DIAGNOSTIC ACCURACY OF CONTRAST-ENHANCED MR ANGIOGRAPHY AND NON-CONTRAST PROTON MR IMAGING COMPARED WITH CT PULMONARY ANGIOGRAPHY IN CHRONIC THROMBOEMBOLIC PULMONARY HYPERTENSION

S. Rajaram[1], A. J. Swift[1], D. Capener[1], A. Telfer[1], J. Hurdman[2], R. Condliffe[2], C. Elliot[2], C. Davies[3], C. Hill[3], D. G. Kiely[2], and J. M. Wild[1]

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Background:

Chronic thromboembolic pulmonary hypertension (CTEPH) is potentially treatable with surgical endartectomy, the outcome of which depends on the localization of the thromboembolic material. The aim of our study was to evaluate the diagnostic accuracy of contrast enhanced MR angiography (c-MRA) and added benefit of non-contrast proton MRI compared to CT pulmonary angiography (CTPA) in patients with chronic thromboembolic disease.

Method:

This was a retrospective study of 89 consecutive patients with CTEPH (n= 54) and patients with normal pulmonary artery pressures with no evidence of pulmonary embolism (n=35). The images were acquired on a 1.5T scanner (GE Healthcare, Milwaukee, USA). Standard c-MRA was performed at breathhold with a 3D Coronal Spoiled Gradient Echo, TR=2.8, TE=1.0, Flip Angle 30°, FOV 48x48, 2x Asset, Matrix 300x200, 125kHz Bandwidth, Slice Thickness 3 mm and average 60 slices. 10ml of contrast agent (Gadovist) was used. The non contrast MRI were acquired as a stack of coronal 2D steady state free precession images, (GE Fiesta), with parameters of TR=3.1, TE=1.3, Flip angle 50°, FOV 48x43.2, 0 Asset, Matrix 256x192, 125kHz Bandwidth, Slice Thickness 10mm. Data was acquired during a breathhold at full inspiration. MRI scans were reviewed on a standard GE workstation by two independent radiologists blinded to the findings. The MRI was scored for quality, presence or absence of CTEPH and depiction of level of disease. The pulmonary vasculature was evaluated for the webs, stenosis, post stenotic dilatation and occlusion. The combined diagnostic accuracy of c-MRA and non-contrast MRI was assessed.

Results:

The overall sensitivity and specificity of MRA in diagnosing CTEPH was 98% (95% CI of 0.89 to 0.99) and 94% (95% CI of 0.81 to 0.99) respectively with a positive predictive value of 96% and negative predictive value of 97%. The sensitivity for identifying central, lobar, segmental and sub-segmental disease is outlined in table 1. The sensitivity improved from 50% to 87.9% for central disease when c-MRA images were analyzed with non-contrast MRI as an added sequence. C-MRA identified more stenosis (29/18), post stenosis dilatation (23/7) and occlusion (37/29) compared to CTPA.

Conclusion:

Our results show that c-MRA has a very good sensitivity and specificity for diagnosing CTEPH. The sensitivity of c-MRA for visualization of adherent central and lobar thrombus significantly improves with the addition of the SSFP sequence that clearly delineates the vessel wall. CTPA is superior for depiction of intraluminal webs and sub-segmental disease, while c-MRA is superior in identifying stenosis and post-stenotic dilatations.

Table 1: Sensitivity of c-MRA and c-MRA+SSFP in the diagnosis of CTEPH as a function of site of disease

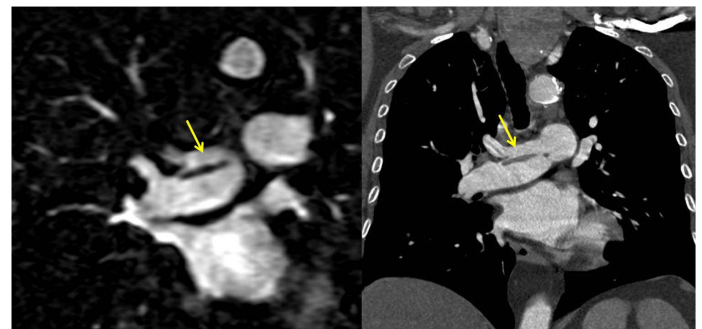|	cMRA/CT	Sensitivity	c-MRA +SSFP /CT	Sensitivity
Central	4/8	50%	**7/8**	**87.9%**
Lobar	20/27	74.07%	**23/27**	**85.2%**
Segmental	34/42	80.95%	34/42	80.95%
Sub-segmental	3/29	10.34%	3/29	10.34%

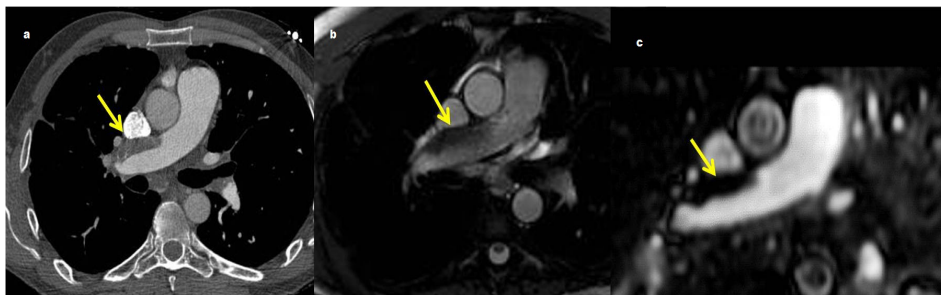**Image 1: A central thrombotic web demonstrated on c-MRA and CTPA**

Image 2: CTPA (a), non-contrast MRI (b) and c-MRA (c) shows a thromboembolic material adherent to right main pulmonary arterial wall

Table 2: Numbers of morphologic changes found in c-MRA and CTPA

Pattern of disease	c-MRA	CTPA
Webs & bands	12	**54**
Stenosis	**29**	18
Post stenotic dilatation	**23**	7
Occlusion	**37**	29
Adherent emboli	19	**36**

Reference: Ley S, Value of contrast-enhanced MR angiography and helical CT angiography in chronic thromboembolic pulmonary hypertension. Eur Radiol 2003;13:2365–2371