

# A comparative study of contrast-enhanced and unenhanced MR Pulmonary Angiography in the diagnosis of pulmonary embolism

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**Purpose:** To evaluate detection of pulmonary embolism (PE) using conventional MR angiography and unenhanced MR angiography applying spatial labeling with multiple inversion pulses sequence (SLEEK) imaging.

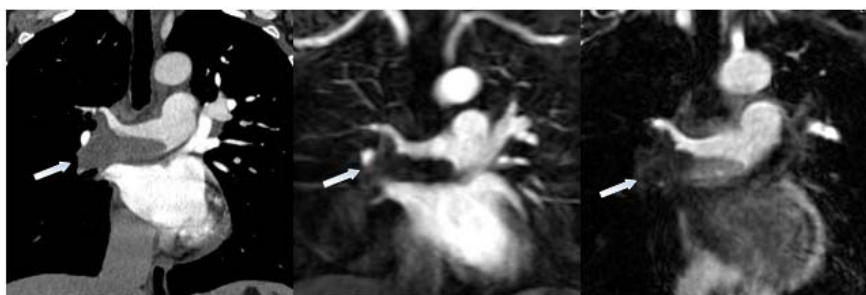
**Method and Material:** 26 patients (15 males and 11 females) diagnosed with PE using computed tomographic(CT) a underwent contrast-enhanced MR pulmonary angiography and SLEEK MR angiography within 48 hours after CT scans. Written consent forms were obtained prior to MR scans. Images from each sequence was analyzed separately by two independent reviewers who recorded presence of emboli in categorized pulmonary artery anatomic territories. CT angiography results were analyzed by a third independent reviewer, who retrospectively recorded presence of emboli using the same format; these review results were used as reference.

Sensitivity, specificity, and positive and negative predictive values for PE detection were calculated and compared for each MR acquisition based on a per-embolus basis, and 95% confidence intervals were calculated according to the efficient-score method. A two-sample t test was used to compare values between different MR acquisitions. Weighted K values were calculated to evaluate the consistency between results from the readers.

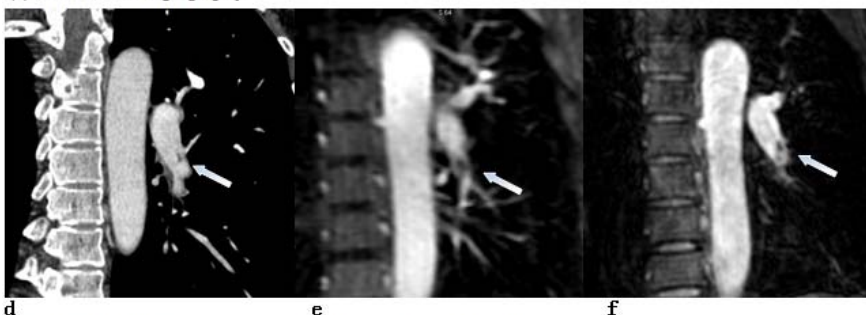
**Results:** Calculated sensitivities for PE detection were 78.8% for MR pulmonary angiography and 83.8% for SLEEK MR angiography respectively. However if the results from two MR sequences were simultaneously used, the overall sensitivity was improved up to 85.4%. Specificities for PE detection was 97.7% for MR Pulmonary angiography and 100% for SLEEK MR angiography., if two MR sequences were simuteanously used the overall specificity was improved up to 100%. Consistency between readers was considerably high (k=0.87).

**Discussion and conclusion:** Contrast-enhanced MR pulmonary angiography and SLEEK MR angiography possessed relatively similar sensitivity and specificity. There were complementary benefits to combine these two MR sequences for the evaluation of PE. However, considering the non-invasive property of SLEEK MR angiography, where no contrast agent was required, it might become a potential diagnostic strategy for pulmonary embolism.

**References:** 1.Bobby Kalb, Puneet Sharma, Stefan Tigges, et al. Mr imaging of Pulmonary embolism: Diagnostic Accuracy of Contrast-enhanced 3D MR Pulmonary Angiography, Contrast-enhanced Low-Flip Angle 3D GRE, and Nonenhanced Free-Induction FISP Sequences. Radiology 2012; Volume 263; Number 271-278.2.Tang H, Wang Z, Wang L, et al. Depiction of transplant renal vascular anatomy and complications: unenhanced MR angiography by using spatial labeling with multiple inversion pulses. Radiology. 2014 Jun;271(3):879-87.3.Stein PD, Chenevert TL, Fowler SE, et al. Gadolinium-enhanced magnetic resonance angiography for pulmonary embolism: amulticenter prospective study (PIOPED III). Ann Intern Med 2010;152(434 - 43):W142 - 3.



**a** **b** **c**  
Pulmonary embolus (arrow) at bifurcation of the right pulmonary artery in a 67-year-old woman. (a) CT pulmonary angiogram. (b) coronal reformation of contrast-enhanced MR pulmonary angiography. (c) SLEEK MR angiography.



**d** **e** **f**  
Segmental pulmonary embolus (arrow) in a 48-year-old man. (d) CT pulmonary angiogram shows focal thrombus in a left lower lobe segmental pulmonary artery. (e) contrast-enhanced MR pulmonary angiography coronal reformations. There is a subtle deformity of the vessel lumen correlating to the thrombus. (f) SLEEK MR angiography images show the thrombus, which contrasts well against the vessel wall.