Abstract ID: 16491 Title: Integrated 4D reconstruction of dynamic data for myocardial blood flow measurements with dedicated SPECT cameras

Purpose: Dynamic nuclear medicine imaging provides important diagnostic information that is not available from static images, such as absolute measurements of myocardial blood flow. Recently, interest in dynamic SPECT has grown due to advances in dedicated cardiac SPECT technology. Although new dedicated systems allow for independent reconstruction of each temporal frame of the dynamic image using conventional methods like OSEM, integrated 4D approaches that reconstruct the entire image set simultaneously may be superior. We investigate the use of one such approach on simulated cardiac data and assess any improvements in image quality and kinetic parameter estimates.

Methods: Two dynamic Tc-99m-tetrofosmin acquisitions (330MBq) were simulated using the NCAT digital phantom: one healthy patient, and one with a lateral defect in the myocardium. We modeled a stationary system with 20 parallel-hole detectors equally spaced over a 180 degree arc on the patient's left side. Early moments post-injection were acquired at 10 seconds per time frame, with longer time frames used after two minutes. We reconstructed 4D dynamic images using two approaches: independent OSEM reconstruction of each frame, and integrated 4D reconstruction using the dSPECT method (IEEE Trans. Nucl. Sci 48(1):3-9, 2001). The images were compared both visually and with quantitative analysis software.

Results: Improvements in image quality were apparent using dSPECT, both in terms of visual appearance and quality of time activity curves (TACs) within regions of interest. The myocardium was better-defined in early, noisy time frames of the image, and TACs were smoother and closer to the truth. Parametric maps obtained from quantitative analysis were more accurate for the dSPECT image, especially for the simulation with a lateral defect.

Conclusions: The dSPECT integrated 4D reconstruction method provides improved image quality and more reliable kinetic parameter estimates from simulated dynamic dedicated cardiac SPECT data, compared to independent time frame reconstruction using OSEM.