A Primer on Three-Dimensional Transthoracic Echocardiographic Imaging of the Tricuspid Valve

The October 2021 issue of *CASE* details a case by Gunaseelan *et al.*[1] of pacemaker-induced tricuspid valve (TV) stenosis that was evaluated mainly by three-dimensional (3D) transesophageal echocardiography (TEE). Intracardiac leads more commonly result in TV regurgitation, and as the authors describe, multimodality imaging can often be useful to determine the exact pathology. In our lab, we often rely on 3D transthoracic echocardiography (TTE) with multiplanar reconstruction (MPR) as the first imaging screening tool to better understand the impact of intracardiac leads. We have found that in cases like the one Gunaseelan *et al.* presented, the TTE can inform the TEE. We have learned a number of lessons to optimize 3D TTE imaging in our lab:

- Two-dimensional images of the TV should visualize the annulus and leaflets throughout the cardiac cycle. When optimizing valve imaging (unlike volumetric analysis), it is fine to foreshorten or use off-axis views to focus on the TV.
- Optimization of two-dimensional images includes decreasing the sector size, decreasing the compression to better contrast the blood pool and tissue, and altering the time gain compensation in the region of the TV.
- Multiple 3D imaging modes (zoom, live 3D, and full volume) can be used to obtain high-quality 3D TTE images with optimal spatial and temporal resolution.[2] In addition, color Doppler imaging can be used with any 3D acquisition mode. Multibeat acquisitions provide higher-quality data versus single-beat but are dependent on rhythm and patient cooperation with breath holds.
- Multiplanar reconstruction allows for visualization of orthogonal (or oblique) and short-axis representations of the structures of interest with the corresponding 3D data set. "Locking" two-dimensional reference planes ensures that they remain orthogonal to one another.
- When analyzing MPR images, the orthogonal transverse lines can be rotated so they are parallel to the TV and can be positioned at the level of the annulus or the leaflet tips. When the longitudinal line transects the middle of the valve plane, a short-axis image can be used to identify the location of intracardiac leads in relation to the leaflets (Figure 1) and can also be used to trace the valve area (as was presented by the authors).

The authors present a nice example of how advanced echocardiographic imaging can be diagnostic of complex pathology. While many labs utilize 3D TEE, fewer use 3D TTE. It is imperative that echocardiographers and sonographers be proficient in the use of both modalities when analyzing TV pathology. Consistent practice and learning labs are helpful toward accomplishing this goal.

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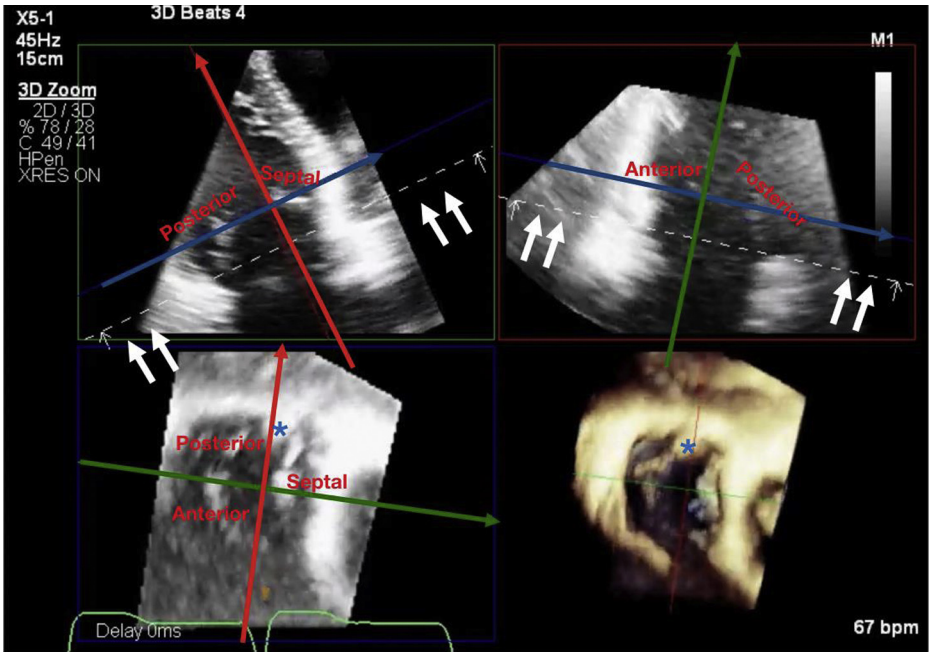

Figure 1 A 57-year-old man with a history of ventricular tachycardia status after implantable cardioverter-defibrillator was referred for severe tricuspid regurgitation. Multiplanar reconstruction from 3D TTE is shown. The orthogonal planes (*blue lines in the green and red boxes*) are aligned parallel to the TV at the level of the leaflet tips, creating a short-axis image (*blue box*). The short axis is oriented with the septal leaflet facing the right side of the image. The *red and green lines* in the orthogonal planes are aligned in the center of the TV. The *white line and arrows* demonstrate visualization of the short axis and 3D images from the atrial perspective. The intracardiac lead (*) is located in the septal-posterior commissure and in this case was not causing leaflet impingement.