

AbstractID: 13717 Title: On-board SPECT: Localization study using scanner-acquired data

Purpose: In previous computer-simulation studies we have shown that on-board SPECT imaging is a promising approach to localizing biological structure. The purpose of this study is to investigate SPECT localization using scanner-acquired data.

Method and Materials: A torso phantom was filled with 0.75 μ Ci/ml of ^{99m}Tc . Five targets (A-E) of 6:1 activity ratio – diameters of 22 to 34mm – were positioned in phantom. SPECT data were acquired with one Trionix Triad detector. The product of activity and 1.5-minute count time models a 4.5-minute clinical scan. Ensembles of 10 images were reconstructed using MLEM for 3 detector trajectories: 360°, 180° left lateral, and 180° right lateral. Localization was assessed across the noisy ensembles using non-prewhitening observers that were forced to select the most suspicious target location from a 3.6-cm diameter search region centered on target. True centroids were derived from a 12-hour SPECT scan that registered with CT to within 1/3mm. Localization error was calculated as the distance between true and measured centroids. Significance was assessed with the Wilcoxon rank sum test.

Results: Mean localization errors for targets (A-E) are A) 0.80mm, B) 1.2mm, C) 1.9mm, D) 1.2mm, and E) 0.90mm using the 180° trajectory more proximal to each target. With the 360° trajectory, mean errors are A) 1.3mm, B) 1.3mm, C) 2.1mm, D) 2.2mm, and E) 1.5mm. Differences between the above 180° and 360° trajectories are significant ($p < 0.05$) at A, D, and E. Mean error is typically much worse using the more distal 180° trajectory: A) 4.5mm, B) 3.1mm, C) 2.8mm, D) 4.4mm, and E) 6.9mm.

Conclusion: This study, using scanner-acquired SPECT data, demonstrates mean localizations to within 1 or 2mm with 4.5-minute scans. The study also shows that detector trajectory can substantially affect target localization and should be optimized for specific target sites.

Conflict of Interest (only if applicable):