In valvular heart diseases, diagnosis may begin with the stethoscope and end with cardiovascular magnetic resonance (CMR). CMR has been increasingly used in Cardiology, because it provides the morphological and functional information necessary for clinical decision-making in cardiovascular diseases.

Superb soft tissue definition, acquisition and three-dimensional reconstructions, together with the absence of ionizing radiation and use of non-nephrotoxic contrast medium (gadolinium), are undeniable advantages of CMR.

The diagnosis of valvular heart disease may benefit from CMR when echocardiography poses technical difficulties (such as inadequate acoustic window) or when there is divergence with other examinations, such as cardiac catheterization. CMR provides accurate information on heart chamber dimensions, ventricular function and mass, plus valve regurgitant volume, as well as on the myocardial fibrosis associated with valvular heart diseases.

Among CMR primary techniques, cine-MRI is the most widely used to evaluate heart valves. The segmented acquisition of dynamic images over some cardiac cycles allows assessing structure motions in any anatomical plane; heart chamber diameters and volumes can be accurately measured, as can ventricular mass and function. According to Simpson’s rule, left ventricular ventricular ejection fraction is calculated from the systolic and diastolic volumes of several cross-sections to the main axis of the heart, spanning the entire ventricle. Cine-MRI also permits the valve area to be measured by direct planimetry. The presence of calcification, which creates a signal void on CMR images, may lead to an overestimation of valve opening by planimetry, but this method usually shows excellent correlation with echocardiography. Measurements of flow velocity, valve area, and transvalvular pressure gradient performed by phase-contrast CMR demonstrate a close correlation with Doppler and catheterization in patients with mitral and aortic stenosis.

One of CMR’s strengths in evaluating valvular heart diseases is its ability to accurately quantify regurgitant volume and fraction in valve regurgitation. Therefore, CMR was considered a first-line imaging method in the consensus on cardiovascular MRI of the Brazilian Society of Cardiovascular Magnetic Resonance Imaging.

Its advantages over two-dimensional echocardiography include the fact that it is not limited by the patient’s chest conformation, it shows low intra- and interobserver variability and allows right ventricle quantification, a chamber usually difficult to access on echocardiograms. These qualities are the CMR’s calling card for inclusion in the follow-up of ventricular function and mass of patients with valvular heart disease (such as aortic stenosis), as well as for functional comparison after surgical intervention.

Velocity-encoded cine-MRI allows the assessment of blood flow velocity across a cardiac vessel or valve. It is equivalent to Doppler echocardiography, but offers the advantage of accessing blood flows in any orientation without being limited by an acoustic window. Using the modified Bernoulli equation, it is possible also to derive transvalvular pressure gradient.

One of the cardiologist’s biggest concerns is that of CMR safety in patients with a mechanical prosthetic valve. It is well established that it is safe to expose a patient with this type of prosthesis to the magnetic fields generally used on CMR (1.5 Tesla). The magnetic force acting on the material is too weak compared to that imposed by the surgical attachment of the prosthesis. On the other hand, these prostheses produce artifacts of signal void (dark area on the MRI image), because the magnetic field becomes distorted by the metallic content. These artifacts often extend to the surrounding structures, depending on the pulse sequence used (this is usually less marked in spin-echo sequences). Consequently, the evaluation of turbulent jets, especially those of lower magnitude, is compromised. With bioprostheses, this effect is usually restricted to the valve annulus and does not interfere significantly in the MRI interpretation.

Described around six years ago, the delayed-enhanced technique consists in acquiring images approximately 10 to 20 minutes after the intravenous injection of a contrast medium (gadolinium) preceded by an inversion-recovery pulse. In addition to allowing the visualization of minimal areas of myocardial necrosis/fibrosis, this technique shows excellent correlation with the pathological anatomy in several heart diseases.

Using delayed-enhanced MRI in patients with severe aortic valve disease (stenosis or regurgitation) but normal coronary arteries, both before and after heart valve surgery, areas of myocardial fibrosis could be identified in 60% of the cases, with good accuracy (78.5%) compared to the myocardial biopsy performed during surgery. Moreover, the diagnosis of myocardial fibrosis (MF) by CMR and biopsy was directly

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2% of the patients are unable to tolerate MRI examination due to claustrophobia. Metal implants in the patient’s brain, in turn, are formal contraindications to MRI, unless they do not have ferromagnetic properties. Finally, the presence of a pacemaker or Implantable cardioverter-defibrillator is also a contraindication to the examination, although some studies have demonstrated its safety in 1.5-Tesla MRI scanners.

Therefore, CMR has already earned its place as an adjunct method in helping cardiologists to define important features of valvular heart diseases’ natural history. It seems that its use will be widely expanded in the coming years.

References