COMPARISON OF DIRECT AND INDIRECT MEASUREMENTS OF AORTIC VALVE REGURGITATION USING PHASE CONTRAST MAGNETIC RESONANCE VELOCITY MAPPING

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Background: Phase contrast magnetic resonance imaging (PC-MRI) has proven very reliable in quantification of aortic insufficiency (AI) in patients with various forms of aortic valve disease, but there are anecdotal instances of significant underestimation of the regurgitant fraction (RF). We therefore wished to compare several methods of calculating RF.

Methods: We reviewed our MRI’s from 2009 to present for pts with 1) RF >= 5% or mild AI by echocardiography, and 2) AI RF calculated by at least two methods reverse flow divided by forward flow at the valve sinuses or sinutubular junction (RFsinus and RFSTJ), and the difference in forward flow at the sinuses and total vena caval flow all divided by forward flow at the sinuses (RFCAVAL). Descending aortic flow was substituted for inferior vena cava flow when direct flow measurement was difficult. Pts with aortopulmonary collaterals were excluded from RFCAVAL analysis.

Results: There was excellent agreement between RFsinus and RFSTJ (60 pts), with an intraclass correlation coefficient (ICC) of 0.93, mean difference 0.9%, and standard deviation of 5.3%. RFsinus trended toward better correlation with left ventricular end diastolic volume (r=0.64 vs. 0.54). There was also good agreement between RFsinus and RFCAVAL (31 pts) with an ICC of 0.74. RFCAVAL was biased, on average 5% greater than RFsinus. RFCAVAL identified four cases in which it estimated the RF 15% higher than the direct measurements, two of which the RFCAVAL measurement appeared more consistent with the correlative clinical data.

Conclusions: Aortic RF quantified by PC-MRI is very consistent between measurement locations in pts with any degree of AI. However, there may be rare cases when direct measurement may underestimate the RF, possibly because of chaotic flow in the ascending aorta during diastole. The bias of 5% by the RFCAVAL method is consistent with previously demonstrated mean differences between aortic and caval flow of 5% in pts without a shunt or AI, likely due to normal bronchial flow. Indirect measurement of the regurgitant volume by subtracting caval flow from aortic forward flow may provide a useful adjunct to routine evaluation of AI to avoid cases of significant underestimation.