Head Radiation Dose from Pediatric CT Examination on Single and 64-slice CT

Kellen Adriana Cury Daros¹, Cristina Farinha Mikuti¹, Reginaldo Bitelli Medeiros¹
¹Universidade Federal de São Paulo, Departamento de Diagnóstico por imagem,Coordenadoria de Física e Higiene das Radiações
R. Mrazsi, 313, São Paulo-SP - e-mail: kcuryd@hotmail.com kmikuti@uol.com, rbitelli11@gmail.com

Introduction:
The pediatric computed tomography (CT) scans have increased worldwide, contributing to higher population radiation dose. Technique diversification in pediatrics exams and different CT technologies of multi detectors computed tomography (MDCT) has led a wide range of exposure levels making difficulty the optimization of doses at pediatric clinical application.

Objectives:
The objective of this study was compare the dose length product (DLP) in the cranial, in the eyes and in the thyroid simulating pediatric head exam undergoing CT singles slice and in MDCT 64, using clinical protocol. Forty thermoluminescent dosimeters (TLD100) were evenly distributed on surface of the head phantom along the sagittal axis.

Methods:
To single slice CT, Tomoscan AV-Philips equipment, 20 TLDs were exposed to scatter radiation and 20 were exposed to primary radiation performed by 120kV, 300mA, and slice thickness-spacing of 3.5mm and 8.7mm in the anatomic position equivalent of the supratentorial and posterior fossa regions, respectively.

To MDCT, Brilliance 64-Philips, the TLDs was exposed to 120 kVp 400 to 359 mA modulated, and slice-spacing of 2.1 mm to all head surface, and it was used a phantom of dose pediatric (16 cm of diameter) for simulation child's cranium.

The TLDs were calibrated for 120kV X-ray over the acrylic phantom TL measurements were performed on Harshaw 4000 system.

Results:
To single slice CT the dose were calculated based on previous study, by mean linear TL density for the region exposed to secondary radiation defined by position (p):

- To secondary X-ray:
  0.35±0.06 cm $\mu$TLD $=7.4(4)x10^{-2}+7.51x10^{-2}$ x $p$ cm$^{-1}$ (Eq 1);
- To primary X Ray to posterior fossa region
  6.0±0.6 cm $\mu$TLD $=3(0.8)x10^{-1}+4(7.1)x10^{-3}$ p cm$^{-1}$ (Eq 2);
- To exposed for the supratentorial region
  9.6±0.12 cm $\mu$TLD $=4(87.7)-0(077)/07$ p cm$^{-1}$ (Eq 3).

To MDCT the dose was estimated to 12 cm of cranium, 2.5 cm to eyes, and 5 cm to thyroid based on TLD response as function of phantom length.

To the single slice CT equipment, the DLP to the cranial eyes and thyroid were 1133(331) mGy, 39(15) mGy and 6.5(2.5) mGy, respectively.

At exams with MDCT equipment the DLP to the cranial eyes and thyroid were 1647(82) mGy, 339(17) mGy and 404(20) mGy, respectively.

Discussion and Conclusions:
These results show that the doses are superior using MDCT. The results for the eyes exposure might be able to induce cataracts since lens opacities can be induced as low as 100 mGy. The clinical protocol adopted in the MDCT generated high levels of thyroid doses not detected at single slice exams.

References: