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iVIEW

EDITOR'S PAGE

The Expanding Frontier in Valve Imaging

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Although widely used for a multitude of indications, cardiovascular imaging plays a critical and irreplaceable role in the assessment of valvular heart disease. In many previous editorials, we have commented about the value of using multiple imaging modalities to gather critically important information for decision-making, but at the same time maintaining an awareness of the risk of duplication and waste. In this issue of *iJACC*, we have been fortunate to assemble a spectrum of research papers that emphasize the role of imaging in pre-operative evaluation of valvular heart disease, procedural and operative planning, and in post-operative evaluation.

Clearly, much of imaging valvular heart disease focuses on valvular pathology, both anatomically and functionally. In some situations, our current algorithms for understanding the severity of valve stenosis appear to be limited. One such example of this relates to the recognition of paradoxical low-flow–low-gradient aortic stenosis (1). A potential approach, proposed by Clavel et al. (2), involves the calculation of projected aortic valve area from stress echocardiography to define the severity of aortic stenosis. However, the use of imaging should not be restricted to overt disease. The use of 3-dimensional imaging with computational simulation may provide the ability to understand leaflet stress, such an approach is not only potentially helpful in the planning of potential interventions (3) but also in the early recognition of disease.

Nonetheless, the main focus of new approaches to valvular disease relate not to the valve, but to the left ventricle and aorta. Aortopathy is widely recognized as part of the bicuspid aortic valve phenotype, and Kang et al. (4) have linked the likelihood of aortopathy to the morphology of bicuspid valve. Given the frequency of bicuspid aortic valve in the population, this information may be of value in creating decision algorithms for tracking aortic size with computed tomography (CT) in selected rather than all patients.

The critical role of left ventricular dysfunction in mitral valve disease is widely understood, but the exact mechanism of ischemic mitral regurgitation remains a matter of debate. In an evaluation of the relative role of papillary muscle infarction and lateral wall injury using late-enhancement cardiac magnetic resonance (5), and the extent of lateral wall injury appeared to be the strongest correlate of ischemic mitral regurgitation. The nature of left ventricular response in aortic valve disease is also extremely important. Park et al. (6) emphasize the association of left ventricular hypertrophy, small left ventricular cavity size, and diastolic dysfunction with the onset of dyspnea in patients with aortic stenosis. Similarly, Capoulade et al. (7) have confirmed insulin resistance as an associate of left ventricular hypertrophy progression in patients with aortic stenosis. This information builds on a literature concerning the contribution of insulin resistance to nonvalvular left ventricular hypertrophy, and reinforces the importance of the metabolic syndrome as a potential target in patients with aortic stenosis.

Cardiovascular imaging also has an essential role in planning of valve surgery and percutaneous interventions. In the planning process for percutaneous aortic valve surgery, over-estimation of annular size may lead to valve rupture or other mechanical injury related to overinflation. In contrast, insertion of too small a prosthesis, due to under-estimation of valve size may lead to aortic regurgitation, which is known to be prognostically ad-

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versorial. Three communications in this issue emphasize the use of CT for annulus sizing from double oblique multi layer reconstructions based upon the line of the perpendicularity assessed from CT (8-10). Nonetheless, CT may not be critical for this purpose, and Kasel et al. (11) have proposed a fluoroscopic approach following the location of the right coronary cusp in order to optimize the position of the C-arm during percutaneous intervention. The use of imaging for guidance of aortic valve interventions should not be restricted to percutaneous interventions. Loor et al. (12) emphasize that variations in valve position may influence the success of minimally invasive surgery, and emphasize the potential role of imaging in guiding decisions regarding upper and lower sternotomy, as well as potential right intercostal approaches for valve surgery.

Post-operative valve dysfunction may not be symptomatic until late in the course of disease. A common problem is the evaluation of the patient with an increased gradient across a prosthetic valve, which may be seen from situations that increase stroke volume or ejection rate such as anemia or anxiety, patient–prosthesis mismatch, and valvular obstruction. Muratori et al. (13) have demonstrated that not only is the magnitude of the gradient important in understanding the likelihood of obstruction, but also the nature of the flow waveform. These investigators identified the difference between expected and observed valve area, acceleration time, and the ratio between acceleration and ejection time as potential guides for the presence of prosthetic valve obstruction. One of the feared complications of valve replacement is valve thrombosis, which is readily recognized using transesophageal echocardiography. Özkan et al. (14) emphasize the heterogeneity in the type, dose, and route of administration of thrombolytic agents for prosthetic valve thrombosis. In an observational study, lower dose, transesophageal echo-guided, repetitive slow administration of lytic agents was found to be the most efficacious.

In an environment where cost and utility of imaging is under question, valvular heart disease remains an area in which imaging is invaluable, and advanced imaging is readily justifiable. The editors commend the contributors to this special issue for lighting the way for new imaging applications to improve decision-making in the advanced management of this increasingly important subject.

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