

The Role of Transesophageal Echocardiography in Device Closure of Peri-membranous Ventricular Septal Defects with the Hybrid Approach

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Abstract

Key Points · Periventricular device closure of peri-membranous ventricular septal defects is safe and effective when compared to conventional surgery and transcatheter device closure. · Intraprocedural transesophageal echocardiography can effectively guide periventricular device closure of peri-membranous ventricular septal defects and improve safety and success rate. · Hybrid approach improves the outcomes in select patients with congenital heart diseases and complex anatomical defects.

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· Periventricular device closure of peri-membranous ventricular septal defects is safe and effective when compared to conventional surgery and transcatheter device closure. · Intraprocedural transesophageal echocardiography can effectively guide periventricular device closure of peri-membranous ventricular septal defects and improve safety and success rate. · Hybrid approach improves the outcomes in select patients with congenital heart diseases and complex anatomical defects.

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In 1966 Drs. Rashkind & Miller set up the stage for transcatheter therapy in congenital heart disease with the publication “Creation of an atrial septal defect without thoracotomy: palliative approach to complete transposition of the great arteries”(1). Since then transcatheter therapy has become the main stay for repair and palliation of select congenital heart defects resulting in improved outcomes. Over the last two decades this has further expanded into hybrid procedures in which the pediatric cardiothoracic surgeons, pediatric interventional cardiologists and pediatric echocardiographers collaborate to perform the procedure with the least invasive approach. An integral part of the success of the hybrid procedures has been the role of transesophageal echocardiography (TEE) in guiding the intervention without the need for fluoroscopy thereby minimizing radiation exposure to the patient (2,3). A meta-analysis of transcatheter device closure of peri-membranous ventricular septal defects (Pm-VSDs) showed a high success rate of device implantation with acceptable margin of safety and rate of complications (4). In patients where transcatheter approach is challenging an alternative approach with comparable results to the transcatheter approach is the role of per ventricular closure with a device through a minimally invasive incision without the need for cardiopulmonary bypass (5).

Yu Jin et al (6) in their report focus on the value of intraprocedural TEE to assist with device closure of the Pm-VSD through the per-ventricular approach. The study is retrospective and includes 207 children with Pm-VSD who underwent device closure of the defect under TEE guidance through a “ultra-minimal trans intercostal incision”. The practical ease of the procedure and the benefits of using TEE intra-procedurally were emphasized in this report. TEE was invaluable in selecting the access site on the right ventricle, guiding the positioning of the guidewire and the delivery sheath. The authors concluded that the clarity of images obtained by TEE during this procedure helped in navigating the anatomically difficult lesions, device selection and positioning to prevent interference of the device with the aortic and mitral valve. TEE also assessed the residual shunt and stability of the device prior to and after release. In this report the rate of successful device occlusion of the Pm-VSDs was 97.64%. Overall this paper has demonstrated that TEE guided closure of a Pm-VSD via minimally invasive device closure is a safe and effective procedure with excellent outcomes when performed by an experienced imager. This has been demonstrated in other studies where TEE was used to guide similar procedures with good outcomes (7).

Per ventricular approach for closure of ventricular septal defects was first described by Amin and colleagues in 1998 (8). This approach should be considered in patients who are too small for transcatheter closure, patients with limited vessel access and in patients with complex VSD anatomy where device placement and device maneuverability may be challenging. The advantage of not requiring or shortening the time of cardiopulmonary bypass is also an added value to the procedure. The success of the procedure is dependent on intra-procedural imaging by TEE in order to assess the anatomy of the defect and to mitigate the potential complications of device closure by guiding the device delivery and adjusting or repositioning the device if needed (9,10). The use of TEE during the hybrid approach gives a wider field of view thereby allowing access to the lesions where percutaneous delivery of the device is restricted (11).

Hybrid procedures minimize the perioperative morbidity and improve the long term outcomes in patients. This approach utilizes the strengths and minimizes the limitations of the individual procedures. The future in the treatment of congenital heart disease will be a collaborative effort to get the best outcomes with the least invasive procedure.

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