Real-time three-dimensional TEE-guided repair of a paravalvular leak after mitral valve replacement

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Introduction

Paravalvular leaks are well-known complications seen following cardiac valve surgery. Fifteen years after mitral valve replacement (MVR), 17% of patients will present with a paravalvular leak.1,2 Interestingly, 25% of all paravalvular leaks are diagnosed in the immediate postoperative period. Based on the patient’s symptoms and on the degree of haemolysis, a reoperation may become necessary. This is associated with increased morbidity and mortality. Recognizing and repairing paravalvular leaks at the time of the initial surgery can potentially avoid the need for a reoperation.

We report a case in which real-time three-dimensional TEE (3D-TEE) was utilized intraoperatively to identify the number, severity, and precise locations of a paravalvular leak at the time of surgery for mitral valve replacement. The 3D image enabled the surgeon to pinpoint the location of the leaks prior to returning to cardio-pulmonary bypass (CPB).

Case report

A 79-year-old female with past medical history of severe symptomatic mitral regurgitation (MR) presented to the operating theatre for mitral valve surgery. She stood 165 cm tall and weighed 73 kg. The pre-procedural TEE confirmed the diagnosis of severe MR showing severe posterior annular and posterior leaflet calcification. Additionally, P2 and P3 segment prolapse with ruptured chordae tendineae could be identified (Figure 1, Supplementary data online, Movies 1 and 2). Owing to the heavy degree of calcification, lack of mobile tissue of the posterior leaflet, and the patient’s advanced age, the surgeon decided to replace the mitral valve with a bioprosthesis (Hancock II porcine, size 27). Moderate tricuspid regurgitation and a patent foramen ovale were also identified echocardiographically and surgically corrected.

After separation from CPB, a paravalvular leak was identified by two-dimensional echocardiography (2DE) (Supplementary data online, Movie 3). The image obtained in the mid-oesophageal commissural view shows a paravalvular leak in the vicinity of where the postero-medial leaflet prolapses. The 3D image enabled the surgeon to identify the location of the leaks prior to returning to cardio-pulmonary bypass (CPB).

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commissure of the native mitral valve would be located. Subsequently, real-time 3D colour Doppler was utilized to gain better understanding of the precise anatomical location of this paravalvular leak (Matrix T, Philips Medical Systems, Andover, MA, USA). The 3D image revealed a second paravalvular leak that had not been previously appreciated by 2D imaging. While the first leak was in close proximity to the posterior commissure, the second leak was further posterior (Figure 2, Supplementary data online, Movies 4 and 5). The decision was made to return to CPB to repair the leaks. After separating from CPB for the second time, no paravalvular leaks could be identified (Supplementary data online, Movies 6 and 7). The patient was brought to the intensive care unit in stable condition. She was extubated on postoperative day 1 and discharged from hospital on postoperative day 14.

Discussion

Although two-dimensional trans-oesophageal echocardiography (2D-TEE) is very sensitive in accurately identifying the presence of a paravalvular leak (88%), pinpointing the exact anatomical location can be very challenging. Currently, to properly assess anatomical and pathological structures, the echocardiographer integrates multiple ‘standardized’ 2D views to create a ‘mental’ 3D image. Conveying this ‘mental’ image to non-echocardiographers can be very difficult.

In order to successfully close the leaks, especially when they are small, the echocardiographer must effectively communicate the anatomical location(s) to the surgeon because the localization of paravalvular leaks becomes even more difficult once the heart is arrested and flaccid.

Three-dimensional echocardiography was first described in the 1970s, but until recently was rarely utilized on a regular basis in the busy operating theatre environment. This was because the acquisition of ECG and respiratory-gated 2D images, which subsequently required off-line reconstruction, was very time-consuming. The Matrix T probe, introduced clinically in 2007, can quickly and easily collect real-time 3D images, enabling the echocardiographer to provide the surgeon with a view that contains all pertinent information and can be interpreted even by non-echocardiographers. This in turn results in better understanding of a patient’s specific pathology.

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Supplementary data

Supplementary data are available at European Journal of Echocardiography online.

References