Objectives: A new F-18 agent for PET myocardial perfusion imaging (BMS747158) has been shown to have excellent image quality in a Phase I clinical trial. In a subgroup of patients undergoing imaging with this agent in a Phase II clinical trial, we assessed if dual gated perfusion study is feasible and leads to improved image quality. We generated motion free perfusion images by combining amplitude based respiratory gating and the “Motion Frozen” (MF) processing technique (JNM 2004:45:1128-34) which eliminates cardiac motion in static images.

Methods: In 6 patients, PET imaging was performed in dual-cardiac and respiratory- mode on a 4-ring Siemens Biograph-64. Static and 8-bin ECG-gated images using either full 5 minutes of the acquisition or a narrow range of breathing amplitude around end-expiration level keeping 30% of a 10-minute acquisition (RespiG) were reconstructed with HDPET. MF was then applied to the gated datasets. We computed the wall/cavity contrast and contrast-to-noise ratio (CNR) to assess image quality. Wall thickness, motion, thickening and ejection fraction (EF) were also estimated with automatic quantification.

Results: On average, the contrast was the same with HDPET (9.1±3.2) and RespiG-HDPET (9.2±2.4) but was significantly improved with MF:HDPET (10.7±3.6) and further with MF:RespiG-HDPET (13.0±4.8, p<0.05). CNR was 16.9±10.4 with HDPET, 20.1±13.3 with RespiG-HDPET, 32.6±12.2 with MF:HDPET and 28.7±4.0 MF:RespiG-HDPET. The wall thickness was significantly decreased with MF:RespiG-HDPET (10.8±1.7mm) compared to HDPET (13.6±2.1mm), RespiG-HDPET (12.5±2.3mm) and MF:HDPET (12.0±1.8)(all p<0.05). EF, motion and thickening did not show any significant change between any processing method.

Conclusions: Dual gated perfusion imaging is feasible with a new F-18 agent and shows significantly improved image resolution, contrast and contrast-to-noise when combined with Motion Frozen processing.

(No table selected)
References:
Title: The application of a compact MR-compatible SPECT system for small animal SPECT/MR imaging and tracer kinetics studies

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Abstract Body:

Objectives: The goal is to develop data acquisition techniques, image reconstruction methods and applications for a compact MR-compatible SPECT system for small animal SPECT/MR imaging and tracer kinetics studies.

Methods: A compact SPECT system consisting of MR-compatible cadmium zinc telluride (CZT) detectors was previously developed for use inside an MRI system with a bore diameter of 12 cm or larger. Each CZT detector has 16x16 pixels and acquires a pinhole projection image of a 25mm diameter common volume-of-view through a pinhole collimator sleeve. Additional projection views were added by rotating the pinhole collimator sleeve. Aside from standard image reconstruction methods, a sparse-view reconstruction method with system response modeling was developed for data acquired with the system in stationary mode with 24 projection views. The SPECT system was evaluated for SPECT/MR imaging within a 3T clinical MRI system. Also, its imaging characteristics were evaluated using simulation and phantom data and its applications to static, e.g., MDP bone and MIBI cardiac, and fast dynamic, e.g., DTPA renal, SPECT imaging with small animals.

Results: There was minimal degradation in both SPECT and MR images when the SPECT system was operated in the 3T MRI scanner. The new sparse-few reconstruction method with system response modeling provided high quality images even without collimator rotation. Results from simulation, phantom and small animal studies showed artifact-free SPECT images with ~3mm and ~4mm resolution using the 1.3mm and 1.7mm diameter pinhole apertures, respectively. The 2mm diameter pinhole had high sensitivity of ~10 kcps/MBq and image resolution of ~4.7mm which allowed fast dynamic data acquisition using the stationary SPECT system.

Conclusions: We demonstrated the feasibility of a compact SPECT system for small animal SPECT/MR imaging. Also, the system is particularly useful for fast dynamic data acquisition in tracer kinetic studies using SPECT.

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References: