# Utility of combined Ga-68 DOTA-TOC PET and Eovist MRI utilizing PET/MRI

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Purpose: Gallium-68 labeled DOTA-TATE is a new PET radiotracer used for the evaluation of somatostatin receptor positive tumors. It has been shown to be sensitive for the detection of neuroendocrine tumors such as carcinoid. Gadoxetate disodium is a hepatobiliary contrast agent used in MRI. Hepatobiliary phase images have been shown to be sensitive for hepatic metastasis, particularly those from neuroendocrine tumors. To evaluate the combination of DOTA-TOC PET and gadoxetate MRI, we imaged patients with known hepatic metastasis from neuroendocrine tumors using the combined modality PET/MRI.

Methods: Informed consent was obtained from all subjects and approval was obtained through the local Committee for Human Research. 7 patients were imaged both with PET/CT and PET/MRI. Each patient was injected with 4.9 (range 3.4-5.5) mCi (182 [124-203] MBq) of $^{68}$Ga DOTA-TOC. The PET/CT was acquired 61 (52-77) minutes after the injection of $^{68}$Ga DOTA-TOC. A portal venous phase CT was acquired after the injection of 150 mLs of Omnipaque 350 (GE Healthcare, Waukesha, WI), which was used for attenuation correction. The PET protocol consistent of a ten 3 minute bed positions, extending from the vertex to the mid-thighs.

PET/MRI imaging began an average of 114 (100-125) minutes after radionuclide injection. Imaging was performed on a 3.0T time-of-flight PET/MRI (investigational only, not FDA approved; GE Healthcare, Waukesha, WI). First a whole body PET/MRI was acquired with the following sequences at each bed position: MRAC, axial LAVA-FLEX, and axial 2D SSFSE. Subsequent to the completion of the whole body PET/MRI acquisition, dynamic contrast enhanced liver imaging was acquired using axial precontrast, two arterial series and a portal venous phase series using a LAVA-FLEX acquisition before and after the injection of 10 mLs of gadoxetate disodium (Bayer Healthcare, Wayne, NJ). A whole body post-gadolinium LAVA-FLEX acquisition was then acquired at all six bed positions using identical scan parameters as the precontrast PET/MRI acquisition. Finally, a combined dedicated liver PET/MRI was acquired at a single bed position with the following sequences: axial and coronal SSFSE, axial echo planar DWI (respiratory gated using bellows, NEX for b = 50 of 4 and NEX for b = 600 of 16), axial and coronal HBP LAVA, and axial navigated HBP LAVA.

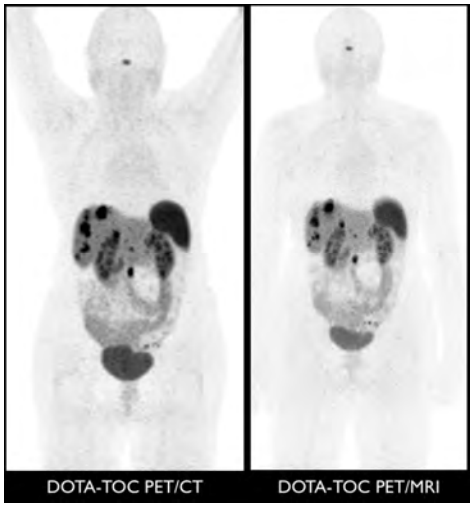


Figure 1: whole body PET/CT (left) and PET/MRI (right) demonstrate equivalent image quality.

Results: PET/MRI acquisition took an average of 52 minutes. A total of 41 lesions in seven patients were included for analysis (29 liver, 11 mesenteric nodes, 1 bone, 1 adrenal, 1 pancreas, 1 small bowel). The average SUVmax for liver lesions was 23.3, with an average size of 3.4 cm. All liver lesions were visualized on hepatobiliary phase images. 90% of lesions were seen using DWI and 86% of lesions were seen on CT. 85% of hepatic lesions were seen on DOTA-TOC PET with uptake greater than background liver. Outside of the liver, all lesions visualized on CT were characterized on whole body MRI imaging.

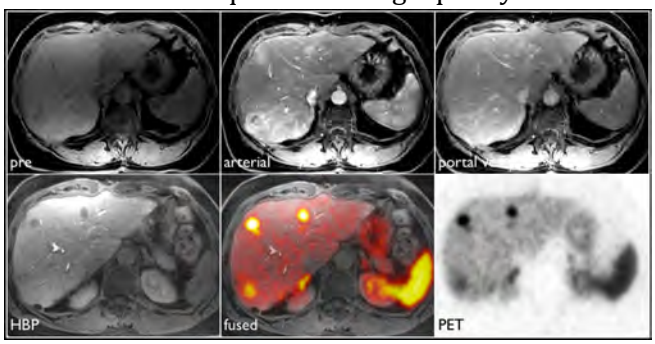


Figure 2: Hepatobiliary phase imaging accurately delineates hepatic lesions with good fusion to simultaneously acquired DOTA-TOC PET images.

Conclusion: DOTA-TOC PET/MRI is at least equivalent to PET/CT, with likely improved detection of hepatic lesions on hepatobiliary phase imaging.