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Effect of Hepatic Arterial Infusion Pumps on PET/MR Images

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Abstract

Attenuation correction (AC) in PET/MR imaging significantly alters the displayed PET signal. Modern AC methods forgo the process of directly calculating attenuation through transmission scans by using MR data to assign a tissue class and corresponding attenuation value to each voxel. However, MR AC often fails in the vicinity of medical implants, which create artifacts in the MR signal. Artifacts cause misclassification of tissue in the AC map, leading to miscalculation of PET signal. These issues are anticipated to affect PET/MR images of colorectal cancer patients with hepatic arterial infusion pumps (HAIPs). However, PET/MR imaging of these patients is desired for simultaneous visualization of liver soft tissue contrast and PET tracer uptake.

This research investigated the effect of HAIPs on PET signal using various AC methods. A NEMA PET Body Phantom was scanned on a GE Signa PET/MR with and without a HAIP on its left and right side, mimicking a clinical scenario. Percent difference images of PET signal with and without the HAIP were created. These images revealed substantial reductions in PET signal in areas near the HAIP, and slight reduction in signal on the side opposite the HAIP with AC applied. Images without AC were unaffected by the HAIP, although they showed signal differences characteristic of non-attenuation corrected images.

Our analysis suggests that PET/MR images of patients with HAIPs would exhibit PET signal loss in regions of anatomy near the pump. Since visualization of the liver for possible metastasis is vital for this patient population, a HAIP located on the right side may render this region non-diagnostic. This work showed a mean 54.8% and maximum 72.8% PET signal loss in regions extending up to 8 cm from the HAIP. Future studies will aim to apply corrected AC maps to HAIP PET/MR images to reconstruct accurate PET signal.