

Quantitative impact of Dixon μ map variability in dual-time-point brain PET/MR

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Background: Dixon-based MR is acquired for attenuation correction of brain PET during PET/MR. Early adopters of PET/MR have noted variability in the performance of Dixon-based tissue segmentation, and questions exist regarding potential impacts on quantitative accuracy in dual-time-point studies.

Methods: Ten patients injected with 10 mCi FDG underwent dual-time-point clinical brain PET/MR on a Siemens mMR, with image reconstructions based on data acquired at 45 –60 and 75 –90 minutes. Dixon μ maps were obtained the time of FDG injection and at 75 minutes. 8 cc of Gadavist was injected for post-contrast MR at 30 minutes. Subjects were removed from the table and re-positioned prior to the 75 minute scan. The delayed μ map was registered to the original μ map using MIMneuro. The aligned image data was copied onto the original μ map DICOM file using Matlab. Early time-point PET data was reconstructed using both the early and delayed μ maps. Atlas-based segmentation was performed to compare regional SUV values.

Results: When comparing the delayed versus original μ map reconstructions, regional SUV values varied on average by +1.9% for both SUVmax and SUVmean. For large brain structures, SUVmax and SUVmean varied by -0.5% to +5.6% and -0.2 to +4.7%, respectively. For deep brain structures, SUVmax using the delayed reconstruction varied by -0.5% to +3.7% and SUVmean varied by -0.3% to +3.6%. Most differences in SUV were higher when using the delayed μ map.

Conclusion: There is variability in regional SUV values for brain PET data reconstructed using two different aligned Dixon acquisitions performed on subjects undergoing repeat same-day PET/MR imaging, with SUV values ~2% higher using the delayed μ map. This variability may impact results in dual-time-point brain PET/MR.

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