Evaluation of 3-D MSPECT for Quantification of Tc-99m Sestamibi Defect Size.

JN Kritzman[1], EP Ficaro[1], YH Liu[2], FJ T Wackers[2], JR Corbett[1].
[1]University of Michigan, Ann Arbor, MI; [2]Yale University, New Haven, CT.

Objectives: The purpose of this study was to evaluate the quantitative perfusion algorithm in 3-D MSPECT for the estimation of defect size in attenuation corrected (AC) and non-corrected (NC) Tc-99m Sestamibi SPECT data acquired using two chest phantoms, the Data Spectrum Elliptical Chest (DSEC) phantom with lung and spine and the Capintec Heart (CAPH) phantom.

Methods: Data for both phantoms were acquired on the University of Michigan modified STEP (M-STEP) system as previously described. For the DSEC phantom, 11 defects (0, 5, 10, 20, 30 and 40ml) were inserted into the 120ml heart wall. Defects were located in the anterior or posterior regions. For the CAPH phantom, 9 defects ranging in size from 0 to 125 ml were inserted in the 178ml LV myocardial wall. Tc-99m concentrations representing a 111 MBq stress study were injected in each of the phantoms. Transmission and emission images were simultaneously acquired in a 64x64 matrix over a non-circular, 360° orbit for 12 min duration. Polarmaps were constructed from the short axis data using 3D-MSPECT. The NC polarmap data was compared to a NC normal male database comprised of 36 low-likelihood patients. AC polar map data was compared to an AC gender composite database of 30 lowlikelihood patients. For each phantom, defect size was recorded for defect thresholds ranging from 0.5 to 4.0 standard deviations (SD). Defect extent was compared to the known defect volume for both the NC and AC data using regression analysis and root mean square errors (RMSE) were calculated.

Results: RMSE was minimized for a defect threshold of 3SD for the NC data and 2.5SD for AC data for both phantoms. The fitted results for the DSEC phantom were NC:y=1.14x+2.16, RMSE=4.27, AC: y=1.12x+0.37, RMSE=1.12. For the NC DSEC phantom, the inferior defects were significantly overestimated resulting in the higher RMSE compared to the AC data. The results for the CAPH phantom were NC:y=1.05x-9.90, RMSE=4.03, AC: y=1.05x+0.22, RMSE=2.18.

Conclusions: 3D-MSPECT demonstrated good linearity in estimating defect size with only a slight overestimation of defect size (non-unity slope values). RMSE for the AC data was significantly reduced compared to NC data.

Journal of Nuclear Medicine 1999; 40(5):181P.