AbstractID: 10196 Title: Effects of pixel size and OSEM iteration parameters on Tc-99m SPECT resolution

Purpose: To evaluate the effect of pixel size and OSEM iterative reconstruction parameters on radial (RR) and tangential (TR) Tc-99m SPECT resolution versus distance from isocenter.

Method and Materials: Ten high-concentration Tc-99m point sources of size <2mm^3 were positioned coplanar 0–9 cm from isocenter in a cylindrical phantom with low-concentration background. Emission scans were acquired on a SPECT/CT system (Symbia T6, Siemens Medical Solutions) with LEHR collimation in continuous (C) and step-and-shoot (SS) modes for 360 views over 360° at 0.9, 1.8 and 3.6 mm/pixel. Data were iteratively reconstructed with 3D-OSEM incorporating resolution, CT-based attenuation, and scatter modeling, for different combinations of iterations and subsets (IT_SUB): 1_18, 10_18, 20_18, 30_18, 30_36, 30_60, 30_90. SPECT resolution was estimated using a Gaussian fit of the radial and tangential profiles through each point source.

Results: TR was consistently better than RR. Anisotropy was independent of pixel size and scan mode but decreased with IT times SUB (e.g., TR/RR=0.78 and 0.62 for 1_18 and 30_90 with 0.9 mm/pixel in SS). Both TR and RR improved linearly with distance away from isocenter. The center-to-periphery resolution differences decreased with IT times SUB (e.g., slopes of resolution versus radius were -0.74 and -0.45 for 20_18 and 30_36 with 0.9 mm/pixel in SS) and with smaller pixel sizes (e.g., slopes of resolution versus radius were -0.89, -0.82 and -0.74 for 3.6, 1.8 and 0.9 mm/pixel for 20_18 in SS). TR and RR improved as a power-law with IT times SUB. The rate of improvement showed no obvious dependence on pixel size. TR and RR were similar between SS and C.

Conclusion: Spatial resolution of SPECT images reconstructed iteratively exhibited power-law dependence on IT times SUB, linear dependence on radial position, and exhibited TR/RR anisotropy – modeling of which are important for accurate SPECT quantification.