Purpose: CT radiation dose estimates are commonly reported as CTDI (mGy) values derived from measurements made with standard phantoms for a specific technique (kVp, mAs, collimation and pitch). Estimates of effective dose (mSv) are generally calculated from the dose-length-product (mGy-cm) and a weighting factor that is derived from a standardized model. These dose estimates are not patient specific and do not include dose estimates for specific organs. There is general agreement of the need for more accurate dose estimates for x-ray computed tomography examinations in pediatric patients. The purpose of our research is to investigate methods that can lead to more patient-specific dosimetry.
Methods: We used Monte Carlo particle transport methods in the GEANT4 toolkit to investigate radiation dose estimates in previously acquired pediatric CT scans of the chest, abdomen, and pelvis (CAP) for which several abdominal organs were semi-automatically segmented. Resulting voxel data were used as input to our existing GEANT4 code.
Results: Monte Carlo dose calculations were made using pediatric CT CAP scans of patients with a wide range of age and body weight. The GEANT4 results were compared to scanner-reported dose estimates of CTDIvol values. Organ dose estimates were obtained with the ImPACT CT Patient Dosimetry spreadsheet(St. George's Healthcare NHS Trust, London, UK).
Conclusions: We found that the dose estimate to a specific organ may be either underestimated or overestimated by as much as a factor of two relative to ImPACT values. CTDIvol values appear to significantly overestimate doses. One of the major variables impacting dose estimates was the large range of organ volume and masses and how they can differ from phantom values. Because of these findings, we conclude that CTDIvol values do not appear toprovide particularly good estimates of organ doses.

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