MR Screening for Lung Cancer

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Synopsis: Recent promising results of CT based-lung cancer screening studies have drastically grown the academic and public interest. However, improved sensitivity of CT screening is associated with higher-false positive rate (1). Some investigators have suggested that recent advanced MR imaging make it possible to detect small metastases (2-3). Moreover, many false-positive nodules with calcification and fibrosis were suggested to be invisible on MR imaging. Therefore, we hypothesized that MR had the potential as the tool for lung cancer screening, and may decrease false-positive rate. The purpose of this study is to determine the possibility of MR screening in lung cancer patients.

Materials and Methods: 28 consecutive patients underwent routine CT, conventional MR imaging, pathological and microbacterial examinations from specimens obtained by transbronchial biopsy, CT-guided biopsy, bronchoalveolar lavage, and/or lung resection, and two-year follow-up CT examination. Conventional MR imaging were obtained by 1.5 T scanner (Gyroscan Intera, Philips Medical Systems, Best, The Netherlands) by using ECG-gated spin-echo (SE) T1-weighted image (T1WI) (TR 500-850 ms (<R-R>)/ TE 10 ms/ NEX 4), ECG- and respiratory gated turbo SE T2-weighted image (T2WI) (TR 1200-2500ms (2<R-R>)/ TE 90 ms/ ETL 8/ NEX 2), and respiratory-gated short inversion time inversion recovery turbo SE image (STIR) (TR 3200-5000 ms/ TE 15 ms/ ETL 5/NEX 2). On each sequence, matrix size was 256×256, reconstruction matrix is 512×512, slice thickness is 8 mm with 1.6 mm slice gap. Field of view is similar to CT examination in each patient. All CT examinations were obtained by a 4 detector-row CT system (Somatom Plus 4 VZ, Siemens Medical Systems, Forchheim, Germany). The scan parameters were as follows: 140kVp, 110 effective mAs (330 mAs), rotation speed 0.5s, 4×1 mm collimation, 10 mm reconstruction thickness. In each subject, all images were reviewed by a chest radiologist without information of the results of pathological, microbacterial and follow-up examinations, and listed the number and longest diameter of detected nodule or ground glass abnormality (GGA). For assessment of the capability of MR imaging as the tool for lung cancer screening, all detected abnormal lesions were divided into three group as follows: less than 5 mm group (A group), equal to or more than 5 mm and less than 10 mm group (B group), and equal to or more than 10 mm group (C group).

To determine the capability of MR imaging as the tool for lung cancer screening, overall detection rates of malignant lesion (true-positive rate) and benign lesion (false-positive rate), and true-positive and false-positive rates in each diameter group were calculated based on the results of pathological, microbacrerial and follow-up examinations, and compared with those of CT by McNemar's test. A p value less than 0.05 was considered significant in all statistical analyses.

Results: In 28 patients, 25 lung cancers and 28 benign nodules were diagnosed by pathological, microbacrerial and follow-up examinations. Representative case is shown in Figure 1.

The results of comparison of the capability as screening tool for lung cancer between CT and MR imaging are shown in Table 1. On overall false-positive rate, all MR sequences could significantly decrease, when compared with CT ($p<0.05$). In A and B groups, all false-positive rates of MR imaging were significantly decreased, when compared with CT ($p<0.05$). There were no significant differences of sensitivity between CT and MR imaging in A and B groups, although 3 localized bronchioalveolar carcinomas (BACs) were not detected on all MR imaging in B group. In C group, false-positive rates of T1WI and STIR were significantly improved, when compared with that of CT ($p<0.05$).

Conclusion: MR imaging has a potential as the tool for lung cancer screening with significantly decreased false-positive rate and without radiation exposure. .

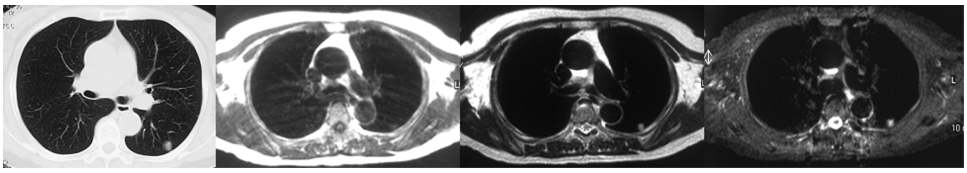

Figure 1. 70-year old female with lung cancer (Bronchioalveolar carcinoma). (L to R: CT, T1WI, T2WI, and STIR)
In the left lower lobe, BAC in 11 mm in longest diameter was clearly shown on CT, T1WI, T2WI and STIR images.

Table 1. Comparison of the capability as screening tool for lung cancer between CT and MR imaging.

	Overall		A group		B group		C group	
	True-positive rate (%)	***False-positive rate (%)***	***True-positive rate (%)***	***False-positive rate (%)***	***True-positive rate (%)***	***False-positive rate (%)***	***True-positive rate (%)***	***False-positive rate (%)***
CT	47 (25/53)	53 (28/53)	0 (0/8)	100 (8/8)	20 (3/15)	80 (12/15)	73 (22/30)	27 (8/30)
T1WI	41 (22/53)	26 (14/53)*	0 (0/8)	38 (3/8)*	0 (0/15)	33 (5/15)*	73 (22/30)	13 (4/30)*
T2WI	41 (22/53)	15 (8/53)*	0 (0/8)	0 (0/8)*	0 (0/15)	47 (7/15)*	73 (22/30)	16 (5/30)
STIR	41 (22/53)	19 (10/53)*	0 (0/8)	0 (0/8)*	0 (0/15)	40 (6/15)*	73 (22/30)	13 (4/30)*

**: Significantly decreased, when compared with CT ($p<0.05$).*

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