

AbstractID: 8560 Title: How well does CTDI estimate organ dose to patients from multidetector (MDCT) imaging?

Purpose: Although CTDI was designed to characterize CT scanner performance, it is often used to estimate patient dose. This study uses voxelized patient models based on actual patient anatomy and Monte Carlo based MDCT simulations to answer the question: how well does CTDI predict patient organ dose?

Method and Materials: 26 voxelized models of female anatomy of various sizes were created from clinical CT data. Breast tissue was contoured by a radiologist and glandular and lung tissues automatically segmented. A previously validated Monte Carlo model of an MDCT scanner was used taking into account source spectra, filtration, collimation, and geometry. Two fixed mA clinical acquisition protocols were simulated: Chest CT and retrospectively gated coronary CTA. For each exam, doses were calculated for breast and lung tissues, and compared to $CTDI_{vol}$ ($=CTDI_w/pitch$), $CTDI_{100center}/pitch$, and $CTDI_{100periphery}/pitch$. Percent difference between each CTDI value and organ dose was calculated and the mean of these differences was reported.

Results: For the Chest CT Protocol: $CTDI_{vol}$ measurements differ from breast and lung dose by an average of 84% and 52% respectively. $CTDI_{periphery}/pitch$ differs from breast and lung dose by an average of 117% and 80% respectively; $CTDI_{center}/pitch$ differs from breast and lung dose by an average of 18% and 3% respectively. For the CTA Protocol: $CTDI_{vol}$ measurements differ from breast and lung dose by an average of 34% and 16% respectively. $CTDI_{periphery}/pitch$ differs from breast dose and lung dose by an average of 58% and 37% respectively; $CTDI_{center}/pitch$ differs from breast and lung dose by an average of 15% and 26% respectively.

Conclusion: $CTDI_{vol}$ generally overestimates organ dose, while $CTDI_{center}/pitch$ provides better estimates of organ dose; Organ dose is affected by patient size (i.e. perimeter); therefore, future work will look into the possibility of scaling CTDI measurements to estimate organ dose based on patient size.