AbstractID: 13625 Title: Low Dose Lesion Contrast on PEM Flex Solo II

Objective:
The aim of this study was to investigate lesion detection with very low doses of radiotracer concentration using a PEM Flex Solo II breast PET scanner.

Methods:
We imaged a phantom with hot radioactive spheres in a warm background of known radiotracer concentration and lesion-to-background ratios (LBR) on a PEM Flex Solo II positron emission mammography scanner (Naviscan, Inc.). Two detectors with variable separation, each 5.6cm X 16cm, scan in unison to cover a 24cm x 16cm field. We tested two breast compression thicknesses of 55mm and 85mm. Sphere diameters were 3.9, 7.8, 16, and 20 mm, and LBRs were 4-to-1 and 10-to-1. We imaged the phantom with between 0.1kBq/mL and 5.0kBq/mL background concentration of 18-FDG solution. Image acquisition was 10min. Lesion uptake was characterized by lesion-to-background metrics used clinically; LBR equals the maximum of a lesion region of interest (ROI) divided by the mean of a background ROI. Overall image uniformity was measured as the coefficient of variation (COV) calculated from 72 ROIs placed throughout the image volume. Contrast-to-noise ratio (CNR) was calculated as LBR/COV, and was compared for different activity concentrations and true LBRs.

Results:
Our phantom results show little change in measured LBR over the range of background activity of 0.5 to 5.0 kBq/mL. Image COV increased slowly from 5 kBq/mL to 1 kBq/mL, and then increased rapidly below 1 kBq/mL. Resulting CNR decreased little between 1-5kBq/mL, then fell to ~50% of nominal value at ~0.1-0.3kBq/mL. When true LBR = 4, the 3.9mm sphere was not visible for any tested concentration; the limits for visualizing the 7.8mm sphere were ~0.2 and 0.4 kBq/mL for compression = 5.8cm and 8.5cm, respectively. These tests require receiver operator analyses, but suggest that PEM imaging may use significantly lower injected doses than routine clinical whole-body PET.