AbstractID: 3539 Title: Improving the quantitative accuracy of a dedicated small animal SPECT/CT scanner

Purpose:
High-resolution radionuclide imaging is an important method for noninvasive assessments of small animal models of human disease. To improve the quantitative accuracy of small animal SPECT/CT, we have developed methods to calibrate the imaging geometry and energy response, and to perform attenuation correction.

Method and Materials:
All studies were performed using the X-SPECT (Gamma Medica, Inc.), which consists of a compact scintillation camera and microCT system on a common gantry. Attenuation correction was performed developing a method to convert CT image values into attenuation coefficients by imaging a calibration phantom containing materials having known linear attenuation coefficients, and was assessed by acquiring SPECT images of phantom containing an aqueous solution of iodine-125. The pinhole imaging geometry parameters were determined by scanning three point sources, and using a fitting algorithm to determine the values of the parameters. A pixel by pixel energy calibration was performed by acquiring data in list mode from flood phantoms.

Results:
CT calibration curves were obtained showing the correlation between CT image intensity and the linear attenuation coefficient for photons emitted by iodine-125 and technetium-99m. SPECT data reconstructed with attenuation correction improved uniformity, by eliminating the cupping artifact that otherwise decreases image intensity at the image center by 30%. The calibration for the imaging geometry resulted in a 10% change in image dimensions compared to images reconstructed using the nominal values for the geometric parameters. The energy calibration corrected for photopeak changes that varied as a function of spatial position and radionuclide photon energy, and produced images with improved uniformity.

Conclusion:
We are able to improve the quality and quantitative accuracy of SPECT images by applying improved image reconstruction and list mode processing techniques.

Conflict of Interest: Bruce Hasegawa receives research support from Gamma Medica. Brad Patt, Joshua Li, and Koji Iwata are Gamma Medica employees.