No. 284

DIFFERENCES IN ATTENUATION CORRECTED MYOCARDIAL ACTIVITY DISTRIBUTIONS IN LOW LIKELIHOOD PATIENTS DUE TO THE EMISSION RECONSTRUCTION ALGORITHM. EP Ficaro, JA Fessler, K Ghia, YC Chen, JR Corbett. University of Michigan, Ann Arbor, MI.

As SPECT imaging systems with attenuation correction capabilities become available, various reconstruction algorithms have been implemented. The aim of this abstract was to investigate the effect of the emission reconstruction algorithm on the distribution of activity in normal myocardium. The comparison was limited to two statistical iterative algorithms, the popular ML-EM algorithm and the PWLS-CD algorithm used in our laboratory.

Using a previously described system, transmission and emission tomographic data were acquired for 112 patients (63F, 49M, 54±13yo) with ≤5% pre-test likelihood of coronary heart disease. Attenuation maps were reconstructed from crosstalk corrected transmission data with a PWLS-CD transmission reconstruction algorithm. Two sets of attenuation corrected emission images were reconstructed using these maps, the first set using 12 iterations (based on simulation studies) of the PWLS-CD algorithm and the second set with 20 iterations (commercially suggested limit) of the ML-EM algorithm. The penalty function of the PWLS-CD algorithm was adjusted to match the resolution of the ML-EM algorithm based on a NEMA line source measurement. Both sets of images were 3-D post-filtered and resliced into short axis images. Normal databases and polarmaps were constructed using the 3D-MSPECT analysis software.

The paired Student's t-test was used to assess regional (4 basal and 4 distal sectors and apex) differences in the normal database distribution constructed from all 112 patients for each algorithm. Significant differences were found in all sectors except the anterior-basal sector. Most notable was a +6% change in the posterior-basal and a -9% change in the apex with the ML-EM distribution compared to the PWLS-CD distribution. To investigate differences between the algorithms for the detection of normalcy, gender composite, reconstruction algorithm specific databases were constructed from 40 randomly selected patients. The remaining 72 patients were quantitatively compared to these databases. The normalcy rates were 94% for PWLS-CD and 86% for ML-EM, p=0.03. For ML-EM, 7 of the 10 false positives were in the post-basal segment correlating with the higher activity in this database segment.

The choice of attenuation correction reconstruction algorithm can have a significant effect on the estimated activity distribution in normal myocardium. This necessitates the construction of algorithm specific databases. While PWLS-CD outperformed ML-EM in this study, a more complete analysis including patients with angiographically confirmed disease is required before declaring one algorithm superior to the other.

No. 285

DOES SCATTER CORRECTION SIGNIFICANTLY IMPROVE ATTENUATION COMPENSATION FOR Tc-99m MYOCARDIAL PERFUSION SPECT? **E.G. DePuey and K. Shahzad, St. Luke's-Roosevelt Hospital and Columbia University, New York, NY**

An artifactual increase in inferior wall SPECT myocardial count density due to attenuation compensation (AC) is a recognized shortcoming of the technique. Scatter correction (SC), by which scattered counts estimated from an energy window below the primary Tc-99m emission photopeak are subtracted from the emission image, has been proposed as a means to resolve the problem of inferior wall over-correction with AC.

To evaluate the adequacy of SC, rest/stress Tc-99m sestamibi tomograms in 71 consecutive patients (pts) were evaluated using filtered backprojection, AC alone, and AC+SC. AC was performed using two 90° angled detectors and two scanning Gd-153 line sources, with correction for Tc-99m crosstalk into the Gd-153 window. Pts were considered as either normal (NL) (n=44) due to no reversible perfusion defects and normal regional function by gated(G) SPECT, or abnormal (ABNL) (n=27) due to reversible perfusion defects and/or fixed defects with abnormal regional function consistent with scar. Pts with only fixed defects but normal regional function by G-SPECT (39 of the 44 NL pts) were considered NL, with the fixed defects attributed to attenuation artifact.

In ABNL pts perfusion defects were maintained with AC in 21 of 27 (78%). With AC+SC defects were more marked than with AC alone in 4, less marked in 1, and equivalent in 16. Fifty fixed defects (30 inferior, 20 anterolateral) were present in 39 NL patients. As stated above, because of normal regional function by G-SPECT they were judged to be due to attenuation artifacts. Thirty-two (64%) of these fixed defects (only 2 anterior, but all 30 inferior) were resolved with AC alone, and the same 32 were resolved with AC+SC. However, inferior wall over-correction resulted in a new anterior defect in 27 of the 44 NL pts (61%) with both AC alone and AC+SC.

We conclude that SC helps AC only miminally, and not to a clinically significant degree, in defining true perfusion defects and in solving the problem of over-correction of inferior attenuation artifacts.

No. 286

END-DIASTOLIC VS UNGATED ATTENUATION CORRECTED MYOCARDIAL PERFUSION SPECT FOR THE DETECTION OF CORONARY HEART DISEASE. **EP Ficaro, CS Duvernoy, JA Fessler, JR Corbett. University of Michigan, Ann Arbor, MI.**

Attenuation correction significantly improves the specificity of SPECT perfusion imaging. Cardiac contraction and the associated wall motion and thickening blur the imaged distribution of myocardial perfusion tracers. We hypothesized that gated (G) end-diastole (ED) images would be more sensitive than ungated (U) images for the detection of coronary heart disease (CHD). This hypothesis was tested for both uncorrected (NC) and attenuation corrected (AC) tomographic studies.

Using a previously described acquisition system, transmission and gated emission tomographic data (16 frames) were acquired sequentially for 47 patients (14F, 33M, 55±14yrs) with angiographically confirmed disease. The mean number of stenosed vessels per patient was 1.5±1.2 with 33 patients having significant disease (50% stenosis). NC images were reconstructed using filtered backprojection (FBP) while AC images were reconstructed using an iterative PWLS-CD algorithm using the measured transmission data to correct for photon attenuation. Transverse images were 3-D filtered, temporally smoothed and resliced into short axis (SA) images. Ungated image sets were produced by summing the gated SA images. Visual and quantitative analyses of the ungated and ED images were performed using the 3D-MSPECT analysis and display software. For the quantitative analysis, ED and ungated perfusion polarmaps were compared to a database of 20 age-matched low likelihood volunteers.

	Gated NC	Ungated NC	Gated AC	Ungated AC
Sensitivity	82%	79%	97%	88%
Specificity	36%	57%	86%	93%
Accuracy	68%	72%	94%	89%

The results of this study demonstrated significant differences ($p<0.05$) only between the NC and AC data, most notably specificity increased significantly consistent with previously published data. There were no significant differences between GNC and UNC nor GAC vs UAC. The decreased specificity for GNC compared to UNC may be attributed to enhancement of attenuation artifacts due to maximization of the partial volume effect at ED and/or the FBP reconstruction algorithm. This affect was not as apparent in the GAC or UAC images. Based on the results of this study, attenuation correction has a greater effect than gating on the diagnostic accuracy of SPECT myocardial perfusion imaging for the detection of CHD.

No. 287

IMPACT OF ATTENUATION CORRECTION ON GATED Tc-99m MIBI SPECT FOR WALL THICKENING ANALYSIS IN THE EVALUATION OF MYOCARDIAL VIABILITY. **V. Roelants, T. Vander Borght, S. Walrand, J. George, X. Bernard, P. De Coster, JL. Vanoverschelde, J. Melin. University of Louvain, Belgium.**

Gated rest myocardial Sestamibi SPECT (GSPECT) provides simultaneously information about perfusion and function. As preliminary data suggest that preserved wall thickening (WT) may be an additional positive criteria for diagnosing myocardial viability (MV), we evaluated the potential usefulness of adding AC to FBP reconstruction of GSPECT studies for WT assessment. 60-90 min. after injection of 740 MBq Sestamibi, 8-frame GSPECT were performed in 15 patients (age: 63±10 yr.) with severe left ventricular ischemic dysfunction. Data were then reconstructed with and without AC and analyzed in a 16-segment model to be matched with rest echocardiography (echo). The segmental WT as well as the left ventricular ejection fraction (LVEF) on GSPECT were evaluated using the Quantitative Gated SPECT (QGS) software. A dichotomal strategy (present/absent) was used to assess visually WT on GSPECT and echo (present, n=133; absent, n=107). AC did not affect LVEF estimates (23±8% versus 26±7% for AC and non-AC GSPECT, NS). Segmental WT assessments by AC or non-AC GSPECT were significant correlated with echo (Phi-coefficient=0.37 and 0.25, respectively; n=240; $p<0.001$) but AC GSPECT demonstrated a better accuracy for WT evaluation than non-AC GSPECT (67% versus 62.5%, respectively). Moreover, when segments with less than 60% Sestamibi uptake (suggestive of non-viable myocardium) were analyzed only AC GSPECT demonstrated a significant correlation with echo (Phi=0.43; n=55; p=0.001 versus Phi=0.20; n=63; p=NS for non-AC GSPECT - 80 *vs* 63%). In conclusion, these data suggest that AC of GSPECT studies improves WT assessment mainly in hypoperfused segments, so that it should increase the ability of GSPECT to detect MV.