

Physics/Instrumentation

Monday October 13, 2008, 8:00h - 9:30h

Room: Poster Walking Tour

PW076 Effect of subdiaphragmatic tracer activity on cardiac SPECT images: comparison between Filtered Back Projection, OSEM, and Wide Beam Reconstruction in an Anthropomorphic Cardiac Phantom Model.

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Background: Subdiaphragmatic activity with ^{99m}Tc -labeled tracers is known to produce artifacts on cardiac images.

Aim: To compare the performance of different reconstruction strategies (filtered back-projection (FBP), OSEM and wide beam reconstruction, WBR), on the evaluation of simulated cardiac lesions, in the presence of subdiaphragmatic activity, as those encountered in clinical practice with ^{99m}Tc -labeled tracers.

Methods: An anthropomorphic phantom was acquired with a dual-head-@90° camera, equipped with a LEHR collimator. An isotope activity comparable that usually obtained in clinical setting was used to fill the heart wall (20.3 MBq). A myocardial infarction was simulated in anterior and inferior region with a cold insert (3.92 cm³, 60° aperture). The presence of subdiaphragmatic activity was simulated in the liver region, with different ratio to cardiac activity (liver-heart ratio; LHR) from 0 (no activity) to 4, and for each activity a SPECT study was acquired (60 projections, 64x64 matrix, magnification factor 1.28, angular step 3°) and reconstructed with conventional FBP (Butterworth, 0.4, 10), OSEM (4 iterations 10 subset maximum) and WBR. The isotope cardiac distribution was displayed as polar map. The perfusion defect was expressed as percent (%) of the corresponding coronary territory. No scatter or attenuation correction was applied.

Results: Anterior lesion: at LHR=0 the defect extent was 5%, 7% and 6% with FBP, OSEM, and WBR, respectively, and for LHR=1 to LHR=4 progressively reduced to 1%, 4%, and 5%, respectively. With LHR>2 an artifactual defect was generated inferiorly, up to 38%. Inferior lesion: from LHR=0 to LHR=1 a reduction in the defect extent was observed, from 6% with OSEM and WBR, to 3% and 4%, respectively; the defect was 1% and 2% with FBP, respectively. With LHR=2 and LHR=4, the defect was included in an artifactual perfusion defect with a cumulated extent of 27%, 18%, and 26%, with FBP, OSEM, and WBR, respectively.

Conclusions: In the presence of a subdiaphragmatic activity, artefacts in the reconstruction process were generated, independently of the method employed. With LHR=1 an underestimation of the true inferior defect was observed, likely due to a scatter effect. From LHR>2, a large false positive inferior defect was generated, inducing either an overestimation of the true defect or a false positive inferior defect. The anterior defect was slightly underestimated with LHR>2. According to these results, SPECT studies in the presence of high subdiaphragmatic tracer activity should be interpreted with caution or repeated. Additional clinical studies, however, are needed.