SCBT•MR
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Presenter: Aleksander W. Krazinski, BA

Title of Abstract: **Reduced Radiation Dose and Improved Diagnostic Image Quality at Cardiovascular CT Angiography by Automated, Individualized X-Ray Tube Voltage Selection: Intra-Individual Comparisons**

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Modality: CT

Organ System: CV

Intro: Increasingly, CT protocol selection abandons standardized acquisition parameters and strives to adapt x-ray tube technique settings to the individual patient habitus. Operator adjustment of acquisition parameters is limited by subjective, personal bias. Patient weight- or body mass index-driven adjustment may not always appropriately account for the individual patient's anatomical tissue distribution. Accordingly, an objective approach for selecting technique parameters optimized for each patient would be desirable. Here, we investigate the effect of an automated x-ray tube voltage adjustment application, which uses attenuation information from the initial “scout” (topogram) acquisition, on image quality and radiation dose in patients undergoing CTA of the heart or aorta.

Purpose: To evaluate radiation dose and image quality at cardiovascular CT angiography (CTA) with an automated x-ray tube voltage adjustment application by intra-individual comparison in patients undergoing CTA of the heart or aorta.

Methods Used: The study was IRB approved and HIPAA compliant. We retrospectively analyzed paired studies in 64 patients (35 male, 60±16 years), who had undergone two 2nd generation dual-source CTA acquisitions of the heart or aorta before and after the implementation of an automated x-ray tube voltage adjustment application. Each study pair consisted of a baseline scan (scan1) where tube voltage was operator selected based on the patient’s body mass index and a follow up scan (scan2) where tube voltage was automatically selected based on the anatomical attenuation of the topogram (“scout”) acquisition. Other parameters were kept identical between the two scans: 2x64x0.6mm collimation; 320mAs modulated reference tube current-time product. Subjective image quality (IQ) was rated and objective IQ was measured by mean arterial attenuation, image noise, signal-to-noise ratio (SNR) and contrast-to-noise ratio (CNR). To adjust for differences in radiation exposure, a figure of merit (FOM) was calculated. Effective radiation dose equivalents were compared. All values are given as mean±standard deviation (SD) and were tested for significance using the Wilcoxon signed-rank test.

Results of Abstract: All studies were considered diagnostic. A different kV level between scan1 and scan2 was automatically selected in 18 patients (28%). Overall subjective IQ (3.30±0.87, 3.56±0.85, p=0.02), SNR (14.6±5.93, 16.65±5.90, p=0.005), CNR (12.13±5.34, 14.08±5.30, p=0.007), and FOM (20.9±24.3, 44.0±44.7, p<0.001) were significantly higher for scan2. Mean image noise [SD HU] (23.8±8.41, 21.8±6.85 HU, p=0.02) and mean estimated radiation dose equivalent [mSv] (10.8±5.82, 8.11±4.22, p<0.001) were significantly lower for scan2. Mean arterial attenuation [HU] (303.9±75.5, 319.95±66.9, p=0.11) was not significantly different.

Discussion: Patient specific protocol adjustment by automated x-ray tube voltage selection can operator-independently optimize cardiovascular CTA image acquisition parameters with improved objective and subjective image quality.

Scientific and/or Clinical Significance? At cardiovascular CTA, patient specific protocol adjustment by automated voltage selection offers significant radiation reduction across an identical patient population while image quality is enhanced.

Relationship to existing Our results suggest that objective, automated systems such as the one investigated here will help to reproducibly select the CT technique setting appropriate for each individual patient’s anatomy.