

Molecular imaging of breast lesions with PET-MRI: proof of concept

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Introduction

To demonstrate the feasibility of combined 3T contrast-enhanced MRI and ¹⁸F-FDG-PET-CT for molecular imaging of breast lesions and to assess possible increase in diagnostic sensitivity and specificity.

Material and Methods

31 breast lesions classified by mammography or ultrasound as BIRADS 4 or 5 were included in this IRB approved prospective study. All patients were examined with ¹⁸F-FDG-PET-CT and 3T MRI of the breast. Examinations were scheduled no longer than 7 days apart. The MRI protocol consisted of a coronal T2-weighted TIRM and a coronal combined high temporal and spatial resolution T1-weighted sequence before and after application of a standard dose Gd-DOTA (VIBE with a high temporal resolution of SI 1.7mm isotropic; TA 3.45 min for 17 measurements; FLASH with high spatial resolution of SI 1mm isotropic; TA 2 min). Patients fasted at least 6 h before injection of approximately 300-700 MBq ¹⁸F-FDG based on the patients weight. Scanning was started 45 min after injection. Blood glucose levels were <150 mg/dl (8.3mmol/l). All patients were subjected to ¹⁸F-FDG-PET-CT scanning using a combined PET-CT in-line system (AllSiemens Biograph, Siemens, Erlangen, Germany). A prone PET dataset over the same region was acquired using a positioning device constructed for PET breast examination, allowing the same patient geometry as the breast MRI coil. CT data was used for attenuation correction. Coregistration of imaging data and image fusion were performed. PET-MRI was assessed for lesion morphology, EH-kinetics and FDG-avidity as well nodal status. Lesions within breast tissues were classified as positive when ¹⁸F-FDG-uptake was greater than blood-pool activity. All lesions were classified using the BIRADS classification and histopathologically verified.

Results

31 lesions were detected by both MRI and PET-MRI. MRI classified one lesion as BIRADS 2, 7 as BIRADS 4 and 24 lesions as BIRADS 5. PET-MRI upgraded 7 lesions to BIRADS 5, which were all histopathologically verified as malignant. One lesion was down-graded by PET-MRI to BIRADS 3, which proved to be a B3 lesion (fibrocystic changes with atypia). Sensitivity and specificity of PET-MRI was 100% and 100% respectively. In two patient PET-MRI revealed a lymphnode metastasis, which had been missed by MRI alone. In one patient with a BIRADS 5 lesion (Fig. 1A) PET-MRI identified positive lymphnodes which were negative in MRI alone (Fig. 1B).

Conclusion

Molecular imaging of breast lesions with PET-MRI is feasible. PET-MRI seems to improve diagnostic confidence in the diagnosis of breast lesions and enables accurate assessment of nodal status.

