

Title: Preliminary Clinical Experience with Simultaneous MR-PET Acquisition: Developing optimal protocols for body examinations

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Objectives: Present clinical MR-PET cases representing initial clinical experience with simultaneous MR-PET acquisition. Compare diagnostic capability of MR-PET with PET-CT. Explore obstacles/solutions encountered while developing optimal whole body and focused MR-PET protocols.

Background: Simultaneous acquisition of MR-PET imaging data is a new modality for oncologic imaging [1-3]. The inherent benefit of the simultaneous acquisition is improved registration and hence optimal allocation of PET findings with anatomic imaging. The purpose of this paper is to present initial clinical experience with development of whole body and more anatomically focused MR-PET imaging protocols of body organs, including pelvic, thoracic, and liver oncologic imaging. Initial experience, validation with PET-CT, challenges, and insight into protocol development will be discussed through a case-based format.

Method: Following IRB approval at our institution, patients scheduled for standard of care clinical PET-CT were consented for additional MR-PET. The simultaneous MR-PET Imaging was acquired on a Biograph mMR system (Siemens Healthcare, Malvern, PA) with total imaging matrix with attenuation body array and spine matrix coils. Biograph mMR incorporates avalanche photodiodes (APDs) into the bore of a 3T magnet. Attenuation correction imaging was performed utilizing a dual echo VIBE Dixon sequence that separates water and fat with TE1/TE2 = 1.23msec/2.46 msec, TR = 3.6 msec, left-right FOV = 500 mm and anterior-posterior FOV = 300 mm. The acquisition was performed in a single station. The PET scan was acquired for 4 min/bed with F18-FDG radiopharmaceutical with a dose of 10-20 milliCurrie. Simultaneously, a coronal T2 HASTE was acquired with TE/TR = 114 msec/1200 msec, thickness = 5 mm, FOV = 500 mm, FA = 120°, base resolution = 256, concatenation = 2. A high resolution DWI acquisition was also performed with the following parameters: orientation = axial, TE/TR = 109 msec/10900 msec, echo spacing = 1.01 msec, averages = 4, fat suppression = SPAIR, thickness = 3 mm, base resolution = 192 msec. FOV 250 mm, with b-values = 50, 500, 1000 s/mm², diffusion mode = 3-scan trace, GRAPPA acceleration factor = 2, BW = 1086 Hz/pixel, with low SAR RF pulse. Additional high resolution small field of view TSE T2 imaging was performed for pelvic indications with TE/TR = 75 msec/5500msec, thickness = 3 mm, base resolution = 384, and FOV = 200 mm.

Results: A total of 18 patients underwent MR-PET and PET-CT and diagnostic performance was compared. Figures 1-3 below show a patient with primary lung carcinoma and two images from a patient with right vulvar carcinoma. Additional cases will be presented including liver, lung, and pelvic oncologic PET-MR imaging.

Discussion: Anatomically focused high resolution MRI combined with PET data acquisition shows promise in oncologic imaging with improved tissue contrast over CT and potential for better allocation of PET findings to anatomy given the simultaneous acquisition. MR-PET imaging demonstrated similar diagnostic performance to PET-CT in identifying extent of primary tumor and presence/location of metastases. Development of optimal whole body and anatomically focused examinations requires consideration of traditional PET viewing in multiplanar mode and potentially gating of some anatomic regions.

References:

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