JRSM Cardiovascular Disease
Volume 9: 1–3

DOI: 10.1177/2048004020947290
journals.sagepub.com/home/cvd
SAGE

Paravalvular leak closure with real time transesophageal echocardiography and fluoroscopy fusion

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Abstract

Transcatheter technology has been increasingly used for paravalvular leak closure. We report the use of "*Fusion Technology*" (EchoNaviagator, Phillips, Tustin, CA) that combines real-time 2 and 3 dimensional trans-esophageal echocardiography with fluoroscopy imaging to facilitate paravalvular leak closure. This could help to identify the exact site, size, depth and shape of the paravalvular leak for proper positioning of the occluder device, which may result in saving time and effort.

Keywords

Paravalvular leak, echonavigator, fusion technique, device closure

Date received: 10 May 2020; revised: 19 June 2020; accepted: 9 July 2020

Introduction

Paravalvular leak (PVL) following valve replacement is a common complication ranging from 2 to 17%.[1] Most patients remain asymptomatic; however, some patients present with progressive shortness of breath, congestive heart failure, and/or hemolytic anemia.[2] Traditionally, patients with PVL were managed with afterload reduction or surgical repair or replacement. However, recently, transcatheter PVL closure has shown to be a less invasive, safer, and more effective approach.[3] Different cardiac imaging techniques allow pre-procedural diagnosis and intervention. Both real-time 2 and 3 Dimensional transesophageal echocardiography (TEE) and fluoroscopy imaging have been used in the evaluation and monitoring of the trans-catheter-based procedures.[4] In this report, we *merge* these two imaging modalities using the *EchoNavigator* system (Phillips, Tustin, CA) for trans-catheter aortic paravalvular leak closure in a patient who presented two months after a bioprosthetic aortic valve replacement.

Case presentation

A 61-year-old female underwent aortic valve replacement for aortic stenosis (Sievers Type 1 bicuspid valve) with a 23-mm Edwards Inspiris valve. Intra-operative Transesophageal echocardiography (TEE) showed excellent function of the prosthetic valve with a mean gradient of 7 mmHg and no leak. The postoperative course was smooth, and the patient was discharged on post-operative day five. Two months later, she presented with dyspnea on exertion and chest pressure. At presentation, the patient had no fever, chills, sweats or weight loss and blood cultures were negative. Laboratory analysis showed no hemolysis. Transesophageal echocardiogram (TEE) revealed the bioprosthetic valve cusps had normal excursion; however, a moderate peri-valvular leak was noted (Figure 1(a)). The patient was brought to the cath lab for closure. Real-time 2-dimensional (2D) and 3-dimensional (3D) TEE were employed with the EchoNavigator system *(Philips, Tustin, Ca, USA…)*.

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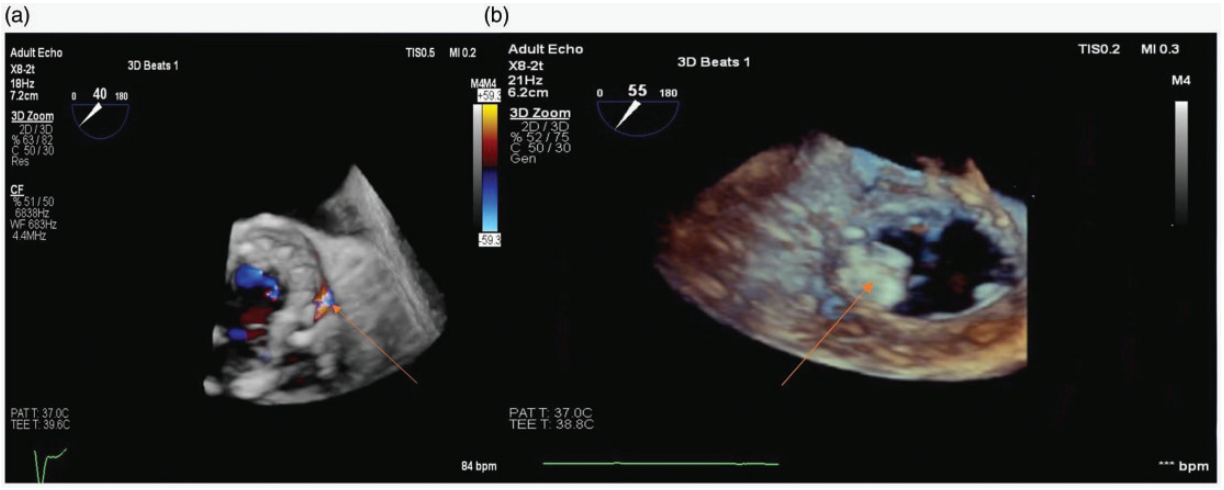

Figure 1. (a) 3D image of pre-procedural color flow TEE Doppler shows prosthetic aortic valve paravalvular leak (between the sewing ring and the aortic wall) at the anterolateral aspect. The arrow points to the leakage site. (b) 3D TEE images showing plug placement (ventricular view) of aortic valve. The arrow shows the plug position after placement.

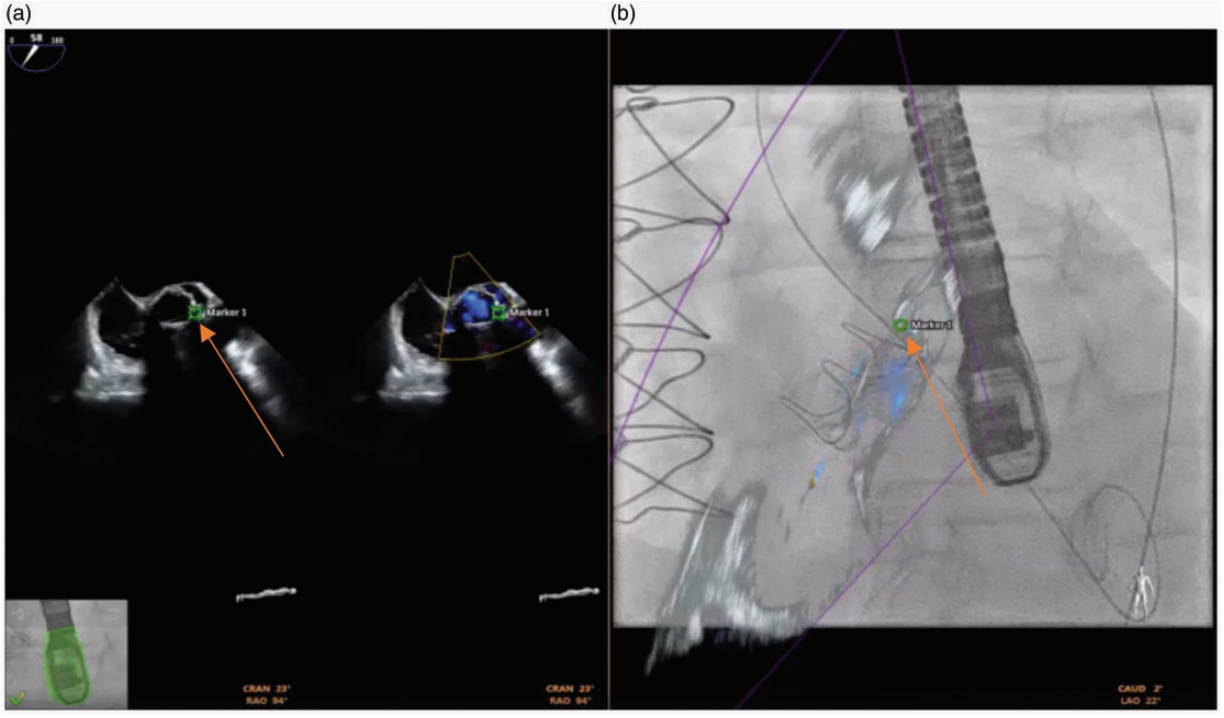

Figure 2. (a) 2D TEE images show prosthetic aortic valve with exact leakage site (defect) marked by the green circle. The arrows (2 A,B) point to the leakage site. (b) 2D TEE images are oriented according to C-arm position and fused with fluoroscopy image (merging technique) using the EchoNavigator system, so that the exact leakage site (green circle) can appear on fluoroscopy, thus facilitating the passage of the wire and plug placement.

The C-arm and the table were adjusted to be able to visualize the TEE probe in the fluoroscopy field. This helped the fusion software EchoNavigator system to identify the TEE probe and adjust its position with the table and the angulation of the C-arm. Through this way, the c-arm and TEE probe can be manipulated with the fused images maintained.[5] This technology helped identify the exact site, size, depth and shape of the paravalvular leak in the left coronary sinus, which was marked in the Echo Navigator system facilitating passage of a guidewire across the leak (Figure 2(a) and (b)). An AL1 diagnostic catheter and flexible straight wire were advanced through the defect into the ventricle. Next, a 5 Fr Glide catheter was advanced deep into the

ventricle. A Confida wire (*Medtronic, MN*) was carefully advanced into the ventricle. A 6 Fr guide catheter and 5 Fr diagnostic catheter telescoped, were advanced into the ventricle. An occluder device (Amplatzer 5/4 mm *St. Jude Medical, Inc.; Minnesota, USA*) was positioned across the leak site. Excellent device position was confirmed on TEE (Figure 1(b)), and aortography showed no aortic insufficiency (AI). The post-procedure clinical course of the patient was smooth. At 4 weeks, a follow-up TTE showed no prosthetic stenosis (PK velocity 2.4 m/s, mean gradient 12 mmHg) and no residual paravalvular regurgitation.

Comment

The percutaneous repair of paravalvular leaks has been widely adopted as an alternative to open surgery.[6] The transcatheter challenges during paravalvular leak closure relate to poor quality of the echocardiography imaging due to shadowing by the prosthetic valve, especially with mechanical valves. The *EchoNavigator* software has been used previously in percutaneous interventions for structural heart disease including: transapical TAVI procedures, atrial septal defect closure, left atrial appendage closure and mitral valve clip procedures.[7] Our report highlights how fusion of real-time TEE and fluoroscopy imaging with the EchoNavigator system facilitates transcatheter paravalvular leak closure. Improved imaging guides the procedure making it quicker and safer leading to better outcomes.

Acknowledgements

This case is a part of an ongoing research project led by Dr Thomas Beaver.

Contributorship

HFA, JWP, AAB, MA, TMB conceived and contributed equally.

Declaration of conflicting interests

The author(s) declared no potential conflicts of interest with respect to the research, authorship, and/or publication of this article.

Ethical approval

Written consent was provided by patient to report and publish this case.

Funding

The author(s) received no financial support for the research, authorship, and/or publication of this article.

Guarantor

Not applicable.

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