

AbstractID: 5695 Title: Variability and Accuracy of Standardized Uptake Values in FDG PET Scans

Purpose: The standard uptake value (SUV) in FDG PET images is used in defining tumor volumes. In lung tumors, an SUV greater than 2.5 may be assumed as tumor. This investigation sought to (1) establish a threshold SUV above which there is significant FDG uptake, and (2) determine other variables leading to inaccuracies in SUV.

Method and Materials: Phantoms (SUV calibration, SPECT, and anthropomorphic with heart and lung inserts) with known activity ^{18}F -FDG concentrations were placed end-to-end to simulate a patient torso of 70 cm. A PET system with GSO detectors and Cs-137 transmission source was evaluated. The activities used, scan and transmission imaging protocols simulated those used clinically. The SUV phantom served as reference and had a SUV = 1.0. Ten ml phantom aliquots were counted separately to determine true activity concentrations.

Results: Three times the noise level of the SUV phantom images determined the threshold for significant SUV. Regions in the SUV phantom yielded a SUV of $0.96 \pm 7.7\%$, and a 1.18 SUV threshold. For $\frac{1}{2}$ activity used clinically, the noise was 12%. The average SUV was the highest at the phantom centers with a range of inaccuracy of at most 20%, attributed to errors in the image reconstruction scatter correction algorithm. Additional errors include incorrect activity and scanner calibrations, and patient weight measurements. These errors can be reduced to very low levels with careful protocol control.

Conclusion: This study yielded a threshold of significant SUV of 1.2, but depends on starting activity. Inaccuracies in the reconstruction lead to further variability in the SUV and was 20% in this study. If This inaccuracy level implies that a threshold of 3.0 should be used instead of 2.5. Similar measurements should be carried out on other PET scanners to determine the limits of SUV detectability and accuracy.