Clinical Utility of a Novel Whole-Body MRI System for Comprehensive Oncologic Staging

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Introduction: Patient management in oncology considerably depends on accurate information about individual local and distant tumor spread. Compared to other imaging modalities, MRI has the distinct advantage to provide high-resolution anatomical details with superior soft tissue contrast for detecting local and distant tumor spread as well as for identifying suspicious lymph nodes. Particularly, the ability to visualize bone marrow enables the detection of bone marrow metastases earlier and with higher sensitivity than standard skeletal scintigraphy [1, 2]. In clinical routine, however, whole-body MR imaging using currently available MRI scanners is considerably limited because multiple repositioning of the patient significantly contributes to the total examination time, which negatively affects patient tolerance and acceptance as well as the cost-effectiveness of the diagnostic procedure. Goal of this study was to evaluate the clinical utility of a novel whole-body MRI system for comprehensive morphologic staging in oncology.

Table 1: Whole-body MRI protocol (tra = transversal; sag = sagittal; cor = coronal)

	head/neck	thorax/abdomen	pelvis/femur	femur/knee/lower leg	lower leg/feet
sequence	STIR-TSE_cor T1-SE_cor dark-fluid TSE_tra (head) STIR-TSE_sag (spine)	STIR-TSE_cor T1-SE_cor STIR-TSE_sag (spine) STIR-TSE_tra_breath-hold (thorax) Fatsat T2-TSE_tra_gated (abdomen) Fatsat T1-FLASH_tra_breath-hold (abdomen)	STIR-TSE_cor T1-SE_cor T2-TSE_tra (pelvis)	STIR-TSE_cor T1-SE_cor	STIR-TSE_cor T1-SE_cor
coils	head matrix neck matrix spine matrix	spine matrix body matrix	spine matrix body matrix periph. angio matrix	spine matrix periph. angio matrix	periph. angio matrix

Material and Methods: Up to now 24 patients were included (10 patients with multiple myeloma, 8 with lymphoma, 2 with colorectal and 2 with renal cell carcinoma, 2 with malignant melanoma). Examinations were performed on a novel 1.5T whole-body scanner designed for complete head-to-toe coverage (MAGNETOM Avanto, Siemens Medical Solutions, Erlangen, Germany). The MR system is equipped with 32 independent receiver channels and simultaneous connection of 76 array coil elements designed for Parallel Imaging in 3 spatial directions (total scan range 205 cm). Patients were examined with automatic table move in 5 subsequent positions (Table 1). The whole-body was scanned in coronal direction using T2- and T1-weighted turbo spin-echo MR sequences. MRI in axial and sagittal planes was added for evaluating brain, spine, abdominal and pelvic organs (Table 1). Parallel Imaging was conducted with an acceleration factor of 2 and GRAPPA [3] reconstruction. Sagittal and coronal images from different table positions were automatically composed after acquisition using software provided by the scanner (Figure 1). Imaging findings were compared to results from conventional MRI, CT or skeletal scintigraphy.

Results: The examination protocol could successfully be performed in all patients. The total scan range of 205 cm enabled whole-body coverage without repositioning even in tall patients. Total scan time was 50 min (coronal whole-body MRI 30 min; additional axial and sagittal MRI 20 min) resulting in a total examination time of 1 hour. Tumor spread to brain, abdominal and pelvic organs, lymph nodes and bone were correctly visualized. Lung metastases with size of more than 7 mm could be detected. An example is shown in Figure 1.

Discussion: Rapid whole-body coverage is feasible in clinical routine within one MRI examination using the advanced coil technology. Taking advantage of the high MRI sensitivity for detecting tumor spread to bone, distant organs and the central nervous system our preliminary experience suggest that comprehensive MRI protocol offers great potentials in oncology for staging and therapy follow-up. Moreover, the technique may be cost effective compared to conventional diagnostic procedures.

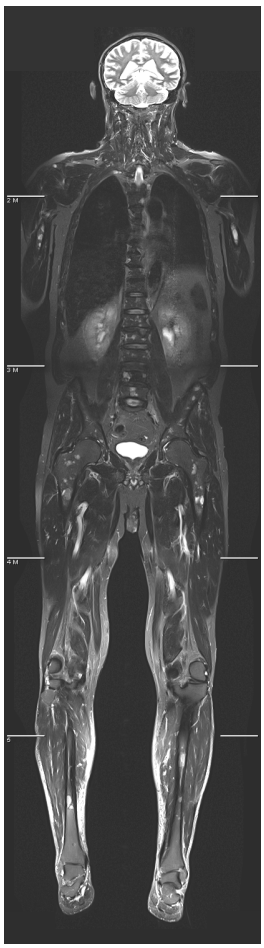

Figure1: Whole-body MRI (STIR) of a patient with multiple myeloma demonstrating multiple bone lesions.

References:

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[3] Griswold MA, et al. Magn Reson Med 2002; 47, 1202-1210