Simulation of a MR-PET protocol for staging of head-and-neck cancer including Dixon MR for attenuation correction.

To simulate and optimize a MR protocol for squamous cell cancer of the head and neck (HNSCC) patients for potential future use in an integrated whole-body MR-PET scanner. On a clinical 3T scanner, which is the basis for a recently introduced fully integrated whole-body MR-PET, 20 patients with untreated HNSCC routinely staged with 18F-FDG PET/CT underwent a dedicated MR protocol for the neck. Moreover, a whole-body Dixon MR-sequence was applied, which is used for attenuation correction on a recently introduced hybrid MR-PET scanner. In a subset of patients volume-interpolated-breathhold (VIBE) T1w-sequences for lungs and liver were added. Total imaging time was analyzed for both groups. The quality of the delineation of the primary tumor (scale 0-3) and the presence or absence of lymph node metastases (scale 1-5) was evaluated for CT, MR, PET/CT and a combination of MR and PET to ensure that the MR-PET fusion does not cause a loss of diagnostic capability. PET was used to identify distant metastases. The PET dataset for simulated MR/PET was based on a segmentation of the CT data into 4 classes according to the approach of the Dixon MR-sequence for MR-PET. Standard of reference was histopathology in 19 cases. In one case no histopathological confirmation was available.
of a primary tumor could be achieved. Mean imaging time was 35:17 min (range: 31:08-42:42 min) for the protocol including sequences for local staging and attenuation correction and 44:17 min (range: 35:44-54:58) for the extended protocol. Although not statistically significant a combination of MR and PET performed better in the delineation of the primary tumor (mean 2.20) compared to CT (mean 1.40), MR (1.95) and PET/CT (2.15) especially in patients with dental implants. PET/CT and combining MR and PET performed slightly better than CT and MR for the assessment of lymph node metastases. Two patients with distant metastases were only identified by PET. We established a potential MR-protocol to be used for HNSCC patients in a recently introduced MR-PET scanner. The proposed protocol can be performed in an acceptable time frame and did not lead to a loss of diagnostic capability compared to PET/CT.