World Academy of Science, Engineering and Technology
International Journal of Biomedical and Biological Engineering
Vol:14, No:07, 2020

# Calculation of Organ Dose for Adult and Pediatric Patients Undergoing Computed Tomography Examinations: A Software Comparison

**Authors :** Aya Al Masri, Naima Oubenali, Safoin Aktaou, Thibault Julien, Malorie Martin, Fouad Maaloul

**Abstract :** Introduction: The increased number of performed 'Computed Tomography (CT)' examinations raise public concerns regarding associated stochastic risk to patients. In its Publication 102, the 'International Commission on Radiological Protection (ICRP)' emphasized the importance of managing patient dose, particularly from repeated or multiple examinations. We developed a Dose Archiving and Communication System that gives multiple dose indexes (organ dose, effective dose, and skin-dose mapping) for patients undergoing radiological imaging exams. The aim of this study is to compare the organ dose values given by our software for patients undergoing CT exams with those of another software named "VirtualDose". Materials and methods: Our software uses Monte Carlo simulations to calculate organ doses for patients undergoing computed tomography examinations. The general calculation principle consists to simulate: (1) the scanner machine with all its technical specifications and associated irradiation cases (kVp, field collimation, mAs, pitch ...) (2) detailed geometric and compositional information of dozens of well identified organs of computational hybrid phantoms that contain the necessary anatomical data. The mass as well as the elemental composition of the tissues and organs that constitute our phantoms correspond to the recommendations of the international organizations (namely the ICRP and the ICRU). Their body dimensions correspond to reference data developed in the United States. Simulated data was verified by clinical measurement. To perform the comparison, 270 adult patients and 150 pediatric patients were used, whose data corresponds to exams carried out in France hospital centers. The comparison dataset of adult patients includes adult males and females for three different scanner machines and three different acquisition protocols (Head, Chest, and Chest-Abdomen-Pelvis). The comparison sample of pediatric patients includes the exams of thirty patients for each of the following age groups: new born, 1-2 years, 3-7 years, 8-12 years, and 13-16 years. The comparison for pediatric patients were performed on the "Head" protocol. The percentage of the dose difference were calculated for organs receiving a significant dose according to the acquisition protocol (80% of the maximal dose). Results: Adult patients: for organs that are completely covered by the scan range, the maximum percentage of dose difference between the two software is 27 %. However, there are three organs situated at the edges of the scan range that show a slightly higher dose difference. Pediatric patients: the percentage of dose difference between the two software does not exceed 30%. These dose differences may be due to the use of two different generations of hybrid phantoms by the two software. Conclusion: This study shows that our software provides a reliable dosimetric information for patients undergoing Computed Tomography exams.

**Keywords :** adult and pediatric patients, computed tomography, organ dose calculation, software comparison
**Conference Title :** ICBMP 2020 : International Conference on Biophysics and Medical Physics
**Conference Location :** Stockholm, Sweden
**Conference Dates :** July 16-17, 2020