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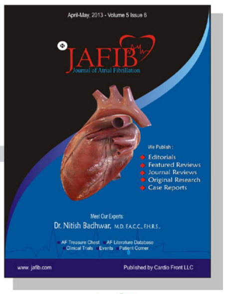

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Three-Dimensional Transoesophageal Echocardiography in Electrophysiology Laboratory

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Abstract

Percutaneous electrophysiological interventions such as atrial fibrillation and ventricular tachycardia ablation are usually monitored by fluoroscopy and electroanatomical mapping systems. Electroanatomical mapping systems lacks soft tissue contrast and adequate visualization of the target area such as right ventricular out-flow tract and left atrium. Recently, real-time 3D transoesophageal echocardiography (RT-3D TEE) has emerged as an important method for visualizing cardiac structures such as left atrium, left atrial appendix, interatrial septum, pulmonary veins, Marshall ligament and mitral valve annulus during invasive procedures. This review aims to describe the RT-3D TEE for the guidance of percutaneous interventional electrophysiological study especially at atrial fibrillation in the cardiac electrophysiology laboratory.

Introduction

Percutaneous electrophysiological interventions including catheter ablation of supraventricular and/or ventricular tachycardia are usually monitored by fluoroscopy and electroanatomical mapping systems.[1,2] Use of the electroanatomical mapping systems including Ensite NaVx and/or CARTO has been shown to reduce fluoroscopic time and radiation dose. Although this systems can be used for complex procedures such as atrial fibrillation and ventricular tachycardia, it lacks soft tissue contrast and adequate visualization of the target area such as right ventricular out-flow tract and left atrium .[2] Two Dimensional (2D) intracardiac echocardiography can also use for the guidance of electrophysiological interventions especially ablation of the atrial fibrillation. This technique improves the efficacy of electrophysiological procedures by identifying anatomical structures and integrating this information with electrophysiological parameters and/or three dimensional (3D) reconstructions of computed tomography/magnetic resonance imaging data. [3] This method is limited by its invasive nature, using large sheaths, 11 F sheath for a 10 F intracardiac echocardiography catheter or 9 F sheath for an 8 F intracardiac echocardiography catheter,[3] with possible bleeding complications. [2] Recently, in line with improvement in the quality of echocardiographic imaging, real-time 3D transoesophageal echocardiography (RT-3D TEE), (is not off-line 3D reconstruction), is available to facilitate electrophysiological procedures such as transseptal puncture without fluoroscopy.[2] It is possible to obtain cross-sectional visualization of the left atrium, left atrial appendix, pulmonary

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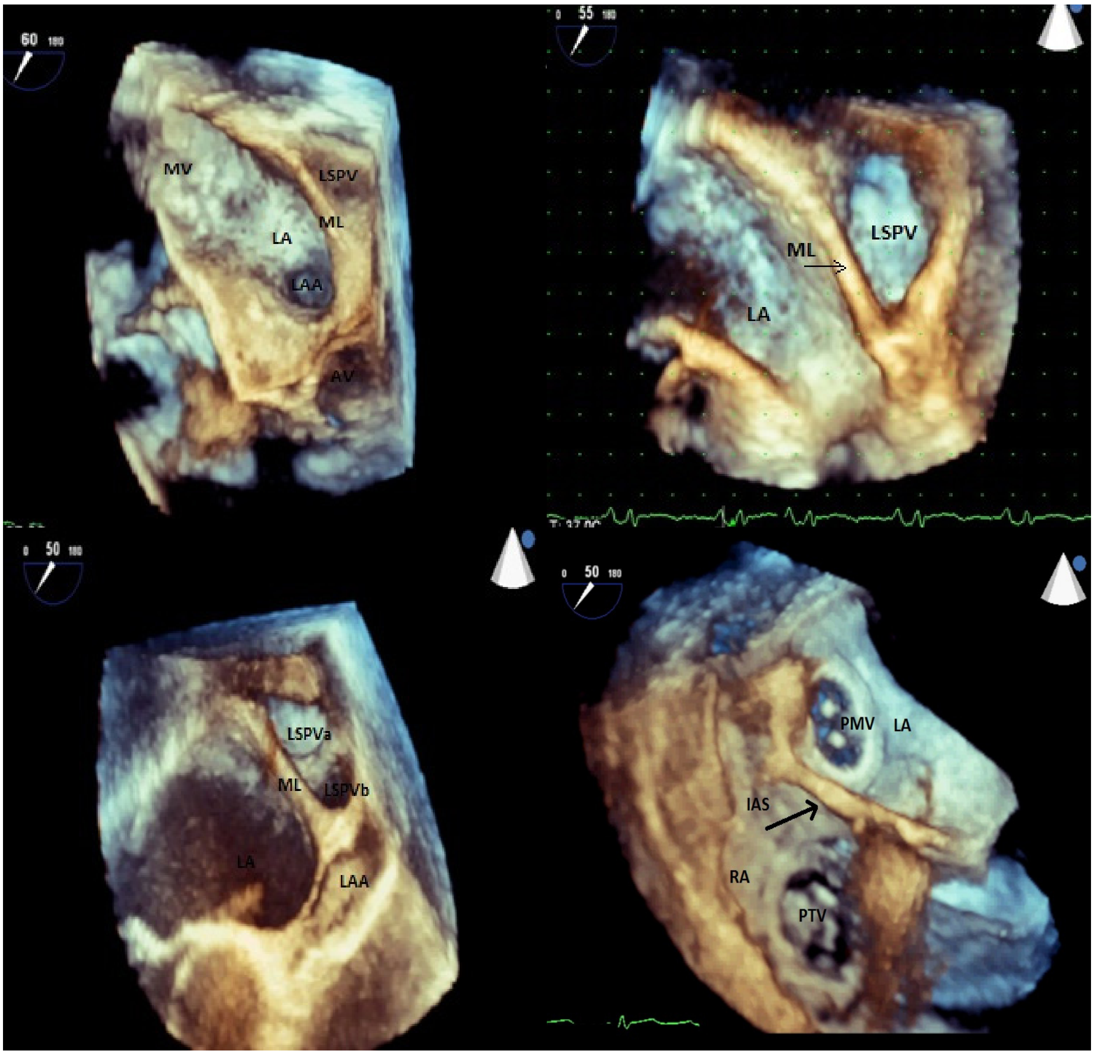
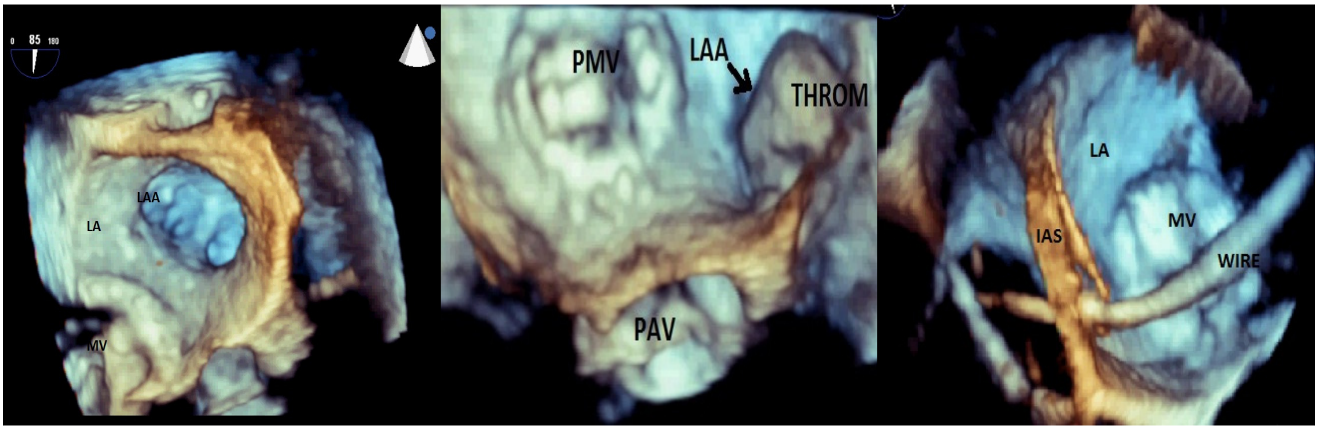
Figure 1: It is possible to obtain excellent visualization of the anatomical area with RT-3D TEE during interventional electrophysiology [**LA**: Left atrium, RA: Right atrium, **LAA**: Left atrial appendix, **LSPV**: Left superior pulmonary vein, **LSPV**a (anatomical variation): Left superior pulmonary vein a, **LSPV**b (anatomical variation): Left superior pulmonary vein b, **MV**: Mitral valve, **ML**: Marshall ligament, **IAS**: Interatrial septum, **THROM**: Thrombus, **PMV**: Prosthetic mitral valve, **PAV**: Prosthetic aortic valve, **PTV**: Prosthetic tricuspid Value]



veins such as left superior pulmonary vein and its anatomical variations, mitral valve annulus, thrombus, and prosthetic valves less invasively with RT-3D TEE [2] (Figure 1,2), which are not possible with 2D TEE.

RT-3D TEE was performed in the supine position using an iE33 echocardiography system (Philips Medical Systems, Andover, USA) with a RT-3D Matrix transducer (X7-2t).[4,5] Initially, gain settings were optimized using the narrow angle gain mode without the need for electrocardiography, which allowed us to obtain RT-3D images of an approximately 30°X60° pyramidale volume. To magnify the pyramidal volume, 3D zoom mode was used for anatomical and pathological tissue visualization such as mitral valve, pulmonary veins and thrombus. Image pages were divided automatically by the instrument into 2 mm or 5 mm squares for measurement of image size. The size of the images including pulmonary veins, left atrial appendix, mitral valve, patent foramen ovale and thrombus were estimated by these squares.[5] Although RT-3D TEE allows for unique perspectives for catheter-based procedures such as atrial fibrillation, some disadvantages of RT-3D TEE must be considered as well. One disadvantage is prolonged TEE probe exposure time most likely due to the learning curve because of the new technique. Secondly, this technique is still limited by a relatively low temporal and spatial resolution when compared with conventional 2D TEE. Additionally, needs for off-line reconstruction and analysis for 3D distances and volumes. Third, the anaesthesiol-

Figure 2: Visualization of the left atrial appendix, its thrombus and transseptal puncture (**MV**: Mitral valve, **LA**: Left atrium, **LAA**: Left atrial appendix, **THROM**: Thrombus, **PMV**: Prosthetic mitral valve, **PAV**: Prosthetic aortic valve, **IAS**: Interatrial septum)



ogy personnel are required during the procedure for atrial fibrillation for sedation. Finally, the high cost of equipment such as the transducer and the 3D-capable echo system be limiting factors for a number of echo laboratories.

Conclusions

Implementation of RT-3D TEE in percutaneous electrophysiological interventions especially atrial fibrillation, left atrial appendage closure and transseptal puncture results in reduction of fluoroscopic time and radiation dose, may reduce complication ratio, and may improve in-hospital and long term outcomes.

Disclosures

No disclosures relevant to this article were made by the authors.

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