Abstract ID: 16326   Title: A Database for Estimating Scanner-Specific CT Organ Dose

Purpose: To develop a database for estimating scanner-specific organ dose in a voxelized patient model for any spectral shape and angular tube current modulation setting. The database enables the estimation of organ dose for both existing and novel acquisition techniques without requiring Monte Carlo simulations.
Methods: The transport of monoenergetic photons through three phantoms was simulated with the PENELOPE Monte Carlo radiation transport routines at 5 – 150 keV in 1 keV increments at 1000 projections in 0.36 degree increments. The source-to-detector distance for each simulation was 100 cm, with a source-to-isocenter distance of 50 cm. The lateral and axial extents of the detector were 100 cm and 16 cm respectively, while the detector pixel resolution was 0.25 mm. The first phantom was a 0.5 mm resolution anthropomorphic voxelized female phantom, while the other two phantoms were standard head and chest CTDI cylinders modeled using mathematical quadrics.
Results: The simulations resulted in a normalized dose deposition table for numerous organs quantifying the typical dose deposited in the organ per emitted photon for each energy level and projection angle. The values in this table can be multiplied by an incident spectrum and number of photons at each projection angle and summed across all energies and angles to estimate the total organ dose. Similarly, the CTDI_{vol} for a particular acquisition can be estimated from the dose deposition tables for the CTDI phantoms. The estimated CTDI_{vol} can be used along with a physical CTDI<sub>vol<\sub> measurement to convert the organ dose calculated from the database to a scanner specific estimate.
Conclusions: The proposed database and procedure enable the estimation of scanner-specific organ dose for CT scans utilizing any spectral shape and angular tube current modulation scheme without requiring Monte Carlo simulations.

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