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EDITORIAL COMMENT

# Transforming the Art of the Assessment of AS Into a Systematic and More Robust Approach*

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Aortic stenosis (AS) is the most common valvular heart disease encountered in Western countries and a frequent reason for ordering an echocardiogram. The evaluation of AS severity relies critically on the measurement of the transvalvular velocity—peak and mean gradients—and calculation of the aortic valve area using the continuity equation.[1] These parameters are key in patient management and guide the indications for intervention.[2,3] Inaccurate measurements can lead to the performance of unnecessary additional tests that increase health care expenditures, delay the appropriate management of patients, and increase risk of adverse events and worse outcomes or potentially unnecessary interventions. Thus, echocardiographic evaluation should be carefully and rigorously performed. In this issue of *JACC: Case Reports*, Springhetti et al[4] eloquently describe the importance of multiwindow interrogation of Doppler signal to assess AS gradients and extend this concept to the evaluation of prosthetic valves, diseases of the ascending aorta, and hypertrophic cardiomyopathy.

The aortic valve velocity/gradient should be systematically recorded from the 4 main echocardiographic windows: the apical, right parasternal, suprasternal, and subcostal windows; the former 2 being the most informative in most patients. It has been clearly shown that recording aortic gradients from only the apical view leads to an underestimation of AS severity in 20% of the patients,[5] an issue which tends to be more pronounced in older patients who often have a more acute angulation between the aorta and left ventricle (<115°).[6] For appropriate monitoring and follow-up, the acoustic window providing the highest gradient should be stated in the report. This is critical to avoid erroneous conclusions on AS progression when follow-up studies are performed by multiple operators. These additional views are best acquired using a Pedoff probe, but if not available, can be accurately obtained using the standard 2-dimensional (2D) transducer. Ideally, peak and mean gradients and the valve area are concordant, but discordance between these parameters can be seen in up to one-third of patients.[7] A low gradient (mean pressure gradient <40 mm Hg) and valve area <1 $cm^2$ is the most commonly observed type of discordance and should trigger a systematic comprehensive approach to identify the reason for the discrepancy.[8] As shown by Springhetti et al,[4] underestimation of the aortic valve velocity may lead to a false diagnosis of discordant AS. Another common cause of error leading to false discordance in the hemodynamic parameters includes an underestimation of the left ventricular outflow tract diameter. Although scientific societies suggest that this measurement could be either performed at 5 mm below the plane of the aortic annulus or at the annulus level (inner edge of the leaflets insertion),[9] we recommend the later approach because we find that it is is more reproducible and is associated with the lowest rate of discordance in our experience.[10] Other imaging modalities—such as transesophageal echocardiography (planimetry of the valve area), dobutamine stress echocardiography, and/or aortic valve calcium

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scoring using noncontrast gated computed tomography (a score above 1,200 AU in females and 2,000 AU in males being suggestive of severe AS)—all have a role in the case of discordance between hemodynamic parameters to clarify the disease severity.[8] Importantly, hemodynamic parameters should be integrated with the appearance of the valve. A quantitative assessment of the degree of calcification cannot be accurately obtained using echocardiography. Nevertheless, 2D imaging provides useful information regarding the degree of valve remodeling and leaflet mobility. When there is a discrepancy between the valve appearance and hemodynamic measurements, a transesophageal echocardiogram and/or computed tomography aortic valve calcium scoring is recommended. The discrepancy of the hemodynamic indices should be clearly identified in the conclusion of the echocardiogram. Similarly, these other imaging modalities should be considered when the AS appears more severe clinically.

The same concepts also apply to patients monitored for prosthetic aortic valve function to interrogate the transprosthetic velocity in all 4 views and to document the view providing the highest gradient in the report. Springhetti et al[4] also show the incremental value of the right parasternal view to avoid underestimating the ascending aorta size and increase the yield for diagnosing aortic dissection. Similar to the assessment of aortic valve gradients, the ascending aorta diameter should be measured in multiple views. The most widely used approach is to measure the aortic root and ascending aorta diameters in the parasternal long-axis view. However, the intercostal space providing the best visualization of the ascending aorta is often 1 intercostal space above that used for acquiring the classical long-axis view. The right parasternal view should be systematically performed when an aorta aneurysm is suspected, or when the ascending aorta is not well seen in the long-axis view. The view in which the aorta measurements are performed should also be identified in the report to avoid false conclusions on the rate of progression.

This case series highlights the clinical importance of studying structures with 2D imaging and Doppler using multiple views to look at the valve, to integrate hemodynamic and anatomical parameters, and to not forget clinical evaluation and clinical judgement.

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