Non Invasive Imaging of Pulmonary Arterial Hypertension and other causes of Pulmonary Hypertension: Clinical State of the Art

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Target Audience: Radiologists, Pulmonologists, Biomechanical Engineers, MR Physicists

Purpose: Review the pathophysiology and the characteristic MRI and MRA findings associated with pulmonary arterial hypertension (PAH) and Pulmonary Hypertension.

Content: (a) Definitions of PAH and PH, (b) Review of the clinical manifestations of pulmonary arterial hypertension and its integration into the Dana Point (2009) classification system. MRI/MRA imaging findings seen with PAH, (c) Review of Protocols, (d) Calculation of right ventricular function and evaluation of RV morphology, (e) Using MRI to determine quantitative prognostic factors including evaluation of flow through the cardiac cycle, evaluation of tricuspid valve regurgitation and estimation of pulmonary artery pressure using the modified Bernoulli equation, (f) MRA Perfusion to showing delayed transit time, (g) Role of ancillary imaging findings: septal straightening increased RV minor axis, Pulmonary trunk greater than 30 mm in size, (h) MRA Flow Quantification using 4-DFlow to determine pulmonary arterial flow and helicity, (i) Experimental role of MRI in diagnosing PAH, including evaluation of pulmonary arterial wall stiffness. Clinical outcome measures for survival with PAH.

Summary: Due to the relatively low prevalence of PAH in the population, it is not often diagnosed *de novo* by the radiologist. However, PH is quite common given the fact that it often secondary to left ventricular failure. Familiarity with both the clinical manifestations and the myriad of imaging findings associated with this important group of diseases can help to suggest the diagnosis. MRA is playing a greater role in the evaluation of PAH, and may help to monitor therapy non-invasively.

References: 1. Lourenco, AP et al. Intl J Cardio 2012;155:350-61. 2. McLaughlin, V V et al. J Am Coll Cardiology. 2009;53:1573-619. 3. Gan, CT. et al. Chest 2007;132:1906-12. 4. Bradlow, WM. Et al. J Soc for Cardio Magn Res 2012;14:6 5. van Wolferen SA et al. Eur Heart Journal 2007;28:1250-7.
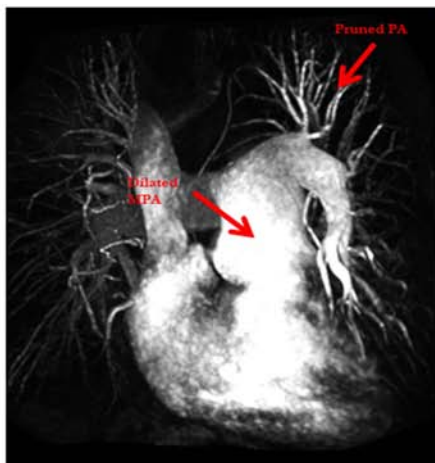
Figure 1. MRA showing dilated main pulmonary arteries and branch pulmonary artery pruning.
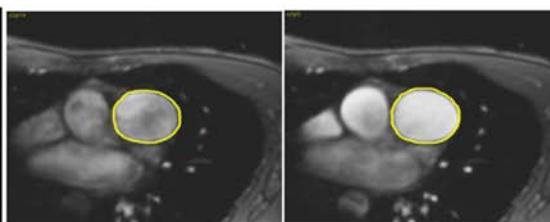

Figure 2. Magnitude images of the main pulmonary artery during diastole and systole showing decreased compliance with little change in the cross-sectional area.
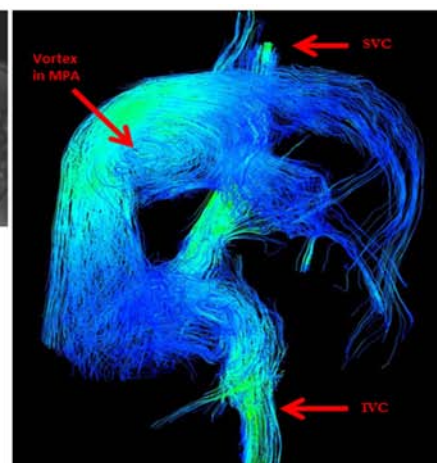

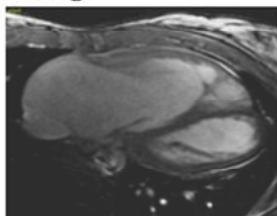Figure 3. 4D Flow with a large vortex in the main pulmonary artery.

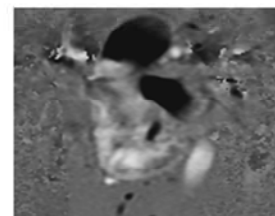Figure 4. Right ventricular dilatation and hypertrophy

Figure 5. Tricuspid regurgitation that can be used to estimate pulmonary artery pressure from peak velocity of the regurgitant jet via modified Bernoulli equation.