

HeartWare Left Ventricular Assist Device Implantation Combined with Surgical Ventricular Reconstruction

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Abstract

Left ventricular assist devices (LVADs) extend survival of patients with end-stage heart failure as a bridge to transplant or for destination therapy. However, implant of these devices may be challenging, especially in cases of a left ventricular aneurysm involving the left ventricular apical wall. In this report, we describe a symptomatic patient with ischemic cardiomyopathy and a large left ventricular anterior aneurysm treated by reconstruction of the left ventricle and simultaneous implant of the HeartWare LVAD system (HVAD; HeartWare International, Inc., Framingham, MA, USA).

Key words: Left ventricular aneurysm, LVAD, Myocardial infarction

Case Report

A 62-year-old male patient was referred to our center 26 days after acute myocardial infarction with ischemic cardiomyopathy and New York Heart Association functional class IV heart failure. Echocardiography revealed left ventricular ejection fraction of 12% and a large left ventricular aneurysm (4.0 × 3.5 × 3.0 cm). Left ventricular apical wall thickness was 4.0 mm on echocardiography. Cardiac catheterization was performed; pulmonary vascular resistance was 6 mm Hg·min⁻¹·L⁻¹, and transpulmonary pressure gradient was 18 mm Hg. Therefore, the patient was not a candidate for heart transplant. Left ventricular assist device implantation

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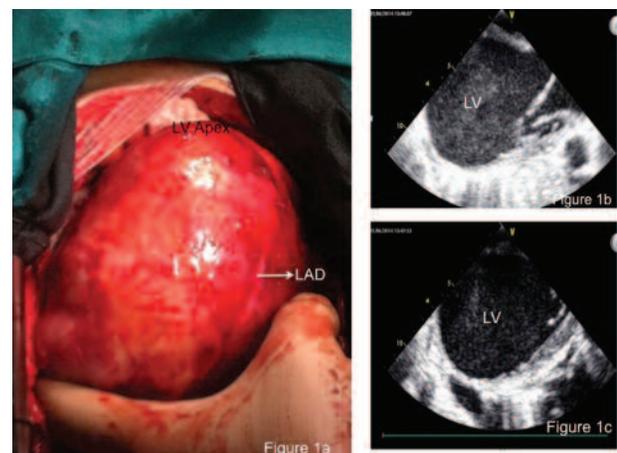
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with surgical ventricular reconstruction was decided due to the patient's deteriorating clinical situation, despite maximal medical therapy.

After median sternotomy, cardiopulmonary bypass was established via aortocaval cannulation. A large aneurysm involving the anterior and lateral wall of the heart was encountered (Figure 1). Aneurysm resection with linear reconstruction was performed by a longitudinal incision parallel to the left anterior descending artery with subendocardial thrombectomy, without cross-clamp and cardioplegia, on the beating heart. Resection was extended to the anterior and lateral left ventricular wall, leaving behind approximately 4 cm of apical wall to implant the pump. The HVAD system was implanted using a standard technique as described in the instructions for use (Figure 2). Intraoperative epicardial echocardiography revealed geometrical symmetry with reduction of the left ventricle cavity (Figure 3). The HVAD was fully functional postoperatively. The patient was extubated on postoperative day 1. The patient's postoperative

Figure 1. Large Aneurysm Involving the Anterior and Lateral Wall of the Heart



Abbreviations: LAD, left anterior descending artery; LV, left ventricle
(a) Intraoperative location of the left ventricular aneurysm. (b), (c) Echocardiography results showing positioning of the left ventricular aneurysm.

period was uneventful, and he was discharged home on postoperative day 12 with a therapeutic international normalized ratio level.

Figure 2. Positioning of the Left Ventricular Assist Device Ring After Left Ventricle Linear Reconstruction

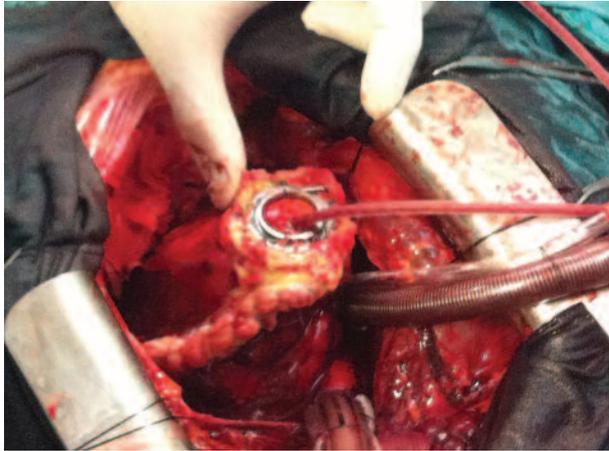
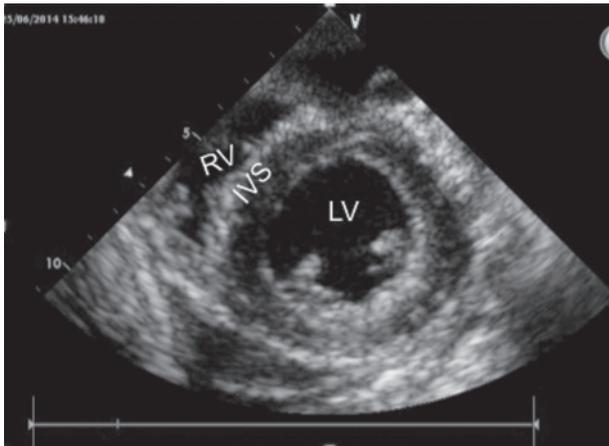


Figure 3. Intraoperative Epicardial Echocardiography: Geometrical Symmetry With Reduction of the Left Ventricular Cavity



Abbreviations: IVS, interventricular septum; LV, left ventricle; RV, right ventricle

Discussion

Over the past 2 decades, successful LVAD implantation for end-stage heart failure as destination therapy or bridge to transplant has been demonstrated in large trials.^{1,2} However, feasibility and success may be challenging in the face of frequently seen complications. In addition to complications during and after the procedure, there are sometimes concerns regarding comorbidities, such as intraventricular thrombosis, mechanical valve complications, left ventricle aneurysm, and aortic regurgitation. Left ventricular aneurysm is a dyskinetic or akinetic portion of the ventricle, most

commonly resulting from myocardial infarction. Left ventricular assist device implantation in patients with left ventricle aneurysm is rare and not frequently found in the literature.³⁻⁵

In our patient, a decision was made to implant the HVAD system with simultaneous ventricular reconstruction. Thrombectomy without ventricular reconstruction could result in a potential endocardial surface amenable to newly generated thrombus with a resultant increased risk of a cerebrovascular event or pump thrombosis. Furthermore, it would be a challenging surgical procedure to implant the device in the considerably thinned ventricular wall. Therefore, we decided on reconstruction of the ventricular wall followed by implantation of the HVAD.

There are 3 previous reports of ventricular reconstruction along with continuous flow LVAD implantation. Garbade and associates reported a simultaneous Dor procedure with LVAD insertion (Thoratec HeartMate II; Thoratec Corporation, Pleasanton, CA, USA).³ They implanted the device on the synthetic patch of the reconstruction site. Although this seems a reasonable method, there are some drawbacks regarding the stability and hemostatic fixation site of the device on synthetic patch material. On the other hand, this technique may provide a more consistent reconstructed ventricular geometry for long-term support. Chernyavskiy and associates also described insertion of an LVAD (Berlin Heart INCOR; Berlin Heart Inc., The Woodlands, TX, USA) in which they secured the inflow cannula onto the synthetic patch material.⁴ More recently, Fatullayev and associates described a method without the use of synthetic material, partially reconstructing the ventricular wall followed by LVAD implantation (HeartWare device) onto the remaining part of the apical wall.⁵ We believe this may provide a more stable and hemostatic surgical option.

Conclusions

In recent years, although total artificial heart implantation is usually recommended in patients with cardiomyopathy and left ventricular aneurysm due to the thinning of the apical wall and difficulty of LVAD insertion, which includes a high risk of surgical mortality, we believe that implantation of latest generation LVAD is a viable alternative due to ease of implantation and lack of postimplant resistance in left ventricle contractility. Our

experience shows that left ventricular aneurysm resection may be compatible with the simultaneous insertion of the HVAD system.

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