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Title of Abstract: **Effect of Body Size on Radiation Exposure and Noise Using a Non-ECG-assisted High-pitch Acquisition for Aortic CTA**

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Modality: CT

Organ System: CV

Intro: Dual source non-ECG-assisted high-pitch CT acquisitions dramatically improve scanning speed, and has the potential for improving image quality during thoracoabdominal aortic CTA. Although there is some evidence that this technique may decrease radiation dose, the relationship between body size, radiation exposure, and noise has not yet been investigated.

Purpose: To investigate the effect of body size on radiation exposure and noise during dual source non-ECG-assisted high-pitch aortic CTA.

Methods Used: IRB-approval was obtained and patient consent waived for this HIPAA-compliant, retrospective study. Forty-five patients (27 men, 18 women; mean age, 67.6 years; mean effective diameter, 34.1 cm) underwent thoracoabdominal aortic CTA on a second-generation dual-source scanner. The CT protocol included noncontrast standard-pitch (pitch, 0.8) and contrast-enhanced non-ECG-assisted high-pitch (average pitch, 2.8; range, 2.0-3.0) acquisitions. Standard-pitch and high-pitch CT were also performed on a custom phantom encompassing a broad spectrum of different body sizes. Radiation exposure—i.e., CT dose index (CTDIvol) and size-specific dose estimate (SSDE)—and noise were compared between standard-pitch and high-pitch across different body sizes, for both the phantom and patients.

Results of Abstract: Mean CTDIvol and SSDE were significantly lower and noise significantly higher for high-pitch compared to standard-pitch, in both patients and phantom ($P < .0001$ for all comparisons). There was a strongly positive correlation between CTDIvol and effective diameter for standard-pitch ($R^2 = 0.96$ and 0.99 in patients and phantom, respectively), and but not for high-pitch. However, there was a strongly negative correlation between SSDE and effective diameter for high-pitch ($R^2 = 0.92$ and 0.63). Image noise in both patients and phantom showed a strongly positive correlation with effective diameter for standard-pitch ($R^2 = 0.97$ and 0.97) and high-pitch ($R^2 = 0.89$ and 0.95); this correlation was significantly higher for high-pitch ($P < .0001$). Both patients and phantom there was an abrupt increase in image noise with high-pitch, beyond an effective diameter of 32 cm (BMI of 28 kg/m²).

Discussion: Thoracoabdominal aortic CTA using dual source non-ECG-assisted high-pitch yields significantly lower radiation dose compared to a standard-pitch acquisition. However, noise increases abruptly in large patients using high-pitch, likely reflecting limitation of the x-ray output from a two tube, single generator system.

Scientific and/or Clinical Significance? Dual source, non-ECG-assisted high-pitch acquisition may result in underexposure of large patients, leading to substantial increase in noise in aortic CTA. This detrimental effect may critically impair reader's diagnostic performance.

Relationship to existing work This is the first work, to our knowledge, investigating the effect of body size on radiation exposure and noise during dual source non-ECG-assisted high-pitch thoracoabdominal aortic CTA.