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Oral presentation

Simultaneous acquisition of MRI and PET cardiac cine 3D images at 9.4 Tesla

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Introduction

Nuclear medicine imaging techniques, such as Positron Emission Tomography (PET) can provide important functional information helpful to the assessment of cardiovascular health. The limitations in resolution and anatomical detail for the PET images can be overcome by superposition on a companion high resolution MR image, ***if*** an accurate co-registration of the PET and MR images is made.

Purpose

The purpose of the this study was to demonstrate that simultaneous PET and MRI images could be obtained through the construction of a unique PET device, that could operate inside a high field (9.4 Tesla) MR micro Imaging system (see figure 1). Comparison of three dimensional ***cine*** images reconstructed from data acquired during simultaneous operation of the MRI and PET systems would demonstrate the power of this approach.

Methods

A 25 gram male Swiss/Webster mouse was anesthesized with an initial injection of nembutol in preparation for imaging in the combined MR/PET system. A tail vein catheterization was inserted for the purpose of administering a 300 micro-Curie bolus of mCi ^{18}F-FDG positron emitter. The isotope was injected 30 minutes prior to the start of data acquisition. Both three dimensional (volume) and two dimensional (oblique slice) MR images were acquired using an ECG triggered 10 frame FLASH ***cine*** imaging sequence (TE 2.7 msec TR 10 msec). The PET data acquisition system was operational and continuously accumulated coincidence data during the entire MR imaging period. The PET acquisition system was configured to record the ECG gate timing data.

Results

Good quality MR images were acquired and successfully co-registered with the three dimensional PET image. The figure 2 below demonstrates the quality of the co-registration through super position of the PET and MR data for selected slice position at two different phases (end diastole and end systole) of the cardiac cycle. A comparison to the higher resolution 2D single slice images oriented along the long and short axes of the heart is shown here. The full 10 frame ***cine*** of the cardiac cycle can be viewed for any orientation of slices from the 3 dimensional data.

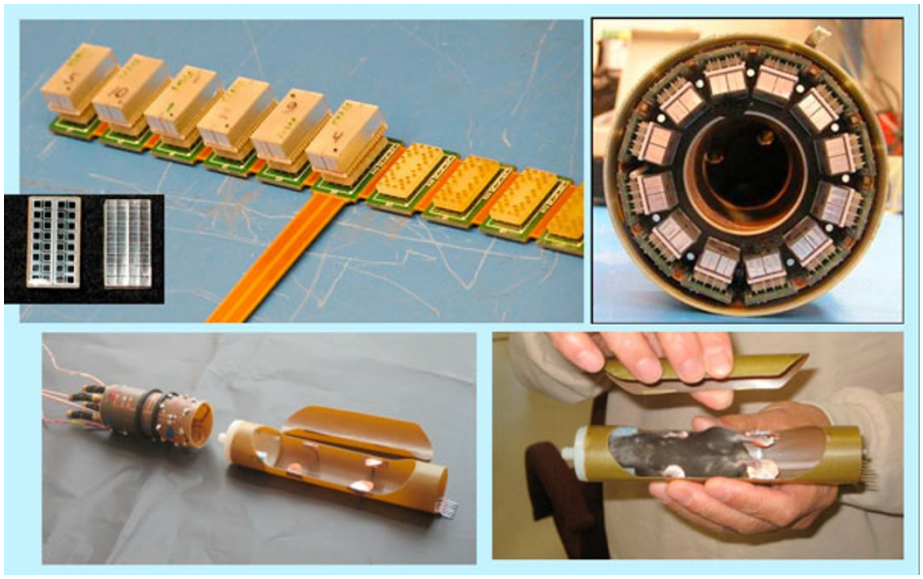

Figure 1

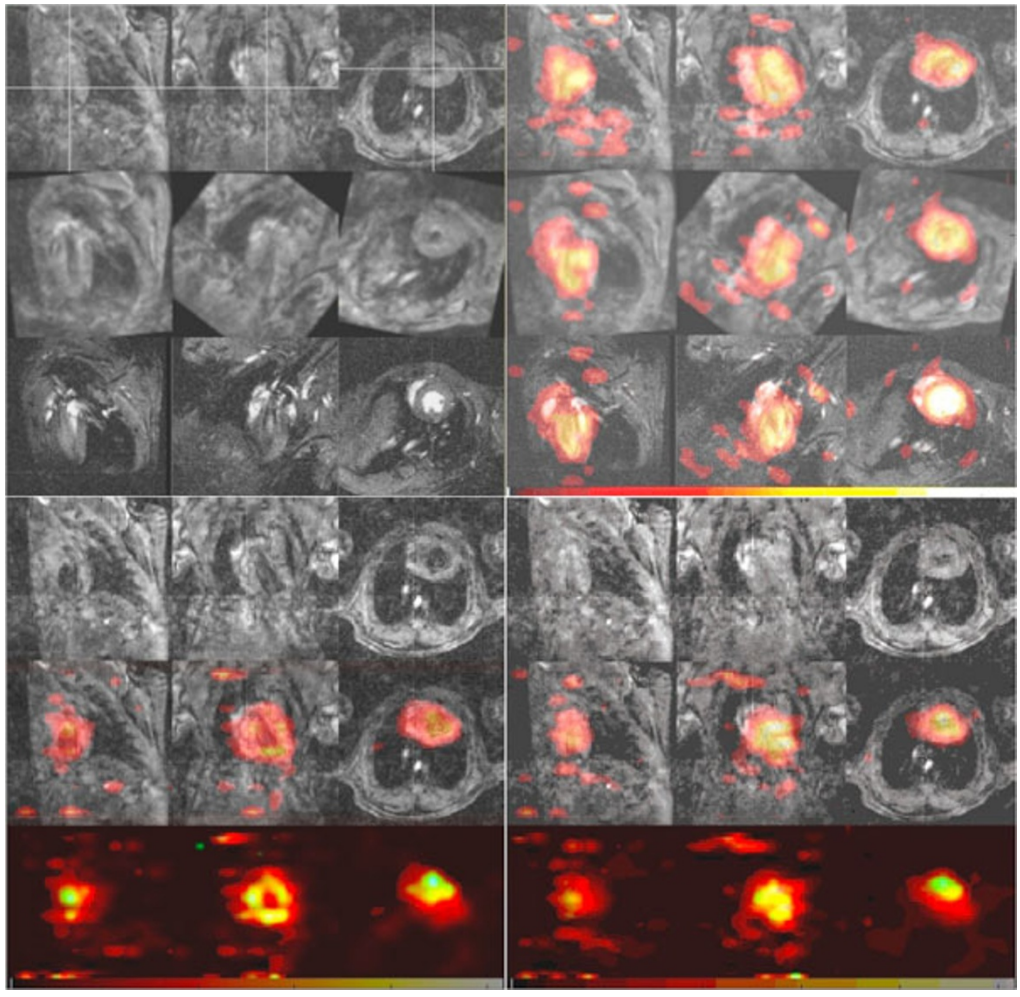

Figure 2

Conclusion

We have demonstrated that dynamic PET and MR images can be acquired simultaneously, allowing precise co-registration of the two image types. This can greatly assist the interpretation of the PET image data and may allow correlation to fine structural changes observable in the MR images. Future studies will compare results using alternative isotopes and delivery systems.