

## Oncological imaging: Whole-body MRI for staging of patients with malignant lymphoma

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### Purpose:

Management and prognosis of patients with malignant lymphoma are not only determined by clinical and laboratory findings but also by the degree of dissemination of the disease. Accurate staging is therefore essential in order to allow for an optimized treatment and survey strategy. Up to now, CT is considered state-of-the-art for cross-sectional imaging in lymphoma patients. However, CT has limited diagnostic accuracy for body parts such as the musculoskeletal system. In addition primary staging CT as well as regular follow-up studies result in recurrent radiation exposure to these often times young patients who can be treated in a curative fashion. MRI is usually limited due to its shortcomings in spatial resolution and the size of FOV. Recently a new multi-channel whole-body MR system has been introduced which enables a high resolution whole-body MR examination in 30 minutes. Aim of this study was to evaluate the diagnostic accuracy of whole-body MRI for staging of lymphoma patients in comparison to whole-body CT.

### Patients and Methods:

27 patients (11 women, 16 men; mean age 53±14 years; 22 Non-Hodgkin lymphomas, 5 Hodgkin lymphomas) were examined in a 1.5T 32-channel whole body MR scanner (Avanto, Siemens Medical Solutions, Erlangen, Germany). Whole-body imaging was performed using coronal scans in 5 overlapping stations with 30-36 consecutive 6 mm slices including a T1-weighted spoiled gradient-echo (FLASH) and turbo-spin-echo (TSE) sequence as well as a T2 weighted STIR and TSE sequence. 19 patients received a contrast-enhanced MDCT (Sensation 16, Siemens Medical Solutions, Erlangen, Germany) which served as standard of reference. All CT data sets and each of the MR sequences were read independently by two radiologists in consensus. 16 neck, 13 thoracic and 12 abdominal nodal stations were evaluated in each patient. Lymph nodes were documented if regarded pathologic based on size criteria (1). If one or more lymph nodes of a distinct nodal station were regarded as pathologically enlarged, the nodal station was judged positive. All extra-nodal findings were documented and judged as pathologic based on size and signal characteristics. Results of the different MR-protocols were compared to the results of contrast-enhanced MDCT.

### Results:

Overall, results of the CT and the four different MR-sequences regarding nodal station involvement compared favourably (Table 1). However, at the neck the overall performance of MR imaging was superior to that of CT. The T2w STIR images in particular detected 7 pathologic nodal stations that were judged negative with CT. In the thorax, the overall MR performance for lymph node involvement was slightly inferior to CT with T2w STIR imaging being the best of the 4 sequences used in this study with only one missed pathologic nodal station. In the abdomen, the overall performance of MR and CT were comparable, however, T2w STIR detected more pathologic nodal stations than CT. Bone marrow involvement was best detected with T2w STIR. Regarding pathologic extrasosseous extranodal findings, T2w STIR and CT showed comparable results (detection rate: 33/35 T2w STIR and 32/35 CT). All other sequences (T1-FLASH, T1-TSE and T2-TSE) were inferior to CT regarding the detection rates of extrasosseous extranodal findings, mainly due to moderate results in the abdomen.

No of nodal stations		negative In CT and MR	in CT and MR	positive only in CT	only in MR	total compared
<b>Neck</b>	T1-FLASH	191	14	2	4	211
	T1-TSE	99	8	1	4	112
	T2-STIR	188	15	1	7	211
	T2-TSE	102	6	3	3	114
<b>Thorax</b>	T1-FLASH	273	12	13	1	299
	T1-TSE	97	8	10	2	117
	T2-STIR	271	25	4	3	303
	T2-TSE	170	14	4	2	190
<b>Abdomen</b>	T1-FLASH	260	16	5	7	288
	T1-TSE	127	9	4	4	144
	T2-STIR	265	23	4	8	300
	T2-TSE	207	17	3	5	232

**Table 1:** Results of the four different MR-sequences compared to the results of CT on a lymph node station basis.

### Conclusions:

Whole-body MRI is a valuable imaging modality for whole-body staging of patients with malignant lymphoma. T2w STIR is the most robust and most sensitive single sequence that achieves results that are comparable to CT. MRI yielded better results than CT for the detection of pathologic lymph node manifestations in the neck and the abdomen as well as for lymphoma manifestations in the bone.

(1) Jager GJ, Barentsz JO, Oosterhof GO, Witjes JA, Ruijs SJ. Pelvic adenopathy in prostatic and urinary bladder carcinoma: MR imaging with a three-dimensional T1-weighted magnetization-prepared-rapid gradient-echo sequence. *AJR Am J Roentgenol* 1996; 167: 1503-1507.