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Contribution ID: **4191** Type: **Oral Competition (Graduate Student) / Compétition orale (Étudiant(e) du 2e ou 3e cycle)**

(G*) Development of a novel synthetic-mask energy subtraction angiography technique for enhanced stent and vessel imaging

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Angioplasty is an interventional procedure for blood vessel stenosis where a catheter is navigated to the obstruction under fluoroscopy to place a permanent wire stent on the blockage to force it open. Clear stent visualization is critical to ensure a stent has not collapsed or fractured, which could lead to re-stenosis and even more severe complications. Overlapping anatomic structures make stents and vessels difficult to visualize non-invasively. Work by Yamamato et al. used the maximum pixel value across a set fluoroscopy frames to create a synthetic mask, but soft tissue motion was too severe and the method did not succeed. We plan to use dual energy subtraction x-ray imaging (DES) to eliminate soft tissue in conjunction with processing techniques similar to Yamamato et al. to enhance visualization of wire stents without catheterization. We created a MATLAB simulation to calculate the nickel signal-to-noise ratio (SNR) for a range of x-ray parameters to determine the optimal settings for DES. We then did a proof-of-concept experiment using an anthropomorphic chest phantom with a nitinol stent overlaid using x-ray settings optimized in the simulation. The stent was shifted to simulate cardiac motion, and a set of DES images were acquired to create the synthetic mask. A prototype, ultra low noise CMOS detector and kV switching generator were installed in our facilities for the first ever testing and experimentation of this novel technique. Quantification of this equipment was performed using an in-house software to generate the detector MTF, DQE, and waveforms of the kV switching techniques. Simulation results revealed parameters to optimize the nickel SNR per unit dose, and material suppression using weighted DES calculations removed soft tissue. Waveform measurements showed that step kV switching could be achieved within 1 millisecond, achieving consecutive DES images at a rate of 30 frames per second. DES imaging allowed for successful mask creation so that all background structures were suppressed and only the stent was visible. By using DES imaging for this technique, soft tissue motion is eliminated and allows for a digitally subtracted image of the stent alone. With the use of advanced prototype equipment, this technique may improve confidence in the diagnosis of collapsed and fractured stents in real time, non-invasively.

Keyword-1

Angiography

Keyword-2

Stenosis

Keyword-3

Metal Stent

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