The purpose of this lecture will be to review recent developments in assessment of valvular heart disease by MRI. Cine MRI is a critical element in the evaluation of valvular heart disease. Although cine MRI provides anatomical depiction of the valves, there is a much wider range of information about the valves that can be determined from this modality. For example, adverse myocardial stress associated with clinically significant valvular heart disease frequently results in left ventricular hypertrophy as well as adverse remodeling of any of the cardiac chambers. Clinical management of patients with valvular heart disease is done within the context of the severity of other cardiovascular parameters such as abnormal global left ventricular function. Cine MRI is well suited to determining other cardiovascular issues related to the valves or due to other coexisting heart diseases.

Cine MRI can provide direct assessments of valvular abnormalities. Some of the best validation studies have used cine MRI to directly visualize the orifice of stenotic heart valves. Planimetry of cine MRI can reproducibly and accurately determine aortic valve area in patients with suspected aortic stenosis.[1-3] The ability to image the heart in arbitrary imaging planes is allowing researchers to better understand the strengths and weaknesses of echocardiographic models used to estimate valve area. For example, the elliptical shape of the left ventricular outflow tract translates to errors in estimating aortic valve area with methods that assume a circular LVOT cross-section such as the modified Gorlin equation.[4] Cine MRI can also provide evidence of other important valvular abnormalities such as severe mitral annular calcification or annular dilatation.

Velocity encoded phase contrast cine MRI produces multiple images across the cardiac cycle with both anatomical and velocity information provided on a pixel-by-pixel basis. Aortic valve[5] and mitral valve area[6] can be determined from velocity gradients across stenotic valves using similar assumptions to those used in echocardiography. Valvular regurgitation can be quantified by MRI. This is valuable in patients with congenital heart disease such as those with pulmonic regurgitation after repair of Tetralogy of Fallot.[7] Measurements of regurgitant fraction have also recently been correlated with color Doppler assessments of valvular regurgitation.[8]

Beyond replication of echocardiographic methodologies, newer MRI methods are opening up new possibilities in diagnostic and therapeutic approaches to valvular heart disease. For example, delayed enhancement MRI can detect myocardial fibrosis associated with severe aortic stenosis,[9] aortic insufficiency,[10] and rheumatic heart disease.[11] This level of myocardial characterization appears unique to MRI. Interventional MRI may be well suited to guiding percutaneous valve replacement.[12] Finally, MRI has been used adjunctively with other forms of molecular imaging to help characterize the pathophysiology of valve degeneration.

Although echocardiography will remain the primary imaging approach to evaluating patients with valvular heart disease, there are a surprising number of developments in MRI over the past few years in this field. In addition, it is important for clinicians to also understand that CT can also evaluate some valve problems.[13-15]

References:
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