1.5T vs. 3.0T: Nodule Detection and Semi-Quantitative Assessment of Pulmonary Nodule

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INTRODUCTION: Detection and diagnosis of pulmonary nodule are one of the important issues for chest radiology, and performed by using multidetector-row CT in routine clinical practice. Although higher detection rate and diagnostic capability of MDCT are considered as the major advantage, radiation exposure is also considered as the fundamental problem. Therefore, several investigators have suggested that pulmonary MR imaging has potential for nodule detection as substitution to MDCT on 1.5T MR systems (1-3). In addition, non-contrast-enhanced and contrast-enhanced MR imaging are sometimes adapted for nodule characterization on 1.5T systems in routine clinical practice according to past literatures (3-6). Although prolonged T1 relaxation time, higher SAR level and higher sensitivity to B1 inhomogenity are considered as main problems on 3T systems, 3.0T MR system is recently utilized various MR examinations because of better S/N ratio and higher spatial resolution than 1.5T system. However, there are no reports that 3T system can adapt as substitution to 1.5T system for nodule detection and characterization on chest MR examinations. We hypothesized that 3T MR system have potential for nodule detection and semi-quantitative characterization of pulmonary nodule without significant difference with 1.5T system. The purpose of this study was to compare the capability of 3.0T system for nodule detection and semi-quantitative nodule signal intensity assessment with 1.5T system.

MATERIALS AND METHODS: 18 consecutive patients (13 men, 5 women, age range 52-79years; mean age, 66.7 years) with pulmonary abnormalities detected on chest radiographs and/or CT underwent pulmonary MR imaging. All MR studies were performed on 1.5 T (Achieva 1.5T, Philips Medical Systems, Best, the Netherlands) and 3.0T (Achieva 3.0T, Philips) scanners by using Black-Blood T1-weighted (TR: 1<R-R>, TE eff : 8-10ms) , T2-weighted (TR: 2-3<R-R>, TE eff :80-100ms), and short tau inversion recovery (STIR) (TR: 2<R-R>, TE eff : 8-10ms) turbo spin-echo imaging. TI on 1.5T was 165ms, and that on 3.0T was 215ms. Respiratory gating technique was used at 3T scanner, and breath-hold technique was used at 1.5T scanner.

On comparison of detection capability, detection rate on each sequence was compared between 1.5T and 3.0T systems by using McNemar's test. On comparison of semi-quantitative nodule signal intensity assessment, region of interest (ROI) was placed over each nodule and rhomboid muscle, and measured signal intensities on each sequences. Then, signal intensity of nodule (SI), signal ratio between nodule and rhomboid muscle(SR) and signal difference between nodule and rhomboid muscle (SD) were compared between 1.5T and 3.0T by means of Student's t-test.

RESULTS: On comparison of detection rate, there were no significant difference of detection rate on each sequence between 1.5T and 3.0T ($p>0.05$). SIs of T1WI and T2WI and SD of T2WI on 3.0T were significantly higher than those on 1.5T ($p<0.05$), although SR and SD on T1WI, SR on T2WI and all parameters on STIR had no significant differences between 1.5T and 3.0T.

CONCLUSION: 3.0T system has potential for nodule detection and semi-quantitative assessment of nodule signal intensity without having significant difference with 1.5T system.

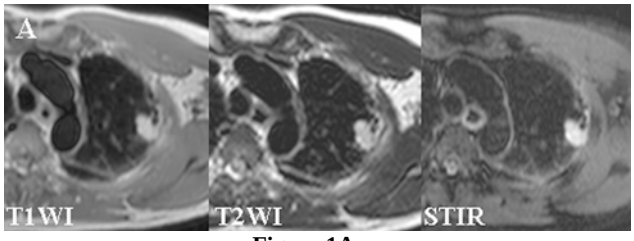

Figure 1A

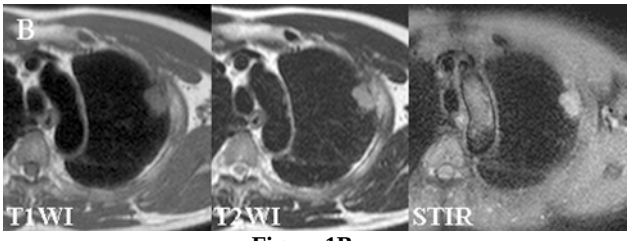

Figure 1B

Figure 1. 62 year-old man patient with adenocarcinoma in the left upper lobe.

A (L to R: T1WI, T2WI and STIR on 3.0T MR system): A nodule in the left upper lobe was demonstrated as high signal intensity on T1WI and T2WI and STIR image. B (L to R: T1WI, T2WI and STIR on 1.5T MR system): A same nodule was demonstrated as low signal intensity on T1WI and high signal intensity on T2WI and STIR. Nodule signal changes on T1WI between 3.0T and 1.5T were clearly demonstrated as compared with T2WI and STIR images.

Table 1. Results of comparison of semi-quantitative parameters on each sequence between 1.5T and 3.0T MR systems.

	T1WI			T2WI			STIR		
	SI	SR	SD	SI	SR	SD	SI	SR	SD
1.5T	772.13±172.27	1.20±0.28	120.26±146.01	900.16±151.41	3.72±0.83	653.376±153.60	1900.06±307.93	1.36±0.17	531.55±230.88
3.0T	1003.27±351.75*	1.36±0.44	258.38±322.89	717.15±267.82*	3.37±1.06	501.06±250.32*	1712.49±919.01	1.75±0.59	703.83±603.47

*: Significant difference with 1.5T system ($p<0.05$)

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