EVALUATION OF RADIATION DOSE IN COMPUTED TOMOGRAPHY STANDARD BEAMS USING SIMULATORS

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1. INTRODUCTION

Computed tomography (CT) is a diagnostic imaging method widely used since its discovery. When CT is compared with conventional radiology, its radiation dose is higher almost always and the absorbed dose to the patient is also higher. The increasing use of CT in children has been verified mainly by reducing the time required to scan - now less than 1 second – eliminating, in most of the time, the use of anesthesia to prevent the child movement during image acquisition . The harmful effects of radiation are more likely to happen in children than in adults because they are in growth stage.

2. OBJECTIVES

- ✓ perform measurements in standards radiation beams for CT using pediatric phantom;

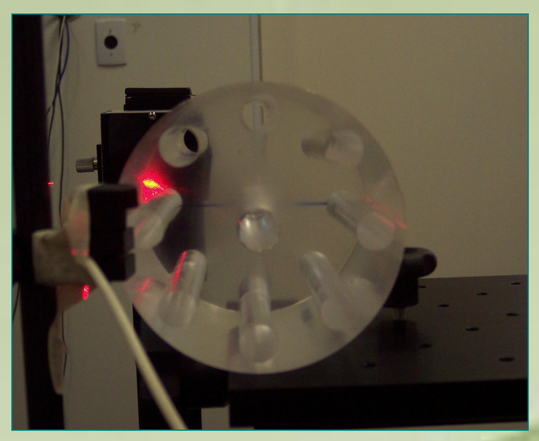
Determine:

- ✓ CT air kerma indices $C_{a,100}$ and C_W ;
- ✓ air kerma-length product (P_{KL});
- ✓ entrance surface air kerma (K_e).

3. MATERIALS AND METHODS

X radiation system, Isovolt HS 160 model

- ✓ CT standard radiation qualities were established in a Pantak/Seifert X radiation system, model Isovolt HS 160
- ✓ Voltage : 100 kVp to 150 kVp



- ✓ pediatric phantom developed by IPEN
- ✓ 10 cm X 15.4 cm

- ✓ pencil ionization chamber Radcal, RC3CT model, 3 cm^3,
- ✓ calibrated at PTB - Germany

4. RESULTS

Table 1. Radiation qualities characteristics, air kerma rates (K_{air}), air kerma length product (P_{KL}) and the entrance surface air kerma rates (K_e) obtained.

Radiation qualities	Tube Voltage (kV)	Filter	HVL (mmAl)	K_{air} Gy/min	K_e Gy/min	P_{kl}
RQT 8	100	3.2mm Al + 0.3mm Cu	6.90	0.018	0.008	0.18
RQT 9	120	3.5mm Al + 0.35mm Cu	8.40	0.027	0.010	0.27
RQT 10	150	4.2mm Al + 0.35mm Cu	10.1	0.045	0.017	0.45

Table2. CT air kerma indices C_k, C_{PMMA}, C_W (free in air and in pediatric phantom) and C_{vol} (derived from C_W).

Radiation qualities	C_k	$C_{PMMA,C}$	$C_{PMMA,P}$	C_W	C_{VOL}
RQT 8	0.018	0.023	0.032	0.029	0.2
RQT 9	0.027	0.035	0.048	0.044	0.4
RQT 10	0.045	0.058	0.079	0.072	0.7

5. DISCUSSION AND CONCLUSIONS

The CT air kerma indices C_k, C_{PMMA}, and C_W (free in air and in the pediatric phantom) and the air kerma-length product (P_{KL}) were determined in this study allowing the possibility of the use of a calibration standard beam for CT measurements in order to establish methods to analyze CT parameters.

In addition, measurements at the pediatric phantom surface developed at IPEN were done to obtain the entrance surface air kerma (K_e). More studies will be made in order to complete a quality control programme as close as possible to the used in medical clinics and hospitals.

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