Improved assessment of breast tumors with PET-MRI

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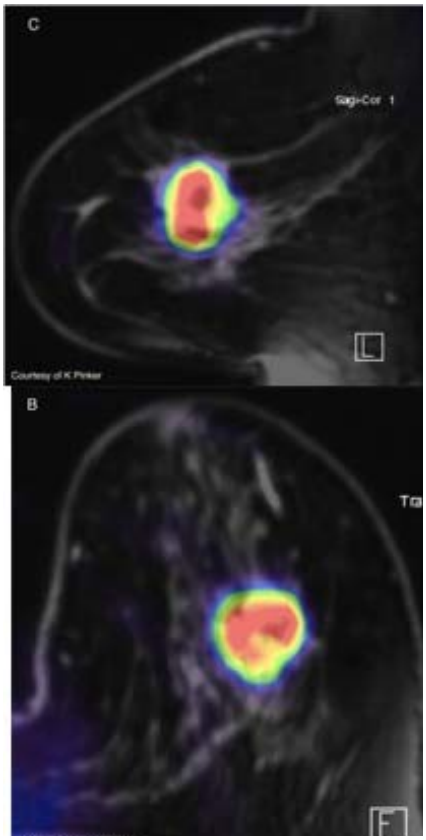
Introduction

To proof that that molecular imaging of breast tumours with proton MR spectroscopy (3D-^{1}H-MRSI), diffusion-weighted imaging (DWI), contrast-enhanced magnetic resonance imaging (CE-MRI) and positron-emission tomography (PET) improves diagnostic accuracy, sensitivity and specificity.

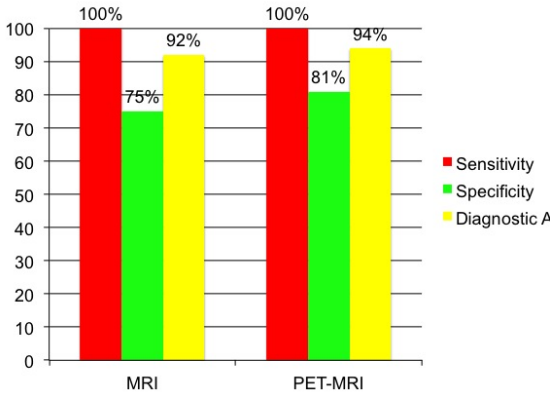


Methods

49 patients with breast lesions detected by mammography or ultrasound and classified as BIRADS 3-5 were included in this IRB approved prospective study. All patients were examined with ^{18}FDG-PET-CT and 3T MRI of the breast. Examinations were scheduled on the same day. MRI protocol included: 3D-^{1}H-magnetic spectroscopic imaging (MRSI) before application of contrast agent to avoid contamination of spectra, a diffusion-weighted sequence (DWI), a T2-weighted sequence and a combined contrast-enhanced high temporal and spatial resolution 3D-T1-weighted sequence before and after application of a standard dose Gd-DOTA. For PET-CT patients fasted at least 6 h before injection of approximately 300 MBq ^{18}F-FDG based on the patients weight. Scanning was started 45 min after injection. Blood glucose levels were <150 mg/dl. A prone PET dataset over the breasts was acquired using a positioning device allowing the same patient geometry as the breast MRI coil. CT data was used for attenuation correction. Co-registration of imaging data and image fusion were performed. PET-MRI was assessed for lesion morphology and EH-kinetics according to BIRADS, restricted diffusivity, increased Choline (Cho)-levels and ^{18}FDG -avidity. An ADC threshold 1.25 x10-3mm2/s and a signal-to-noise ratio of the Cho resonance peak >2.55 were defined as a marker of malignancy. Lesions classified as positive when ^{18}F-FDG-uptake was greater than blood-pool activity. All lesions were histopathologically verified. Nodal status was assessed.

Results

There were 33 malignant and 16 benign lesions. CE-MRI had a sensitivity of 100% and a specificity of 75%. Diagnostic accuracy was 92%. DWI had a sensitivity of 85% and a specificity of 88%. Diagnostic accuracy was 86%. MRSI had a sensitivity of 64% and a specificity of 88%. Diagnostic accuracy was 71%. PET had a sensitivity of 100% and a specificity of 81%. Diagnostic accuracy was 94%. The combined use of all modalities achieved an excellent sensitivity of 100% and good specificity of 81% in the diagnosis of breast cancer. Diagnostic accuracy was 94%. PET-MRI identified 88% of all lymphnode metastasis as compared to conventional MRI with 71%,



Conclusions

Molecular imaging with PET-MRI of breast tumors enables an accurate breast cancer diagnosis with improved sensitivity, specificity and diagnostic accuracy as compared to conventional MR of the breast. Lymphnode metastases can be more confidently identified.