CONTINUOUSLY MOVING TABLE MR IMAGING AT 3T: A COMPARISON TO 1.5T

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INTRODUCTION

In the last years, continuously moving table (CMT) acquisition techniques have been developed to efficiently acquire extended Fields of View (FoV). Clinical relevance of these techniques, especially for cancer patients, has been reported [1-3] and CMT acquisitions are used in our daily clinical routine for metastases screening at 1.5T. However, 3T scanners are getting more and more popular due to the intrinsic higher signal-to-noise ratio. Regarding moving table acquisitions, CMT angiography at 3T is a current field of research [4,5]. In this abstract we want to demonstrate the feasibility of 3T CMT conventional imaging. Clinical relevant protocols like T1-weighted fat saturated gradient echo imaging and T2-weighted short tau inversion recovery turbo spin echo imaging have been implemented at a 3T system and compared to 1.5T.

METHODS

Phantom and volunteer experiments were performed on a 1.5T Magnetom Avanto and a 3T Magnetom Trio wholebody scanner (Siemens Medical Solutions, Erlangen, Germany). Two clinical relevant pulse sequences with CMT were implemented at the 3T system: a T1-weigthed fat saturated gradient echo sequence (T1-FLASH) and a T2-weigthed turbo spinecho sequence with short tau inversion recovery for fat suppression (STIR-TSE). To maintain image contrast in the acquired 3T images compared to 1.5T, parameter optimization has been performed at 3T. Due to T1 prolongation at higher field strengths, the repetition time TR and the inversion time TI of the STIR-TSE had to be adapted as well as the echo time TE and TR of the T1-FLASH. Furthermore, the shape and the length of the adiabatic inversion pulse have been modified to obtain sufficient suppression of surrounding tissue and fat. Since the specific absorption rate (SAR) increases dramatically at higher field strengths, the TRAPS (transition between pseudo steady states) approach has been used for STIR-TSE acquisitions, to enable volunteer examinations in the abdomen at 3T [6]. For comparison the TRAPS algorithm was also used at 1.5T. The final experimental sequence parameters for the 1.5T and 3T acquisitions are given in **Tab. 1**. To account for the table motion the frequency of RF pulses has been adapted for both sequences on both field strengths according to the table speed [7]. The used phased array coils were switched on and off in dependence on the imaging position in the isocenter of the magnet. The STIR-TSE measurements were performed during free breathing, while for the T1-FLASH measurements 2-3 breathing commands were given to cover the whole abdomen from thorax to pelvis. For a closer comparison of the images acquired at different magnetic field strengths, signal-to-noise ratio (SNR) and contrast-to-noise ratio (CNR) in the liver, in one kidney and in the spleen were calculated.

Table 1: Sequence parameters at 1.5T and 3T.

Sequence parameters	STIR-TSE		T1-FLASH	
	1.5T	3T	1.5T	3T
TR (ms)	3656	3898	102	150
TE (ms)	102	95	2	1.5
BW (Hz/px)	450	455	300	454
Partial Fourier	6/8	6/8	7/8	7/8
Slice thickness (mm)	6	6	5	5
Matrix	256x216	256x166	320x260	320x260
FoV (mm^2)	400x337	400x338	380x308	380x308
TI (ms)	150	200	-	-
Fat suppression	None	None	Fat Sat	Fat Sat
Table speed (mm/s)	4.0	3.7	10.0	6.8

RESULTS

Volunteer STIR-TSE and T1-FLASH images acquired at 1.5T and 3T are exemplarily shown in **Fig. 1**. No image degradation is visible by doubling the magnetic field strength. SNR and CNR results calculated in the different tissues are presented in **Tab. 2**.

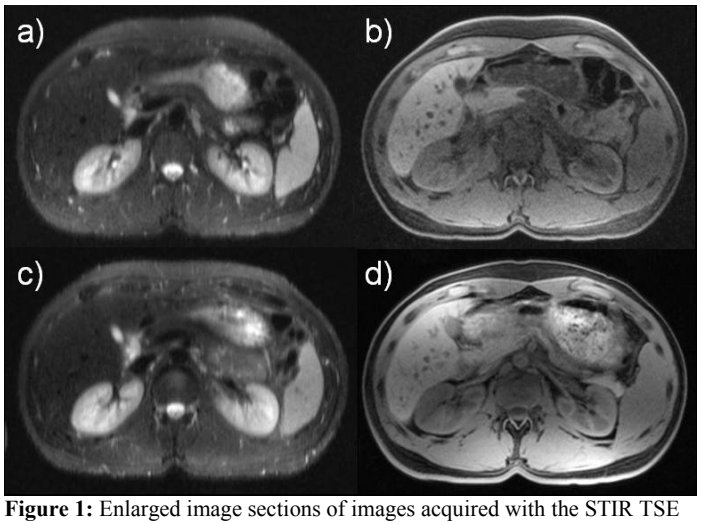

Figure 1: Enlarged image sections of images acquired with the STIR TSE (left column) and T1-FLASH (right column) at a,b) 1.5T and c,d) 3.0T.

Table 2: SNR / CNR_{fat} at 1.5T and 3T.

	STIR-TSE		T1-FLASH	
	1.5T	3T	1.5T	3T
Liver	23 / 5	20 / 2	40 / 25	65 / 39
Spleen	82 / 58	104 / 81	28 / 8	52 / 25
Kidney	110 / 86	138 /119	22 / 7	36 / 11

DISCUSSION

In this abstract we demonstrated the feasibility of moving table imaging at 3T. Regarding the SAR at higher field strength, no sequence interruption occurred due to too high RF power absorption even for the STIR-TSE, validating again the necessity of the TRAPS algorithm. Image SNR as well as CNR_{fat} increased compared to 1.5T. This signal increase becomes clearly visible especially in T1-weighted FLASH images, since the intrinsic signal of most tissues is higher in the investigated region and therefore noise variations are more obvious than in the STIR-TSE. However, care has to be taken in choosing the sequence parameter to get comparable contrast for 1.5T and 3T. Changing T1 and T2 values of tissues resulted in different CNR values for the different field strengths especially for the liver. To what extent the change in contrast affects metastases screening will be the focus of future studies in patients. The higher field strength however, offers new ways of combining different examination strategies like perfusion imaging or spectroscopy with conventional morphologic imaging techniques and therefore new possibilities in diagnostics, patient treatment and patient comfort, since all examinations can be performed in one single examination.

REFERENCES

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