

AbstractID: 10688 Title: Filtered Region-of-Interest Cone-Beam CT from Rotational Angiography for Image-Guided Interventions: Evaluation of Dose Reduction and Image Quality

Purpose: Rotational angiography is widely used to generate 3D data for image-guided interventions. In standard practice, full-field acquisitions are obtained, though the surgeon's region of interest (ROI) is considerably smaller, e.g. for stent placement. To reduce dose to the patient while delivering the desired image quality for the intervention, we developed a filtered ROI (FROI) method for reducing the beam intensity outside the ROI by using an x-ray attenuating filter. We evaluated dose reduction and image quality resulting from this method.

Method and Materials: A gadolinium-based filter with a central circular opening is mounted on the aperture of the x-ray tube of a rotational angiography system effectively splitting the beam into a high-intensity ROI and a low-intensity filtered region. Artifact-free reconstruction is achieved by equalizing the filtered-region intensities to those in the ROI using a calibration image. Dose reduction in FROI-CT is assessed theoretically through the dose area product and experimentally using dose measurements. Image quality in unfiltered and equalized filtered images is assessed using the scatter fraction and the contrast-to-noise ratio (CNR) in both projection images and reconstructed volumes.

Results: Experimental dose measurements for a filter thickness of 1.29 mm and an ROI size of 20% FOV yield a 60% dose reduction, similar to theoretical calculations. Scatter fractions inside the ROI are reduced by 35% compared to conventional images. CNR in projection images in the ROI is improved from 450:1 (conventional RA) to 533:1 (FROI) and is similar in the filtered region. CNR in the reconstructed ROI is 65:1, similar to conventional RA, and lower in the filtered region (45:1 filtered, 75:1 conventional).

Conclusion: The results support the potential dose-reduction capabilities and utility of ROI imaging in rotational angiography while supplying the desired image quality inside the (reconstructed) ROI.