MR Imaging of the Thorax during Whole-body MRI: Evaluation of different MR Sequences and Comparison to thoracic CT

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Purpose:

Due to recent developments in MR-hardware whole-body MR imaging for staging of tumor patients attracts increasing attention. Regarding its diagnostic accuracy in solid organs, lymph nodes and the musculoskeletal system results are very promising. However, lung imaging is still perceived as inferior to multi detector CT. Since pulmonary lesion detection is important in whole body cancer imaging, this could be a severe limitation for the practical use of whole body MR imaging in cancer patients. The aim of this study was to compare the feasibility of different MR sequences that can be used for lung imaging with whole-body MRI and to evaluate the diagnostic accuracy for the detection of pulmonary lesions in comparison to MDCT that is the current gold standard thoracic imaging.

Patients and Methods:

Twenty-four tumor patients were included in this study (11 women, 13 men; mean age 52±19 years). Primary tumors were lymphomas in 15 cases, bronchial carcinoma in 5 cases, larynx carcinoma in 2 cases, one rectal carcinoma and one carcinoma of unknown primary. All patients were examined in a 1.5 T 32-channel whole body MR scanner (Magnetom Avanto, Siemens Medical Solutions, Germany) for primary staging. All patients had a MDCT (Sensation16, Siemens Medical Solutions, Germany) of the chest which served as gold standard. MR imaging protocol of the chest included the following sequences: 1. axial and 2. coronal respiratory-triggered (RT) T2w STIR, 3. axial RT T2w TSE and 4. contrast-enhanced (CE) 3D-VIBE. Data sets of the CT and the four MR sequences were evaluated independently and in a random order by two experienced radiologists in consensus. All pulmonary pathologies detected in MR such as pulmonary nodules, infiltrates, scars or atelectases were documented and results of the different MR sequences were compared to the results of chest CT.

Results:

As far as feasibility goes, axial STIR and contrast-enhanced 3D-VIBE were of diagnostic quality in all cases. Coronal STIR and axial T2w TSE were of diagnostic quality in all but one case each that was hampered by breathing motion artifacts. In comparison to MDCT that detected 63 pulmonary lesions (1 infiltrate, 2 apical scars, 5 calcified nodules, 55 non-calcified nodules; size: 3-75mm) in 11 of 24 patients (46%) sensitivities for the detection of these pulmonary lesions were: 89% (56/63) for the axial STIR and 91% (52/57) for the coronal STIR imaging. The axial T2w TSE sequence had a sensitivity of 87% (39/45) and the axial CE 3D-VIBE yielded 81% (51/63). The pulmonary lesions that were not detected with MRI were either calcified or smaller than 5 mm in size. Only in the CE 3D-VIBE a single lesion with a diameter of 8 mm was not detected. There were 2 false positive findings on axial STIR images and 1 each in coronal STIR, axial T2w TSE and CE 3D-VIBE. Due to a better bronchial delineation axial T2w TSE images facilitated the best segment localization that might be important for surgical resection.

Conclusions:

Results of this pilot study indicate that pulmonary MR imaging is feasible. In a whole-body MR examination STIR imaging achieves an excellent diagnostic accuracy as compared to chest CT.

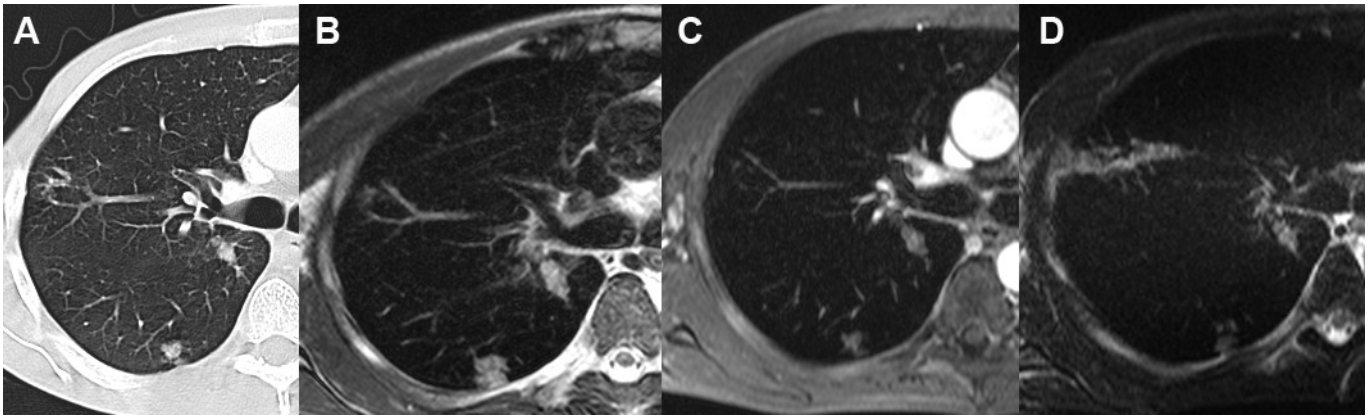

Figure 1:
Axial images of a 40year old male with larynx-carcinoma. MDCT (A) detected two suspect pulmonary nodules in the right segment 6 and a pulmonary infiltration in the right segment 3 (not displayed on this image). All findings were also detected with the different MR sequences: Axial T2w TSE (B), axial CE 3D-VIBE (C), axial T2w STIR (D) and coronal T2w STIR (not displayed).