

Non-contrast MR-angiography compared to contrast-enhanced CT-angiography in the diagnosis of pulmonary embolism: preliminary results

A. Mayer¹, R. De Paoli¹, M. Manganiello¹, L. Martella¹, G. Robotti¹

¹Department of Radiology, Lugano Hospital Civico, Lugano, Switzerland

Introduction:

Spiral CT is a well established and widely used method for the diagnosis of pulmonary embolism. Certain conditions however, like history of severe adverse reactions to contrast agents, refusal by the patient to receive contrast or to undergo an exam using x-rays, pregnancy and severe cardiovascular disease, which prohibits the administration of large quantities of fluids under high flow conditions, still pose a dilemma for clinicians. This group of patients cannot be examined using contrast-CT, scintigraphy or conventional angiography. Non-contrast MR could solve this problem, as it does neither use x-rays nor require administration of any fluids.

The purpose of this study was to assess if non-contrast MR could accurately distinguish those patients suffering from pulmonary embolism.

Materials and Methods:

10 patients referred to our department for evaluation of pulmonary embolism were first examined by CT (Siemens Sensation 16-slice, Erlangen, Germany) and then by MR (Siemens Sonata, Erlangen, Germany). We used a standardized protocol for CT angiography (100 ml contrast i.v. at a flow rate of 5 ml/sec. with bolus tracking, 0.75 coll., 1 slice, 0.75 incr.). The sequences acquired in MR were True FISP single shot and True FISP cine in both axial and coronary planes using breathhold and ECG-triggered techniques. For each MR exam the time between entrance into the MR suite and exit was recorded.

The exams were independently read by two experienced radiologists trained in MR and CT respectively. Each main, lobar and segmental pulmonary artery was evaluated for the presence of pulmonary embolism. The results were then compared.

Results:

Median age of the patients was 70.5 years with a range from 42 to 83 years. Average length of the exam was 25 minutes with a range from 20 to 35 minutes. Both CT and MR found 6 out of 10 patients positive for pulmonary embolism. The exact results of the comparison can be seen in table 1. and 2..

	false positive	true positive	false negative	true negative
2 main pulmonary arteries	0	5	0	15
5 lobar pulmonary arteries	0	19	1	30
18 segmental pulmonary arteries	4	15	21	140
all pulmonary arteries	4	39	22	185

Table 1.: MR results compared to CT (CT taken as gold standard)

	sensitivity	specificity	positive predictive value (PPV)	negative predictive value (NPV)
main pulmonary arteries	100%	100%	100%	100%
lobar pulmonary arteries	95%	100%	100%	97%
segmental pulmonary arteries	42%	97%	79%	87%
all pulmonary arteries	64%	98%	91%	89%

Table 2.: analysis of results shown in table 1.

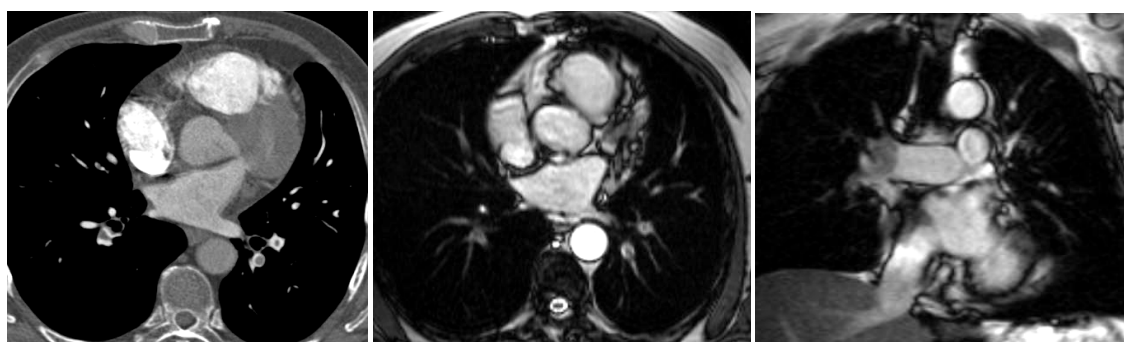


Fig.1.: Pulmonary embolism in both lower lobes and right main pulmonary artery

Discussion:

Our results suggest a good correlation between non-contrast MR and CT-angiography, especially for more central arteries. Results for segmental arteries were not as good with a noticeable drop of sensitivity from over 95% to 42%. This is mainly due to the exam of one patient who had pulmonary cancer with big masses in both lower lobes. This resulted in a lot of flow artefacts in True FISP, which made it very hard to discriminate true filling defects. 9 out of 21 false negatives and 1 out of 4 false positives at the level of the segmental pulmonary arteries occurred in this patient. Pulmonary embolism of the main arteries was however correctly identified.

Conclusions:

Non-contrast MR-angiography using True FISP sequences with breathhold and ECG-triggering techniques is a good and valuable alternative to CT-angiography in patients with relative or absolute contraindications to CTA.