

# Case Series:

# Lung Imaging with MRI

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## Background

MR imaging (MRI) of the lung can be applied in a variety of clinical scenarios. It is not only a feasible alternative to computed tomography (CT) of the lung – especially to avoid unnecessary radiation burden in young patients – but it can easily provide additional diagnostically relevant information on physiological parameters such as perfusion or respiratory dynamics. Diffusion-weighted imaging can even add biological information about cell density.

This case series aims to provide an insight into typical applications of MRI and to visualize characteristic findings. On page 6 of this issue of MAGNETOM Flash you will find a detailed review on lung imaging protocols available with the Siemens MR scanners.

## Materials and methods

All images shown in this case series were acquired at 1.5 Tesla (MAGNETOM Avanto) with a combination of the body and integrated spine coil using software version *syngo* MR B17.

Sequence parameters were adapted to patient needs. Selected parameters of some of the shown sequences were as follows:

### Coronal T2w HASTE (breathhold)

TR / TE = 228 / 20 ms, SL = 8 mm,  
FOV = (500\*500) mm<sup>2</sup>,  
matrix = (192p\*320) px<sup>2</sup>

### Transversal T1w VIBE

#### (no fat-saturation ; breathhold)

TR / TE = 3.23 / 1.15 ms, SL = 4 mm,  
FOV = (384\*450) mm<sup>2</sup>,  
matrix = (384\*512i) px<sup>2</sup>

### Transversal T1w VIBE

#### (fat-saturated; breathhold)

TR / TE = 3.3 / 1.18 ms, SL = 4 mm,  
FOV = (350\*400) mm<sup>2</sup>,  
matrix = (448\*512i) px<sup>2</sup>

### Coronal TrueFISP (free-breathing)

TR / TE = 412.8 / 1.16 ms, SL = 4 mm,  
FOV = (450\*450) mm<sup>2</sup>,  
matrix = (512\*512i) px<sup>2</sup>

### Transversal T2w TSE (SPAIR, breathhold)

TR / TE = 2040 / 116 ms, SL = 6 mm,  
FOV = (380\*380) mm<sup>2</sup>,  
matrix = (256\*256) px<sup>2</sup>

### Coronal T2w TSE

#### (BLADE, free-breathing)

TR / TE = 2040 / 123 ms, SL = 5 mm,  
FOV = (480\*480) mm<sup>2</sup>,  
matrix = (320\*320) px<sup>2</sup>

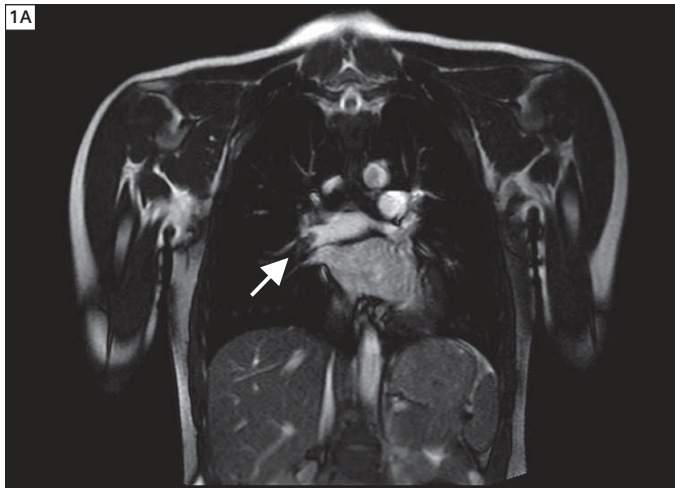
### Transversal DWI (free-breathing; three b-values 50, 400, 800 s/mm<sup>2</sup>)

TR / TE = 5983 / 79 ms, SL = 8 mm,  
FOV = (248\*379) mm<sup>2</sup>,  
matrix = (115p\*192) px<sup>2</sup>

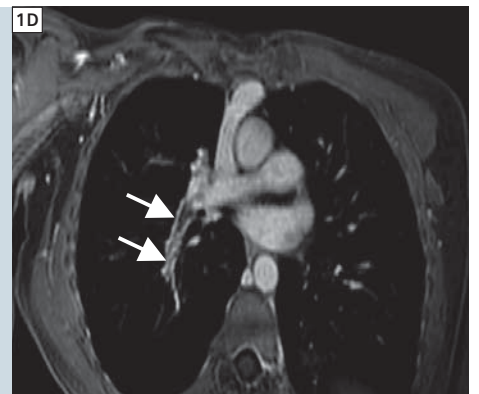
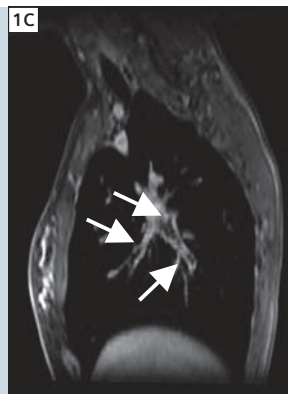
## Case 1

### Young female patient with bilateral acute pulmonary embolism

An 18-year-old female patient presented with clinical suspicion (dyspnoea and elevated D-dimeres) of acute lung artery embolism. To avoid unnecessary radiation exposure, this patient was referred immediately to our MR unit.



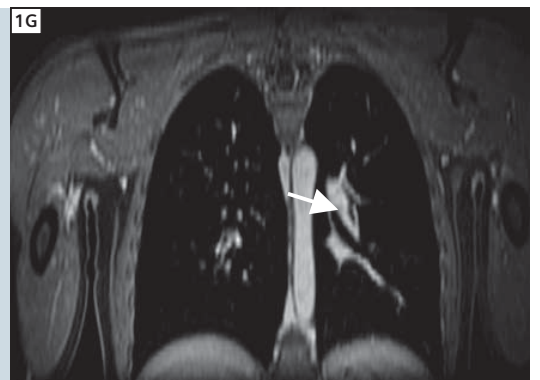
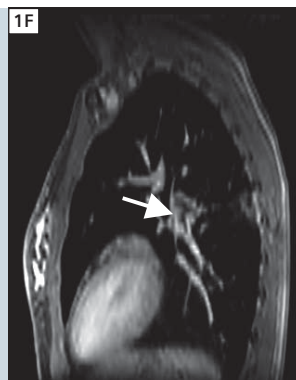
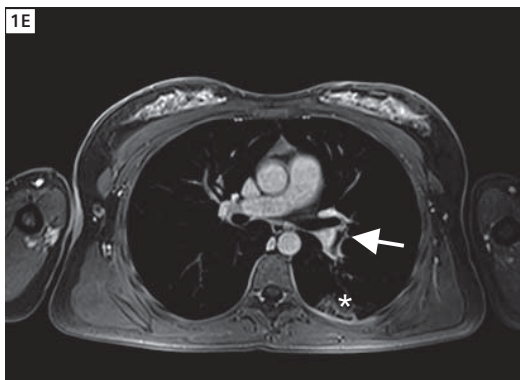
**1A** Coronal TrueFISP images; the emboli are already well delineated (arrows).



**1B** Transversal, ...

**1C** ... oblique sagittal,

**1D** ... oblique coronal contrast-enhanced 3D VIBE images visualize the right thrombus in greater detail (arrows).

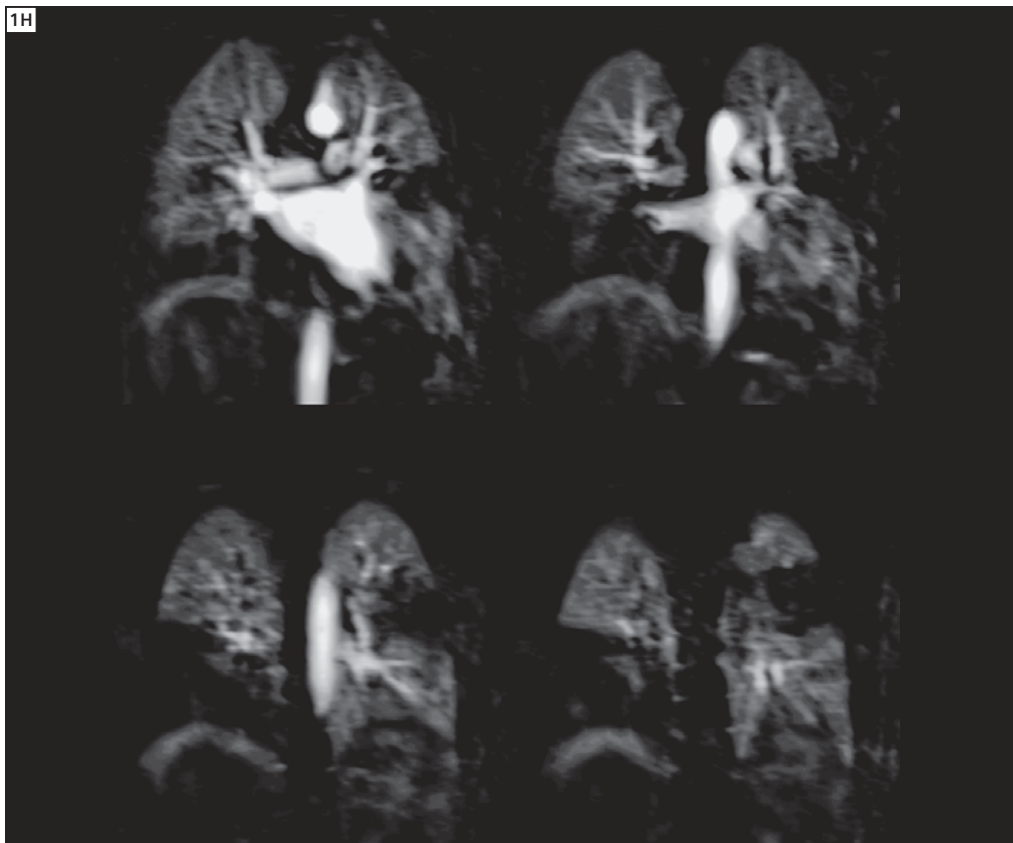


**1E-G** Corresponding reconstructions of the left side thrombus; an infarction pneumonia can be seen in this area (marked by \*).

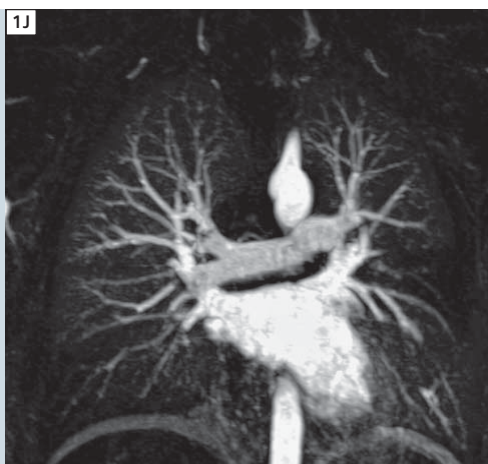
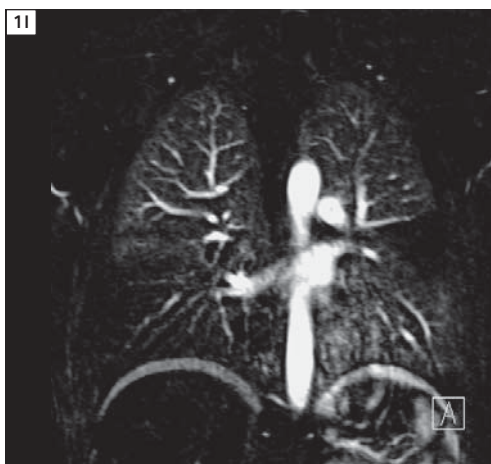
Imaging findings show an acute embolism of the right lower lobe segment and partially also on the left side. The thrombus is already visible in the coronal True-

FISP images. However, post-contrast 3D data show the extension of the emboli in much greater detail. A dynamic contrast enhanced T1w 3D scan with high

temporal resolution (*syngo* TWIST) was performed to evaluate the degree of perfusion defects caused by the emboli.



**1H** Parenchymal phase derived from the perfusion scan; corresponding perfusion defects to the emboli are well delineated.



**1I-K** Coronal thick-slice maximum intensity projections (MIP) demonstrating filling defects of the corresponding vessel segments.

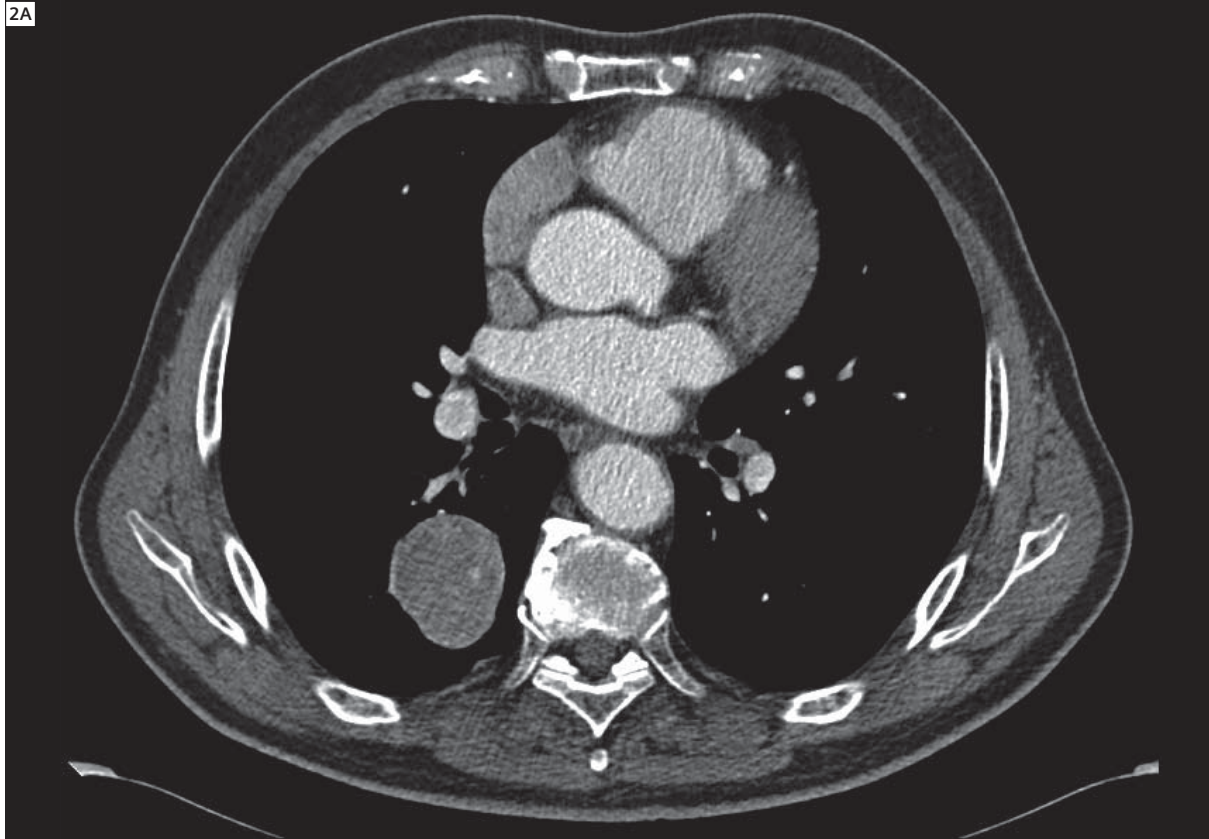
## Case 2

### Rule out of vessel malformation of the lung

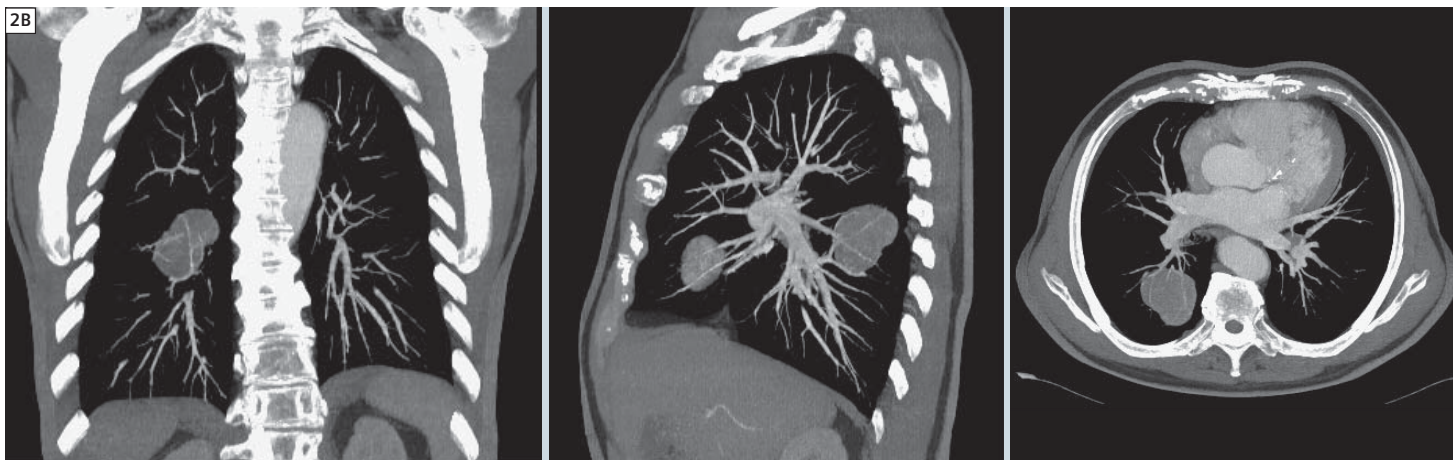
Lung MRI of a 77-year-old male patient is shown with a suspicious lesion in the right lung. A clear rule out of an arterio-

venous malformation was not possible with the already performed diagnostic tests and the patient was therefore

referred to our institute. A well delineated, ellipsoid shaped lesion can be seen. Based on morphological features, a

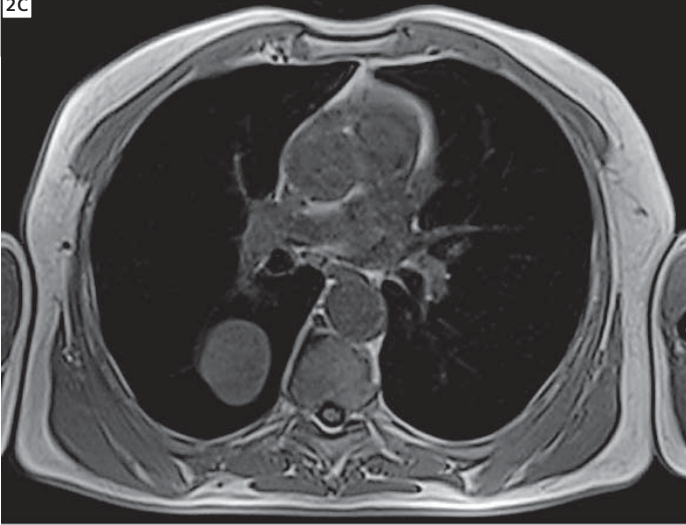


**2A** Contrast enhanced CT scan showing well delineated but enhancing lesion within the right lung.



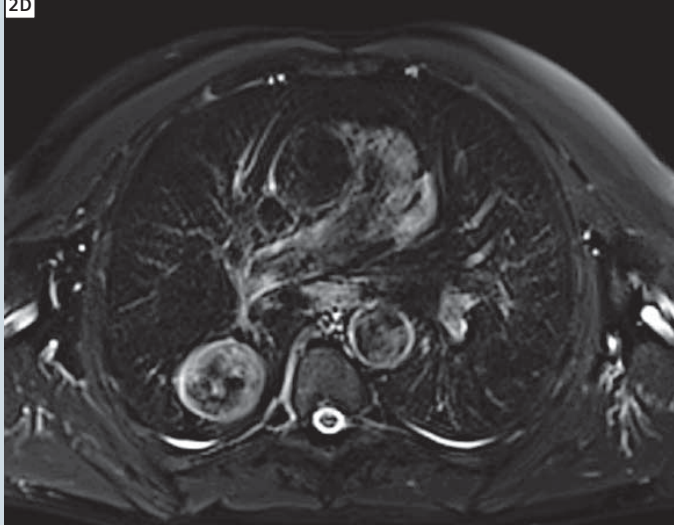
**2B** Thick-slice multiplanar reconstruction (MPR) showing close relationship of the lesion to arterial lung vessels.

2C



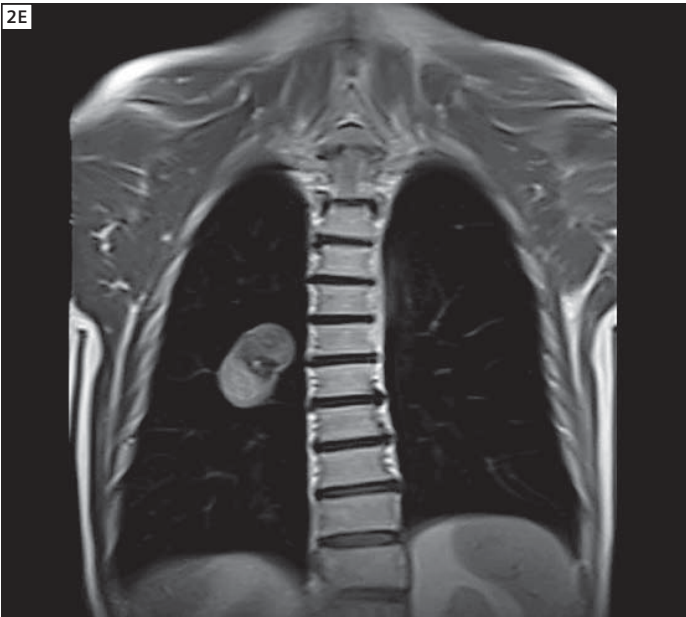
2C Native transversal T1w MRI, ...

2D



2D ... corresponding T2w TSE with fat saturation.

2E



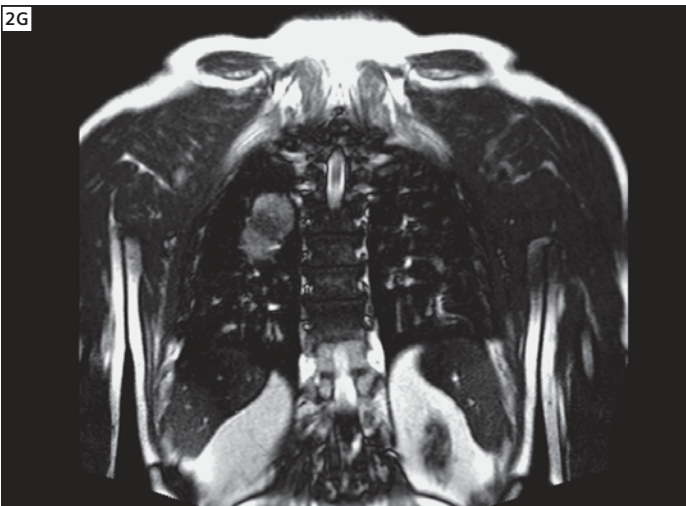
2E Coronal HASTE and ...

2F

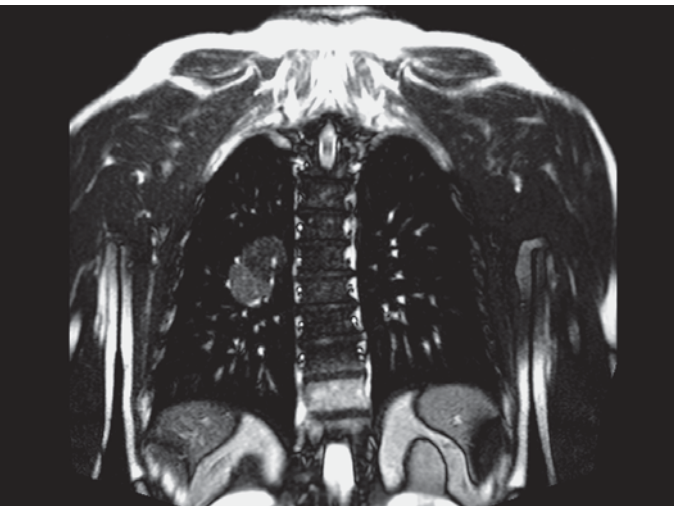


2F ... coronal T2w TSE showing different but well delineated components of the tumor, supporting the suspicion of hamartoma.

2G

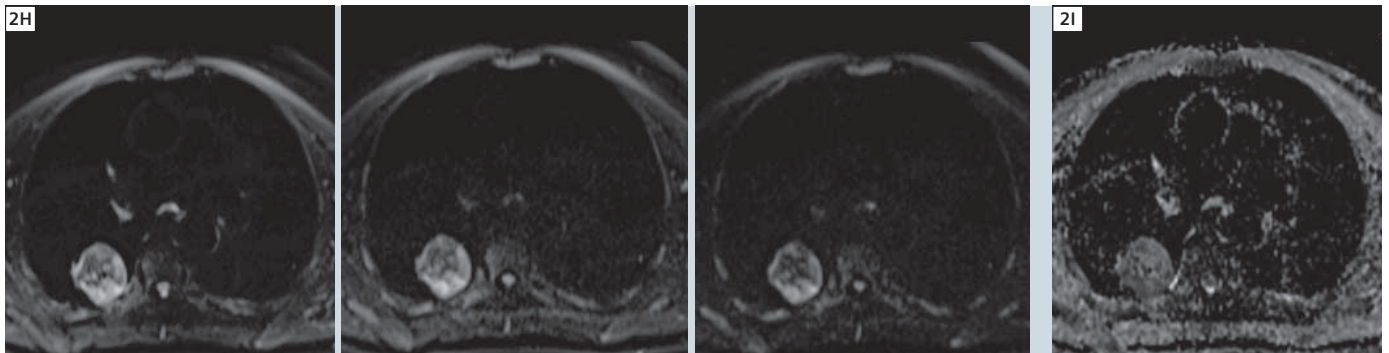


2G Coronal TrueFISP acquired during free-breathing demonstrating free degree of movement during the breathing cycle.



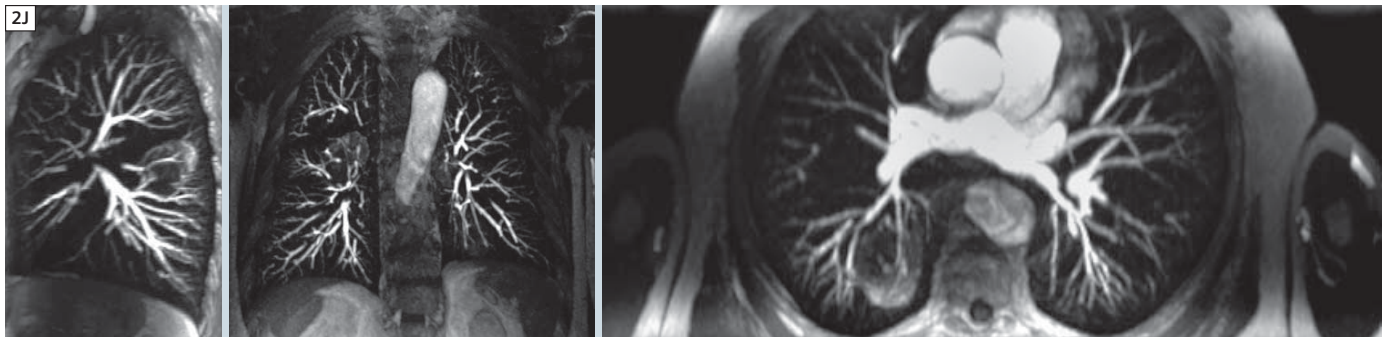
hamartoma is possible. While the tumor has a close relationship to several arterial vessels, dynamic MRI could rule out a vessel malformation (no arterio-venous malformation, no aneurysm). Contrast-media enhancement of the

lesion, however, has to be interpreted as a sign of potential malignancy and further invasive evaluation was warranted (surgical resection).

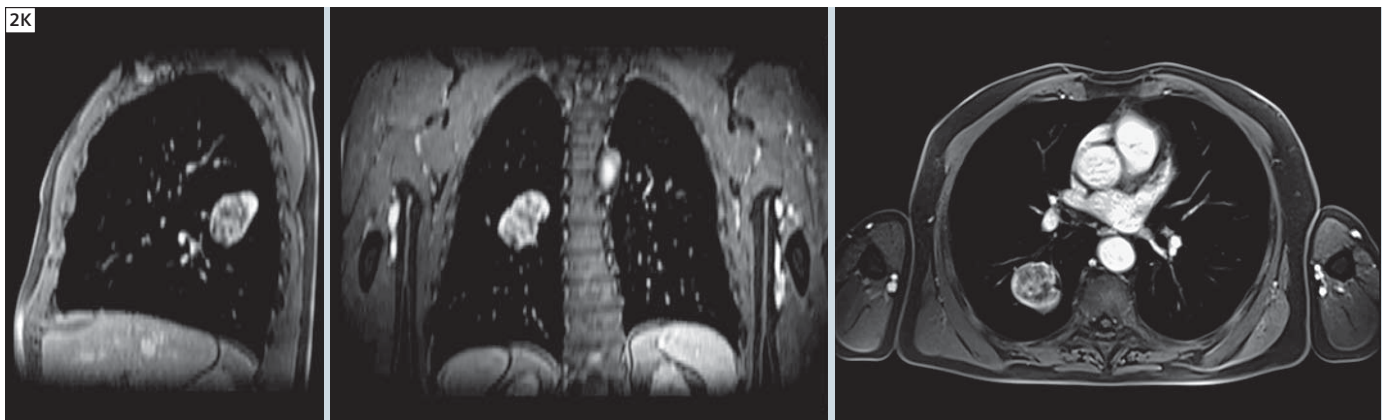


**2H** Original b-value images derived from DWI exam (right b = 0, middle b = 400, left b = 800 s/mm<sup>2</sup>), ...

**2I** ... Liecorresponding ADC map.



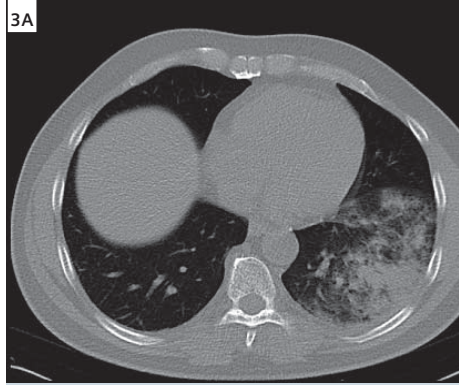
**2J** Multiplanar thick-slice MIP of late-arterial dynamic scan showing relationship to arterial vessels and contrast-media enhancement as potential sign of malignancy; no imaging feature of AVM / aneurysm can be visualized.



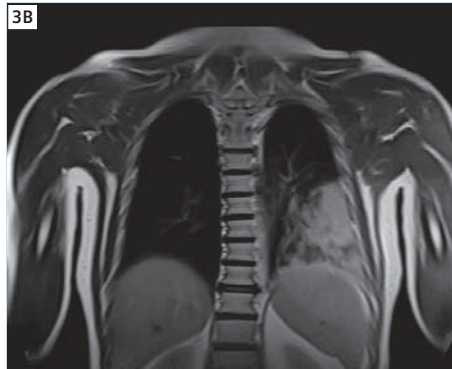
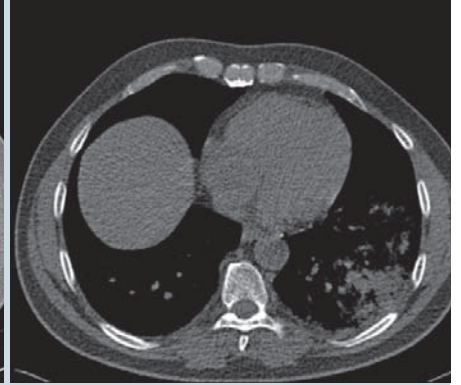
**2K** Multiplanar reconstruction based on late-phase 3D T1w VIBE demonstrating inhomogenous but evident contrast enhancement.

### Case 3 Pneumonia

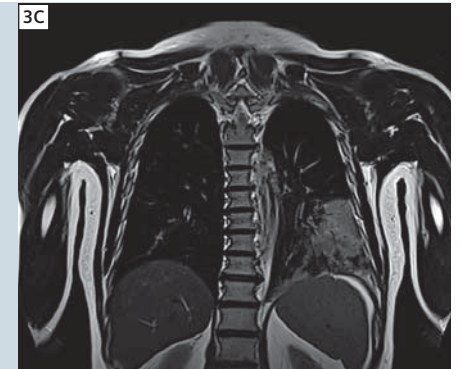
A 66-year-old male volunteer was diagnosed with pneumonia a few days previously. This case clearly shows the potential of MRI to detect and evaluate inflammatory processes of the lung. In addition to the pneumonia of the left lower lobe, a slight apical effusion and reactive mediastinal / hilar lymphadenopathy (not shown) is present. No signs of malignancy and / or masking of lesions by the infiltrate can be found.



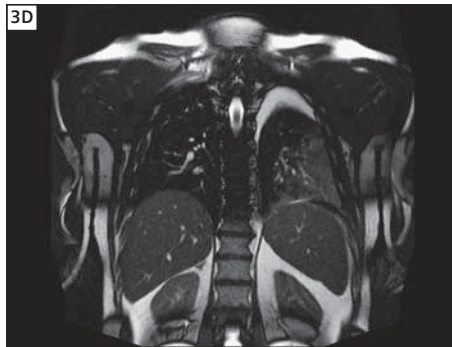
3A Native low-dose CT of the lung.



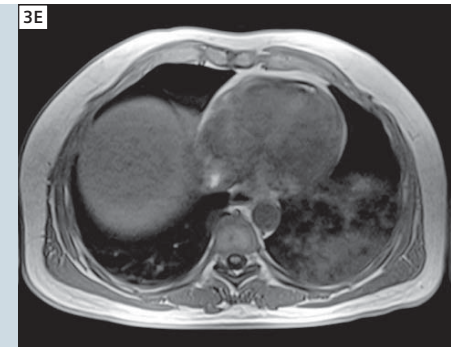
3B Coronal HASTE.



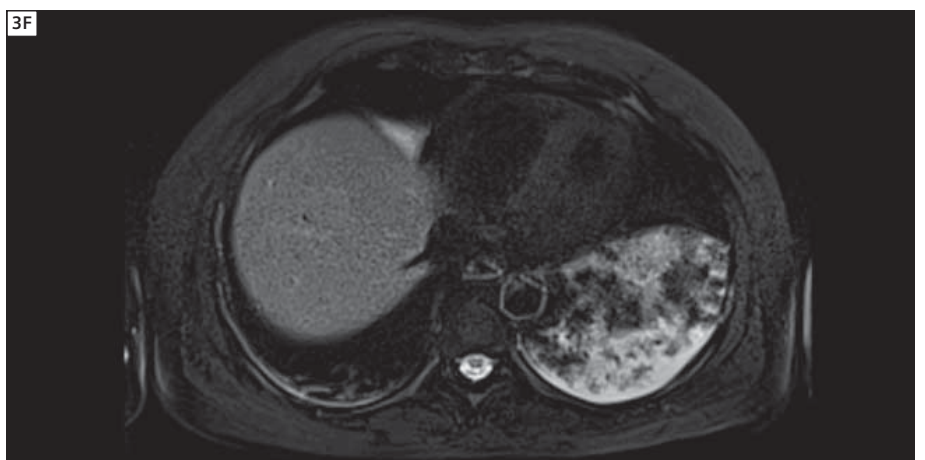
3C Corresponding T2w TSE.



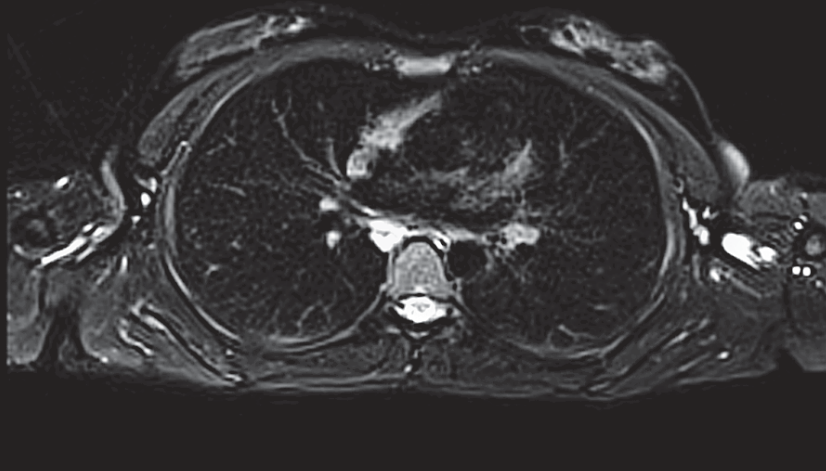
3D Coronal TrueFISP at a different slice position showing additional apical pleural effusion.



3E Native T1-weighted image.



3F Corresponding T2-weighted TSE with fat saturation at comparable height of the lung to the CT images in figure 3A.



**4A** Transversal T2w TSE with fat saturation showing bihilar lymphadenopathy.



**4B** Coronal T2w TSE (BLADE technique).

## Case 4 Sarcoidosis

This 25-year-old woman underwent MRI for the follow-up of a proven sarcoidosis. The protocol was adapted to also evaluate the supraclavicular and nuchal lymph node stages, which were unsuspecting (therefore not shown). Best visualized by fat-saturated T2w MRI, however, multiple mediastinal and hilar lymph nodes are visible. The lung parenchyma is normal and no pleural effusions can be seen. However, a reduction of the degree of bihilar lymphadenopathy was diagnosed compared to CT and in accordance with clinical parameters, recurrent inflammation of the sarcoidosis stage 1 was concluded.

## Conclusion

This short case series shows that MRI of the lung is capable of assisting in the detection and diagnosis of a large range of lung pathologies. With growing experience in the application of MRI in the lung, it can play an important role in future diagnostic set-up of lung pathologies, especially in younger patients.

### Contact

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