paediatric patients, following

manufacturer and published guidelines. This included the addition of 0.1mm of copper to all truck examinations. After the first month of use, and further adjustments to settings, a follow up dose audit was undertaken. This showed a significant reduction in DAP values while ensuring diagnostic image quality was maintained. Good agreement was also found with DAP measurements from the other paediatric hospital. Further follow up audits are required for the different X-ray procedures in order to provide a more comprehensive cross site comparison. Once clinical and medical physics staff are satisfied that adequate dose optimisation has been achieved, the exposure factors will be applied across all future paediatric sites. This will ensure a high standard of care and dose optimisation for paediatric patients in Ireland.

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Initial experiences in establishing a 68 Ga-based radiopharmaceutical service in PET/CT

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This study will report on our centre's experience during the installation and validation of a 68 Ge/68 Ga generator and the introduction of 68 Ga-DOTA-TOC imaging to our PET/CT service. Key factors considered in the establishment of the service include shielding and equipment requirements, work practices to ensure occupational exposures are as low as reasonably achievable and quality control procedures. 68 Ga is a short-lived radioisotope (t1/2 67.7 min) that is produced from a 68 Ge/68 Ga generator. 68 Ga decays through positron emission with a mean energy of 836 keV followed by photonic annihilation radiation of 511 keV. The 68 Ga eluate is labelled with DOTA-TOC before being administered to the patient. 68 Ga-DOTA-TOC binds to the surface of neuroendocrine tumours, permitting them to be visualised on PET/CT. The 68Ge/68Ga generator is housed in the existing shielded.

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Challenges encountered when shielding a dual-room sliding gantry CT installation

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Best practice guidelines recommend that a CT scanner be located adjacent to the Emergency Department (ED) or in the Emergency Room. Modern CT technology has evolved in recent years such that it now possible to move a CT scanner between two adjacent rooms and operate the system in either room. One of the main benefits for installing a dual-room sliding gantry CT system in an ED is that it reduces the number of bed transfers critically unstable patients are required to undergo when CT imaging is requested. In addition, it substantially reduces delays resulting from transferring these patients from the ED to the Radiology Department. Many publications exist which outline shielding criteria for rooms in which CT equipment is planned to be installed. The practice of identifying shielding solutions is considered a routine task for those professionals who undertake this work on a regular basis. It is only in the event that regulatory and construction requirements are revised or when new technologies are purchased that this task can be challenging. This presentation outlines the significant shielding challenges encountered when designing the shielding for a sliding gantry CT scanner which can be operated in either a dedicated CT Room or in an adjacent Resuscitation Room within an ED. The solutions to address the difficulties whilst ensuring that the clinical needs and mechanical, electrical and aesthetic aspects of the facility were not compromised are presented. The work also highlights that specific shielding guidelines are required for this new type of installation.

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Relative response of eye dosimeters to variations in scattered X-ray energy spectra encountered in interventional radiology

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The most appropriate operational dose metric for monitoring radiation dose to the eye lens has been identified as the personal and directional dose equivalent at 3 mm depth, Hp(3). Other suggested methods include evaluating Hp(3) through Hp(10) or Hp (0.07), and using conversion factors. There are many uncertainties, however, associated with these dosimetry methods. In particular, the energy response for different dosimetry techniques may vary considerably depending on the incident X-ray energy spectrum. For Thermoluminescent Detectors (TLDs), Optical Stimulated Luminescence Detectors (OSLD) and Electronic Personal Dosimeters (EPD), the deviation of the energy response from unity is reported to vary by a factor of 0.9–2.8 across Hp(0.07) and Hp(10) measurements, with overestimations occurring in the 30-60 kV range. This range coincides with scattered energy spectra encountered in both interventional radiology and cardiology. Establishing how dosimeter energy dependence affects dose measurement accuracy in the clinical setting, whether Hp(3), Hp(0.07) or Hp(10), has received little attention in the literature; however, the effect has been identified as the dominant source of uncertainty in current eye dosimetry methods. Accordingly, this study aims firstly to measure scattered X-ray energy spectra to staff in Interventional Radiology procedures under varied conditions and system settings. Consequently, the dosimetry accuracy of a series of currently available eye dosimeters, including TLDs (100s, 100Hs), OSLD and Electronic Personal dosimeters (EPDs), and a variety of real-time trunk dosimeters will be presented, with energy dependent correction factors established for each dosimeter type, leading to more precise dose measurement.

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Experience of implementing patient dose tracking software in neuro and vascular interventional radiology

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Commercial Dose tracking software, initially installed in 2014, has been used to collect radiation dose metrics from both Neuro-Interventional (Siemens AXIOM Artis dBA) and Vascular Interventional (Philips Allura Xper FD20) Radiology X-ray Systems. The experience of using such software with both systems differs greatly