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Unlocking the Potential of Three-Dimensional Echocardiography for Diagnosing Pulmonary Valve Diseases

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Recently, there has been a significant evolution in cardiac imaging techniques, with three-dimensional (3D) three-dimensional echocardiography (3DE) emerging as a promising tool for diagnosing pulmonary valve (PV) diseases. This editorial explores the potential of 3DE in revolutionizing the diagnosis and management of PV disorders.

3DE offers unparalleled insights into the anatomy and function of the PV, which allows for more accurate assessments of valve morphology and the underlying pathologies (Figure 1).[1,2] Its ability to provide real-time dynamic images enhances the precision of diagnosis and treatment planning.[3,4] Unlike conventional methods, 3DE helps us to simultaneously visualize all the PV leaflets and more accurately understand the pathology. Moreover, it facilitates the planimetry of the anatomical orifice and 3D color-Doppler of the vena contracta.[5] These enhance our ability to interpret the degree of stenosis[6] and/or the cause of insufficiency with greater accuracy.

Healthcare providers worldwide are increasingly integrating 3DE in their clinical practices to improve diagnostic accuracy and patient outcomes.[7] However, despite its benefits, there are challenges that hinder the widespread adoption of 3DE, including its cost, training requirements, and technical limitations. Obtaining a 3D image of the PV requires a longer learning curve.

Furthermore, the number of two-dimensional echocardiography (2DE) parameters for assessing the severity of pulmonary regurgitation and stenosis are lesser than those for other valves.[8] Apart from the technical challenges, the PV has been the least studied among the four heart valves in both 3D and 2DE. A critical barrier lies in not dedicating enough time to study the PV and overlooking the crucial role of 3DE in assessing valve function, which is equally applicable to the PV.[9]

The future of PV imaging depends on the refinement of 3DE techniques via continuous research and development, expansion of its clinical applications, and improvement in its accessibility. Collaboration among clinicians, researchers, and industry partners

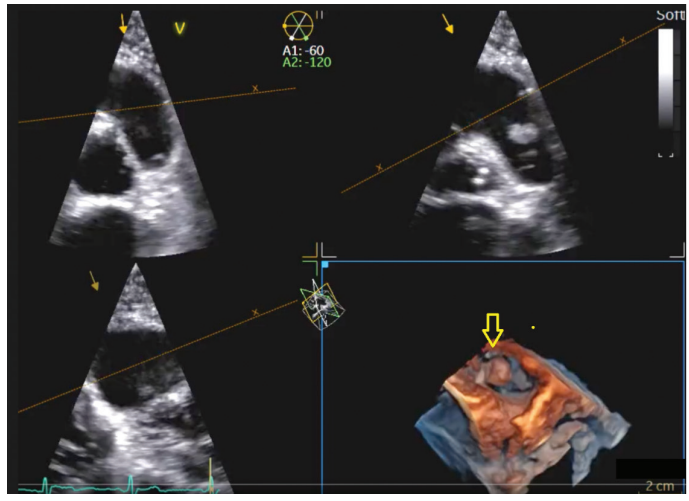

FIG. 1. Live/real-time, three-dimensional, transthoracic echocardiography of the pulmonary valve that was acquired with a Ge Healthcare Vivid E95, using a 4Vc transducer, and processed with EchoPAC 204. The short-axis en face view shows a pedunculated, well-circumscribed, and homogeneous mass attached to the pulmonary valve (arrow).

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will drive innovation in this field, which will enhance diagnostic accuracy and provide comprehensive insights into PV pathologies.

Combining 3DE with other imaging modalities, such as cardiac magnetic resonance and computed tomography, can further enhance our diagnostic capabilities. This allows for a more comprehensive assessment of PV diseases. The synergistic approach of multimodal imaging offers significant benefits in terms of accuracy and depth of understanding, which paves the way for improved patient care and treatment outcomes.[10] Exploring the complexities of PV diseases highlights the crucial role of 3DE as a state-of-the-art technology in advancing cardiac care. To fully utilize the potential of 3DE, continuous refinement of its techniques, broadening of its clinical applications, and ensuring better accessibility are required. A collective effort, along with synergistic approaches that integrate complementary imaging modalities, holds great promise for enhancing patient care, improving treatment efficacy, and driving progress in cardiovascular medicine.

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