Abstract:

To implement and evaluate a dedicated receiver array coil for simultaneous positron emission tomography/magnetic resonance (PET/MR) imaging in breast cancer. A 16-channel receiver coil design was optimized for simultaneous PET/MR imaging. To assess MR performance, the signal-to-noise ratio, parallel imaging capability and image quality was evaluated in phantoms, volunteers and patients and compared to clinical standard protocols. For PET evaluation, quantitative (18) F-FDG PET images of phantoms and seven patients (14 lesions) were compared to images without the coil. In PET image reconstruction, a CT-based template of the coil was combined with the MR-acquired attenuation correction (AC) map of the phantom/patient. MR image quality was comparable to clinical MR-only examinations. PET evaluation in phantoms showed regionally varying underestimation of the standardised uptake value (SUV; mean 22 %) due to attenuation caused by the coil. This was improved by implementing the CT-based coil template in the AC (<2 % SUV underestimation). Patient data indicated that including the coil in the AC increased the SUV values in the lesions (21 ± 9 %). Using a dedicated PET/MR breast coil, state-of-the-art MRI was possible. In PET, accurate quantification and image homogeneity could be achieved if a CT-template of
this coil was included in the AC for PET image reconstruction. o State-of-the-art breast MRI using a
dedicated PET/MR breast coil is feasible. o A multi-channel design facilitates shorter MR acquisition
times via parallel imaging. o An MR coil inside a simultaneous PET/MR system causes PET photon
attenuation. o Including a coil CT-template in PET image reconstruction results in recovering accurate
quantification.