Published in final edited form as:
Thorac Cardiovasc Surg. 2011 March ; 59(2): 119–120. doi:10.1055/s-0030-1250637.

Repair of Abdominal Aortic Aneurysm in Heart Transplant Patients: Before or after Left Ventricular Assist Device Implantation?

G. S. Mehta, **C. M. Bhamidipati**, **D. J. LaPar**, **G. Ailawadi**, and **J. A. Kern**
Division of Thoracic and Cardiovascular Surgery, Department of Surgery, University of Virginia, Charlottesville, Virginia, United States

Abstract

Endovascular abdominal aortic aneurysm repair in decompensated heart failure patients requiring ventricular assist device (VAD) placement needs careful consideration of both complex disease states. We present this clinical dilemma and describe our choice of transcatheter aneurysm repair in the face of advanced refractory heart failure following VAD implantation.

Keywords

aneurysm; aorta/aortic; circulatory assist devices (IABP, LVAD, RVAD, BVAD, TAH); endovascular procedures/stents, except PCI; heart failure; heart transplantation

Clinical Summary

A 51-year-old male awaiting bridge to transplant (BTT) (status: post-quadruple coronary bypass, mitral valve annuloplasty, and biventricular pacemaker placement, with uncontrolled hypertension, and ischemic cardiomyopathy, in New York Heart Association [NYHA] class IV congestive heart failure [CHF]) developed acute decompen-sated heart failure. Given the extremis presentation, a HeartMate II™ (Thoratec Corp., Pleasanton, CA, USA) left ventricular assist device (LVAD) implantation was pursued. Cardiopulmonary bypass (CPB) via the right axillary artery and femoral vein was accomplished, and redo sternotomy, pericardial adhesiolysis, and aortic cross-clamping were uneventful. LVAD inflow was attached to the left ventricle, the outflow conduit was attached to the ascending aorta, and pump speed was set at 9600 rpm with a mean flow rate of 5.5 lpm. The perioperative course and intensive unit stay were unremarkable, and oral anticoagulation to maintain an international normalized ratio (INR) of between 2.0–3.0 was started following intravenous heparin therapy.

The patient was known to have a 4.8-cm fusiform, infrarenal, abdominal aortic aneurysm (AAA), and since the patient responded amazingly well, endovascular aneurysm repair (EVAR) was offered 10 days after LVAD placement. Anticoagulation was transitioned to intravenous heparin, and 2 weeks after the initial operation, a transcatheter Powerlink® (Endologix, Inc., Irvine, CA, USA) bifurcated stent-graft along with a 25 × 95-mm supra-renal extension were placed. On the day of EVAR, pump flow was 5.4–6.3 lpm; while the

Correspondence ***John A. Kern, MD*** Associate Professor of Surgery Division of Thoracic and Cardiovascular Surgery Department of Surgery University of Virginia Health System P. O. Box 800679 Charlottesville, VA 22908 USA Phone: + 14349824301 Fax: + 14342435781 jkern@virginia.edu.

speed remained constant at 9600 rpm, the pulse index varied between 2.3–3.0, and pump power ranged between 6.9–7.5 W. Endografting was accomplished using bilateral femoral access, and LVAD flows did not require adjustment. Immediately following the procedure, there was no evidence of endoleak by Cook Coda® (Cook Medical, Inc., Bloomington, IN, USA) endo-balloon. Subsequent hospitalization was uneventful, and oral anticoagulation to maintain an INR of 2.0 was initiated. The patient was discharged home one week after EVAR, 30-day and serial 3-month follow-ups revealed no endoleak with improvement of cardiac function to NYHA class II.

Discussion

According to the United Network for Organ Sharing database, the available number of donor hearts has remained constant over the last 10 years. In contrast, with the rising incidence of CHF and increasingly numbers of transplant centers offering mechanical alternatives, the use of LVAD to treat refractory CHF has increased the prevalence of advanced functional heart failure [1]. Importantly, even though patients on LVAD as BTT can improve significantly [2], multifactorial constraints may lengthen the duration on mechanical support. Given the timing of FDA clearance for BTT, HeartMate™ II was ideal for our patient. Given that LVAD is a relatively new technology, there are no established guidelines and no randomized trials to reference when treating AAA in heart transplant patients managed by LVAD. Management of such challenging dilemmas as the repair of small AAA in heart transplant patients depends on center excellence and surgeon volume.

It is well known that an AAA ≥ 5.0 cm is a contraindication to LVAD placement as destination therapy (DT). Our decision to repair the AAA after LVAD implantation was made based on several considerations. Foremost, severe vascular disease has been repeatedly listed as a contraindication to heart transplant, and worsening of AAA after heart transplant is well documented [3]. Further, while rupture of small sized aneurysms is known to occur, the presence of an infrarenal fusiform aneurysm in the setting of hyperlipidemia and advanced arterial disease with uncontrolled hypertension is catastrophic. With an aneurysm growth of 0.3–0.5 cm/year our patient would have required AAA repair ≤ 2 years. When risk-adjusted to a non-heart transplant candidate, LVAD patients with known AAA should undergo enhanced aneurysm surveillance and “prophylactic” repair despite the size because of the increased rupture risk [4]. The excellent intermediate post-LVAD recovery was serendipitous to EVAR, and, importantly, our decision avoided rehospitalization, an unnecessary economic burden, and prevented psychological insult.

Insofar as EVAR raises troponin-T *de novo* due to myocardial damage, deferring AAA repair following transplant would have been detrimental to the newly transplanted heart. Significantly, the AAA repair stabilized the distal aorta for planned subsequent femoral cannulation during potential transplant surgery. In conjunction with the above practical benefits, other important technical advantages such as the exclusion of any residual mural thrombus, putative cerebral protection at the next operation, and maximum preservation of the native aorta with remodeling advantages were important considerations for our decision. Thus we submit that if a similar AAA in a risk-adjusted non-heart failure patient would have been repaired electively, then patients like ours should also receive similar access to therapy.

Fortuitously, recent articles have postulated that advances in VAD technology require a reconsideration of historical contraindications, and suggest that these criteria be revised [1, 5]. Clearly, adaptive patients lead a productive life with LVAD implantation, and should not be denied their second chance to life!

Acknowledgments

Support 1. T32/HL007849 (CMB) from the National Heart, Lung, and Blood Institute. The content is solely the responsibility of the authors and does not necessarily represent the official views of the National Heart, Lung, and Blood Institute or the National Institutes of Health.

2. Thoracic Surgery Foundation for Education and Research (GA).

References

1. Garatti A, Bruschi G, Colombo T, et al. Noncardiac surgical procedures in patient supported with long-term implantable left ventricular assist device. Am J Surg. 2009; 197(6):710–714. [PubMed: 18926514]
2. Allen JG, Weiss ES, Schaffer JM, et al. Quality of life and functional status in patients surviving 12 months after left ventricular assist device implantation. J Heart Lung Transplant. 2010; 29(3):278–285. [PubMed: 19837607]
3. Vantrimpont PJ, van Dalen BM, van Riemsdijk-van Overbeeke IC, Maat AP, Balk AH. Abdominal aortic aneurysms after heart transplantation. J Heart Lung Transplant. 2004; 23(2):171–177. [PubMed: 14761764]
4. Englesbe MJ, Wu AH, Clowes AW, Zierler RE. The prevalence and natural history of aortic aneurysms in heart and abdominal organ transplant patients. J Vasc Surg. 2003; 37(1):27–31. [PubMed: 12514574]
5. Krishnamani R, DeNofrio D, Konstam MA. Emerging ventricular assist devices for long-term cardiac support. Nat Rev Cardiol. 2010; 7(2):71–76. [PubMed: 20065952]