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Hybrid Reconstruction of PET data for Spinal Cord Imaging in PET/MRI.

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Spinal cord PET is challenging in PET/MR due to the absence of vertebral bone in attenuation correction and the impact of partial volume effects. The aim of this study is to investigate whether a hybrid image reconstruction method can improve quantification accuracy in the spinal cord and PET image quality in PET/MR. Simulated PET data created with the XCAT phantom to represent physiological [^{18}F]FDG uptake is reconstructed using the Hybrid Kernelised Expectation Maximisation (HKEM) algorithm, implemented in SIRF, with a simulated T2-weighted MR image as an anatomical prior. This is compared to Ordered Subset Expectation Maximisation (OSEM) for measured uptake, contrast to noise ratio (CNR) and coefficient of variation (CoV). Measured uptake in the spinal cord is increased in HKEM images at vertebral positions C4 - T4 compared to OSEM when both algorithms use an attenuation map without bone features (P=0.002). Overall, HKEM increases measured uptake in the spinal cord compared to OSEM (P=0.016) but was not significant for OSEM with a post-reconstruction filter (P=0.19). HKEM leads to higher image quality (CNR 0.9, CoV 18%) than OSEM without bone attenuation correction (CNR 0.3, CoV 46%, P=0.003) and is comparable to OSEM with a post-reconstruction filter (CNR 0.7, CoV 5%, P=0.36). We conclude that HKEM used with T2-weighted anatomical MR could be beneficial in PET/MRI for improving both the accuracy of measured spinal cord uptake and PET image quality.

Field

Software and quantification

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