Value of live 3D transoesophageal echocardiography in the diagnosis of mitral valve lesions

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We experienced a case in which live 3D transoesophageal echocardiography (TEE) was found much more valuable than 2D TEE in assessing mitral lesions in circumferential direction and making surgical plans for mitral valve prolapse.

Live 3D transoesophageal echocardiography (TEE) is now commercially available. It provides high-quality, real-time 3D images of the mitral valve structures through an ideal echo window. Here, we report a case, suggesting that live 3D TEE played a prominent role in assessing mitral valvular lesions and, therefore, making surgical plans for mitral valve prolapse.

The Carpentier nomenclature was applied to the mitral leaflets (i.e. A1/A2/A3 = lateral, middle, and medial scallops of the anterior leaflet; P1/P2/P3 = lateral, middle, and medial scallops of the posterior leaflet; ALC, anterolateral commissure; PMC, posteromedial commissure). Philips™ IE 33 was used as an echo equipment with a Philips™ S3 probe for 2D transthoracic echo (TTE) and an X7-2t probe for live 3D TEE.

Case study

A 47-year-old man with severe mitral regurgitation (MR) was referred to our echo laboratory for pre-operative evaluation. Routine 2D TTE and 2D TEE showed flail A2 leaflet with torn chordae tendineae and prolapse of P2 and P3. Severity of MR was diagnosed as IV/4 based on a holosystolic retrograde flow in the pulmonary vein shown by pulsed Doppler ultrasound. Live 3D TEE visualized the entire mitral valve in real-time as viewed from the left atrium. This 'surgeon's view' showed flail A2 and A3 leaflets with two torn chordae tendineae and prolapse of P2, P3, and PMC (Figure 1; Supplementary data, movie 1). Furthermore, the entire regurgitant orifice was clearly delineated as a black zone by meticulously rotating the live 3D TEE image (Figure 2; Supplementary data, movie 1). Colour 3D Doppler image showed the volumetric proximal isovelocity surface area (PISA) of mitral regurgitant flow (Figure 3; Supplementary data, movie 3) as well as a horizontal view of PISA (Figure 4; Supplementary data, movie 4), which could have never been observed by 2D echo. These findings were helpful in understanding the extent of MR. Surgical procedure including chordae tendineae reconstruction not only of anterior leaflet but also of posterior leaflet was planned primarily based on these live 3D TEE findings and was completed successfully. At the time of the surgery, flail A2 and A3 with two torn chordae tendineae as well as prolapsing P2, P3, and PMC were confirmed, and the surgeon’s diagnosis was totally in accord with the diagnosis based on live 3D TEE.

Discussion

Reconstructive 3D TEE and live 3D TTE have been reported as feasible modalities in diagnosing mitral valvular diseases. However, neither modality can produce a high-resolution live en face view of the whole mitral valve, which is essential for understanding of the anatomical abnormality. By rotating the ultrasound crystal of multiplane TEE probe, we are trying to form mental 3D image of the target from the obtained serial 2D image sets; however, it is clear that we are unable to reconstruct 3D image with...
both spatial and temporal accuracy comparable with live 3D TEE image.

In our case, 2D TEE visualized prolapse only of A2, P2 and P3, whereas prolapse of A3 and PMC could be delineated only by live 3D TEE. In addition, it is not so easy and precise to evaluate how widely the prolapse lesion extends in the circumferential direction by rotating ultrasound crystal of 2D TEE probe compared with live 3D TEE en face view. Appropriate surgical plan could be made only by the live 3D TEE images, which is in accord with the results of the paper on live 3D TEE by Pothineni et al.4

Summary

In our case, spatial information along the mitral ring circumference provided by live 3D TEE was essential for clinical decision-making.

Supplementary data

Supplementary data are available at European Journal of Echocardiography online.

References