Editorial

# From low-dose to no-dose: thin-section magnetic resonance imaging for evaluation of pulmonary nodules

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*Comment on:* Ohno Y, Koyama H, Yoshikawa T, *et al.* Standard-, Reduced-, and No-Dose Thin-Section Radiologic Examinations: Comparison of Capability for Nodule Detection and Nodule Type Assessment in Patients Suspected of Having Pulmonary Nodules. Radiology 2017;284:562-73.

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Magnetic resonance imaging (MRI) of the lung remains a challenge for radiologists, due to certain limitations such as the low proton density of pulmonary parenchyma and fast signal decay associated with susceptibility artefacts at air-tissue interfaces. While gross pathologies of the lung parenchyma can usually be visualized, MRI could not be clinically established so far for the detection and evaluation of pulmonary nodules. However, technical advances during the past two decades, such as parallel imaging, rotated phase-encoding, and shared-echo technique have led lung MRI from a technological alcove to the doorsteps of clinical routine (1-3).

Compared to computed tomography (CT), MRI offers the additional advantage to provide additional functional information that may go beyond the pure morphologic assessment, allowing for repeated measurements and to evaluate different parameters. This intrinsic aspect of MRI has already been appreciated in other fields of chest imaging, such as cardiac MR, in which technological advances and standardized protocols have helped to establish this method in clinical routine within a relatively short period of time from its introduction (4,5). For these applications, MRI benefited mostly from its ability to provide superior soft tissue contrast and the lack of associated ionizing radiation. Several studies have already demonstrated the non-inferiority of MRI in detecting extensive pulmonary pathologies such as pneumonia, especially those that result in an increase of pulmonary proton density (6,7). On the other hand, although technological advances have brought relevant progress to lung MRI as well, imaging of pulmonary nodules remains a challenge and there is still scepticism to introduce this technique in a broader clinical scenario (1,2,8).

In the August 2017 issue of *Radiology*, Ohno *et al.* reported their results from a single-center prospective trial, in which thin-section MRI with ultrashort echo time (UTE) was directly compared to standard and low-dose CT (LDCT) for the detection and characterization of pulmonary nodules (9). In their paper, the authors reported that the capability of lung MRI with UTE was non-inferior to LDCT and standard CT. They reported a high sensitivity of at least 92.2% and specificity of 99.5% for all modalities without significant differences. In addition, they also found that inter-observer and inter-method agreement of MRI with LDCT and standard CT were both excellent. These results are concordant with results from prior smaller, focused studies and encourage the application of MRI as a substitute or at least a viable alternative without exposure to ionizing radiation to CT imaging in the detection and characterization of pulmonary nodules in the future (3,7-9).

 

In their analysis, Ohno *et al.* evaluated a total of 243 nodules, of which 49 (20%) were larger than 15 mm, and 150 (62%) were larger than 8 mm. In addition, the average diameter of pseudo solid nodules was 22.9±4.4 mm, almost the double of solid nodules (11.1±6.6 mm). While such averages are relatively large, it should be pointed out that there were 38 solitary nodules with a diameter of 4–6 mm. No nodules with a diameter below 4 mm were analyzed which should emphasize the remaining relevance of LDCT and standard CT, especially for screening purposes (10,11). Nevertheless, such small lesions might not be considered worthy of any further examination, even according to the most recent updates from the Fleischner Society, in which follow-up is generally suggested for nodules larger than 6 mm (12).

Additionally, according to Fleischner Society recommendations, initial and follow-up studies should be performed with similar technique to minimize interscan variability, even considering the variety of dose reduction techniques, dose modulation and iterative reconstruction algorithms that may be used in LDCT (13). This might be especially true for usage of lung MRI which has not been included in these recommendations so far.

Moreover, a proper detection and assessment of calcification size and distribution represents a major diagnostic criterion when characterizing pulmonary nodules, which may be not properly achieved with lung MRI (10,11). However, despite the limited ability of MRI to visualize calcified nodules, the evaluation of different parameters might overcome these shortcomings. In fact, the inclusion of specific sequences in a lung MRI protocol, such as diffusion-weighted imaging, T2-weighted imaging, proton-density-weighted or short-tau inversion recovery sequences might further increase detection and characterization of pulmonary diseases (14-16). Nevertheless, due to generally slower and repeated imaging acquisition, respiratory and cardiac motion may have a stronger influence on image quality in MRI compared to CT.

Lung MRI with UTE itself has also been shown to perform well for depicting accompanying radiological findings either of mediastinal (i.e., aneurysm, pericardial or pleural effusion, pleural thickening, lymphadenopathy) or lung parenchymal diseases (i.e., pulmonary fibrosis, infectious diseases) with similar accuracy compared to standard and LDCT (7,17). However, certain pulmonary conditions such as emphysema, bullae, bronchiectasis, and reticular opacities, still represent a possible limitation regarding the performance of lung MRI, whereas standard CT and LDCT play a key role (10,18,19). However, considering the continuous technical advances and encouraging results, lung MRI may become a modality of choice for cases in which exposure to ionizing radiation should be strictly avoided, in particular infants (20). However, further and larger studies are needed to provide more accurate data of sensitivity and specificity of lung MRI in detecting also smaller pulmonary nodules.

Once broadly available, sufficiently robust, and also appropriately reimbursed, lung MRI could become the first line imaging method for the assessment of chest diseases in younger patients, pregnant women, and disorders requiring repeated examinations over prolonged periods, in which MRI could contribute significantly to lowering the cumulative radiation dose (21).

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