Poster #: 31

Title of Abstract: **Evaluating the Complex Relationship of Automated Tube Current Modulation, Noise Index, Image Noise and Phantom Size**

Institution: M.D. Anderson Cancer Center

Authors: Jensen CT, Rong XJ, Tamm EP, Gershan V, Cody DD, Liu X, Paulson EK and Kundra V

Modality: CT

Organ System: Multi

Intro: There is a complex relationship of automated tube current modulation, noise index, image noise and phantom size.

Purpose: To determine the influence of phantom size on automated tube current modulation (ATCM) performance.

Methods Used: Four, tissue equivalent, abdominal CT dose phantoms (CIRS 007TE) were scanned using a GE HD750 scanner. To simulate an extra-large patient size, a 5th phantom was created by wrapping a fat-ring around the Large Adult phantom. Abdominal CT protocol: 120kVp, 0.8s rotation time, 40mm beam width, 0.984 pitch, 2.5 mm image thickness and Large Scan Field-of-View. With Auto-mA and Smart-mA enabled, Noise Index (NI) was varied resulting in various levels of image quality. Images were reconstructed using standard algorithm. For each phantom size/NI combination, ROI (n=3/image) and noise measurements (standard deviation of ROI) in 10 consecutive images of the central portion of the phantom were performed. The relationship of average noise versus NI was plotted for each phantom size.

Results of Abstract: For each phantom size, noise increased linearly as NI value increased (R2 = 0.9898-0.9996). However, the slopes (range: 0.47-1.26) differed among phantoms of different sizes. Using a constant NI value and same scan protocol, noise levels decreased with phantom size. For the 15 year old to medium phantom sizes (circumference of 71, 86, and 96cm), the differences in slopes (1.26, 1.21, and 1.11) were relatively minor, indicating that the measured noise values were similar as a function of NI value. The slopes (0.68 and 0.47) of the large and extra-large phantoms (circumference of 116 and 136cm) were substantially less compared to the small-medium size phantoms, and also quite different from each other, resulting in three distinct sets of lines on the noise vs NI plot.

Discussion: Large and extra-large phantoms, at a given NI, demonstrated less image noise than anticipated. Counter intuitively, this suggests that for large and very large phantoms, a higher NI could be used for maintaining adequate image quality while achieving lower radiation dose.

Scientific and/or Clinical Significance? ATCM was limited in obtaining the same noise across phantoms of different size when using the same NI. Utilization of ATCM requires NI value be optimized based on patient size for optimal performance.

Relationship to existing work Increased understanding of automated tube current modulation

N/A