Respite for 2-Dimensional Right Ventricular Imaging?

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The complex geometry and structure of the right ventricular (RV) cavity make the assessment of RV function and volumes by 2-dimensional (2D) echocardiography arduous. Highly trabeculated endocardial border and bellows-like contractile pattern are not explicitly imaged by 2D echocardiography.[1,2] Furthermore, the retrosternal position of the right ventricle hinders its visualization, and minimal changes in the angle of insonification affect RV chamber measurement and thereby, reproducibility.

See Article by Amsallem et al

Parameters of RV function and volume derived from 2D echocardiography (tricuspid annular plane systolic excursion, RV to left ventricular diameter ratio, and fractional area change) do not reliably predict the risk of RV failure during mechanical circulatory support with left ventricular assist device.[3,4] Similarly, 2D assessment of RV function and volume in pulmonary hypertension has been challenging. The etiology and hemodynamic classification (pre- versus postcapillary) of pulmonary hypertension are important determinants of the RV remodeling process, leading to distinct RV remodeling phenotypes.[5,6] In particular, the etiology of the pulmonary hypertension affects the RV deformation pattern and leads to contractile dysfunction involving the entire RV free wall or is localized to only the RV basal/apical regions.[5]

Predetermined geometric assumptions do not account for changes in RV geometry during the progression of the underlying condition. They jeopardize the accuracy of 2D quantification of RV function and volumes.[7] Newer echocardiographic techniques that do not require geometric assumptions provide a far more reliable assessment of RV function and volumes than conventional 2D echocardiography.[8] Three-dimensional echocardiography and speckle tracking imaging have been shown to predict RV failure and clinical outcome more accurately than 2D echocardiography in chronic pulmonary hypertension.[5,7]

In this issue of *Circulation: Cardiovascular Imaging*, Amsallem et al[9] propose a new 2D echocardiography-derived RV end-systolic remodeling index (RVESRI) in patients with pulmonary arterial hypertension (PAH). Amsallem et al define the new RVESRI as the ratio of end-systolic RV lateral wall length to end-systolic septal height measured in the RV-focused apical 4-chamber view. The lateral wall length is measured from the lateral tricuspid annulus to the RV insertion of the interventricular septum. The septal height is measured as a straight line from the septal tricuspid annulus to the RV insertion on the interventricular septum. The RVESRI prognostic value was prospectively evaluated in 228 patients with PAH during a mean duration of 3.9±2.4 years in a single center. The primary end point of death, transplant, or hospitalization for heart failure was reached in 88 patients. The RVESRI was found to be more closely associated with clinical outcome than RV end-systolic size or the transverse to longitudinal RV ratio. When added to the Registry to Evaluate Early And Long-term PAH Disease Management score, the incremental predictive value of RVESRI was superior to that provided by 2D echocardiography-derived RV free wall longitudinal strain: C statistics of 0.81 (0.74 to 0.88) for Registry to Evaluate Early And Long-term PAH Disease Management score and 0.83 (0.77 to 0.89) for Registry to Evaluate Early And Long-term PAH Disease Management score+RVESRI. Thus, Amsallem et al advocate RVESRI as a simple reproducible prognostic marker in PAH.

Whether end-systolic RV free wall length to septal height ratio is a more accurate marker of RV remodeling in PAH than are conventional 2D echocardiographic parameters awaits further studies. As with other 2D echocardiographic measurements, an RV-focused apical 4-chamber view that avoids foreshortening, displays the largest basal RV diameter, and includes the entire RV free wall is essential for accurate quantification of RV linear measurements.[10] Measurement of end-systolic RV free wall length relates to the longitudinal contraction of the right ventricle.[11] However, RV contractility does not only depend on the traction of the tricuspid annulus toward the apex. Bulging of the interventricular septum into the RV and radial displacement of the lateral free wall are important contributors to RV pump function. Measurement of RV free wall length may indirectly assess the radial free wall displacement that makes a substantial contribution to RV pump function in PAH patients with dilated RV and preserved tricuspid annular systolic excursion.[11]

Three-dimensional echocardiography allows direct measurement of RV volumes that have been validated against cardiac magnetic resonance imaging.[12] Three-dimensional imaging technology is progressing rapidly and may become increasingly available for assessment of RV function and geometry in clinical practice.[13,14] Meanwhile, the predictive value of 2D echocardiography-derived RVESRI needs to be confirmed in other PAH centers.

Disclosures

None.

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