AbstractID: 12643 Title: A scatter correction algorithm for quantitative Yttrium-90 SPECT imaging

Purpose: To develop a scatter correction algorithm for quantitative ^{90}Y bremsstrahlung SPECT (^{90}Y QSPECT).

Method and Materials: ^{90}Y SPECT/CT scans were acquired for 1mCi/10cc vial within a large acrylic phantom (STD) and anthropomorphic torso phantom with 13 μCi/cc in liver insert and two 16cc spheres with 1.66 mCi/sphere (sphere-to-liver ratio, S/L = 8). SPECT was acquired with two primary (P1: 65-95 & P2: 95-151 keV) and one scatter (S: 252-302 keV) window. Correlation analysis of projection profiles distal to ^{90}Y sources established that scatter in each P image could be modeled as a fraction of the S image to calculate scatter fractions (SFs). S projections scaled by the SF and smoothed with a 9.6 mm FWHM Gaussian filter were subtracted from the P projections, followed by 3D-OSEM reconstruction of the scatter-corrected P projections with CT-based attenuation and system resolution compensations. Iterations (IT) and subsets (SUB) that yielded the correct S/L ratio was determined. SPECT reconstruction of the STD was used for ^{90}Y SPECT sensitivity calibration. Accuracy of ^{90}Y QSPECT was evaluated by comparing the calculated ^{90}Y activities in the RSD phantom to the true values.

Results: The SFs for P1 and P2 were 1.06 and 1.23, respectively. The optimal IT and SUB for ^{90}Y SPECT were found to be 8 and 16. Based on ^{90}Y QSPECT images, the calculated activity (%error) in the RSD phantom liver insert was 14.2 (11%) & 13.1 (3%) μCi/cc for P1 & P2, while those for the two spheres (mCi) were 1.60 & 1.52 (6%) for P1, and 2.29 & 1.86 (25%) for P2.

Conclusions: The measured accuracies for the liver insert (P1 & P2) and spheres (P1) are encouraging. The overestimation of sphere activity with P2 suggests improvements of the calibration and scatter correction algorithms are needed.