Fast image acquisition and processing achieved with multi-detector CT scanners has resulted in a tremendous growth in the use of CT examinations during the last decade. To 20% of these examinations are performed in infants and children (0-15 years) and the number of repeat scans is increasing (1). Moreover, new generation high-speed multi-detector CT scanners have obviated the need for radiation in children, and have led to the wide use of high-dose examinations. For example, cerebral CTA is frequently performed in paediatric populations with acute onset of neurological deficits. Undoubtedly, the growing use of CT is of great benefit to patients. However, extended radiation usage is associated with an increased risk of radiogenic cancer, especially in paediatric patients (2). Medical care at higher risk for potential harmful radiologic effects due to the higher radiation sensitivity and the higher lifetime expectancy compared to adults.

The use of CT examinations must be justified, i.e. the examination must be appropriate and the expected benefits must outweigh the potential risks. All CT examinations should be optimised to the extent that the examination is appropriate and the radiation doses are as low as possible. The results of this project have formed the basis for the revision of the EC Radiation Protection Directive 97/43/Euratom and 2003/122/Euratom, official Journal of the European Union of 17/1/2014. Moreover, new generation high-speed multi-detector CT scanners have obviated the need for radiation in children, and have led to the wide use of high-dose examinations. For example, cerebral CTA is frequently performed in paediatric populations with acute onset of neurological deficits. Undoubtedly, the growing use of CT is of great benefit to patients. However, extended radiation usage is associated with an increased risk of radiogenic cancer, especially in paediatric patients (2). Medical care at higher risk for potential harmful radiologic effects due to the higher radiation sensitivity and the higher lifetime expectancy compared to adults.

The European Commission project aims to facilitate the harmonisation of the role, and legal and practical arrangements in the member states regarding radiation protection education and training of medical physicists working in diagnostic and interventional radiology. EFOMP is the main EU partner in the project, which officially started with a kick-off meeting in September 2013 in Austria. EFOMP is the main EU partner in the project, which officially started with a kick-off meeting in September 2013 in Austria. In Austria, the main tasks of this project are to develop a specific training programme for the MPEs working in diagnostic and interventional radiology. Twelve modules have been selected, each addressing one specific theme. The ‘Dosimetry from concept to the adolescent’ module will address dosimetry and radiation protection methods associated with radiological examinations for children and adolescents.

The Medical Radiation Protection Education and Training project (EUTEMPE-RX, www.eutempere-rx.eu) has created a network of excellent teaching centres to provide the best possible training opportunities for European medical physics professionals to become MPEs working in diagnostic and interventional radiology. EFOMP is the main contributor to this project, which officially started with a kick-off meeting in September 2013 in Austria. In Austria, the main tasks of this project are to develop a specific training programme for the MPEs working in diagnostic and interventional radiology. Twelve modules have been selected, each addressing one specific theme. The ‘Dosimetry from concept to the adolescent’ module will address dosimetry and radiation protection methods associated with radiological examinations for children and adolescents.

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The European Medical ALARA Network (EMAN, www.eman-network.eu/) aims to build a bridge between researchers, health professionals and policy makers and to provide a platform for network partners. The EMAN is a consortium member in this project, which ended on September, 2012. To sustain the network, the societies involved signed a letter of intent to continue collaboration after the project ends. EMAN has focused on the justification and optimisation of pediatric examinations. For these practices, justification and indication for the examination are of paramount importance. Practical approaches to paediatric CT are discussed in the ‘WG 1: Optimisation of Patient Exposure in CT Procedures – Synthesis Document’ that can be found on the EMAN website.

Table 1: Techniques for reducing radiation dose in paediatric MDCT

- Adjust CT acquisition settings for paediatric patients so that dose estimates are no greater than the corresponding adult doses regardless of the patient's size. Reduce x-ray tube voltage, use high pitch values, and use specific settings for children, if available.
- Use iterative reconstruction (IR) algorithms. Statistical IR methods influence image noise. Model-based IR algorithms reduce noise and artefacts, and enable higher dose reduction than statistical methods.
- In-plane shielding can reduce radiation dose to organs and tissues of the body. However, in many cases, shielding can impair image quality and produce artefacts.
- Patient radiation dose due to z-overscanning may be considerable. For scanners with 64 or more detector rows, z-overscanning is much greater, since the extent of overscanning increases as pitch or beam collimation increases.

Figure 1: A dose image generated from patient-specific Monte Carlo simulation.

Figure 2: Using an automated online dose monitoring system, it is possible to (remotely) monitor the doses of all patients undergoing a x-ray exam in a room of interest. Current example shows the exposure data of a patient plotted in the dose distribution of similar studies performed in the same room. The patient can be categorised as an outlier.

References:

Poster References: