

Use of Fusion Imaging in Safe, Rapid and Accurate Placement of Percutaneous Right Ventricular Assist Device in the Management of Acute Post-Surgical Right Ventricular Failure

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Abstract

Fusion imaging (FI) technology using Echo-Navigator that integrates live transesophageal echocardiogram (TEE) and overlays on real-time fluoroscopy. We present our experience placing a right ventricular (RV) support device, a ProtekDuo, in our patient with post-operative RV failure using FI to guide the implantation.

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Fusion imaging (FI) technology using Echo-Navigator (EchoNav, Philips Healthcare, Best, The Netherlands) integrates and overlays live/real-time transesophageal echocardiography (TEE) images on real-time fluoroscopy [1]. Here, we describe the novel use of FI guidance in the placement of a right ventricular assist device (RVAD, ProtekDuo, LivaNova, London, UK) in the proximal main pulmonary artery (MPA) beyond the pulmonic valve (PV) in an adult patient with post-operative right ventricular (RV) failure. The patient

was a 45-year-old man presenting with worsening dyspnea and fatigue for several months. Two-dimensional (2D) transthoracic echocardiogram (TTE) followed by 2DTEE showed severe bicuspid aortic valve stenosis with moderate insufficiency and severe mitral regurgitation (MR). The patient underwent successful mitral repair and aortic valve replacement but peri-procedurally suffered a ventricular fibrillation arrest (VF) requiring resuscitation and remained in cardiogenic shock. A subsequent 2DTTE showed severe RV dysfunction, and a decision for emergent placement of an RVAD via the right internal jugular vein was made. The device was successfully placed by utilizing FI guidance to visualize the PV in real-time and live TEE to accurately superimpose imaging. This helped facilitate the placement of the RVAD cannula tip in the MPA lumen beyond the PV (Figures 1-3, Video 1). Unlike standard techniques, in which echocardiographic and fluoroscopic images are interpreted separately, simultaneous visualization of TEE and fluoroscopic images on the same screen helped save time and ensure adequate placement, and the large bore device could be manipulated with improved precision, avoiding complications such as malposition, valvular damage, or cardiac perforation.

Thus, FI played a crucial role in the reliable, safe, and rapid placement of the RVAD device in our patient. In addition, the use of FI may reduce overall radiation exposure to both the patient and cath lab personnel during the procedure by placing more dependence on echo guidance supplemented by intermittent X-ray imaging when necessary. Furthermore, it may improve efficiency by allowing for more accurate device placement, avoiding the need for device positioning changes, streamlining procedural workflow, and reducing the need for equipment setup, multiple monitors, or conflicting information in the cath lab [2]. The integration of FI can also improve the education of trainees. The use of FI has been shown to enhance the learning curve of interventionists performing advanced structural procedures [3]. Following RVAD implantation and subsequent placement of an implantable cardiac-defibrillator (ICD), our patient showed improvement in RV function by 2DTTE, was then weaned off the RVAD, gradually recuperated, and a month later was able to be discharged in good condition.

References

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Figures/Video with Captions:

Figure 1. Right ventricular assist device (RVAD) implantation guided by fusion imaging (FI). Anatomically correct superimposition of TEE images of the pulmonic valve and main pulmonary artery in real time on the fluoroscopy screen using FI. FI was assistive in guiding the guide-wire to course through the right ventricle, across the pulmonic valve, and into the right pulmonary artery to ensure that the RVAD followed the path for precise implantation. **Video 1** . Shows real time accurate implantation of the RVAD cannula as it is guided using FI, 3-4 cm across the pulmonic valve with the tip placed in the main pulmonary artery.

Figure 2. Right ventricular assist device (RVAD) implantation guided by fusion imaging (FI). Two-dimensional TEE image showing the tip of the RVAD positioned in the main pulmonary artery distal to the pulmonic valve.



