

destruction and dysfunction, hemodilution, and resulting coagulopathy. Avoidance of blood products may reduce the elevation in prereactive antibodies commonly observed in patients awaiting heart transplantation with LVADs.

This communication represents the application of off-pump technology for inserting a HeartMate Vented Electric LVAD with a cardiac stabilization device. This technique may reduce the morbidity and mortality associated with LVAD implantation and expand the indications for LVADs to patients with end-stage heart failure. This would be especially beneficial for older high risk patients not considered heart transplant candidates, such as those patients enrolled in the REMATCH trial (Randomized Evaluation of Mechanical Assistance for the Treatment of Congestive Heart Failure).³ Furthermore, for those patients who require an intracardiac repair (intraventricular thrombus removal or septal defect repairs) necessitating CPB at the time of the HeartMate Vented Electric LVAD implantation, our technique would permit off-pump preparation of the sewing cuff and aortic outflow cannula, thereby reducing CPB support time and its associated sequelae.

Addendum

The patient described in the preceding brief communication underwent successful transplantation 278 days (~9 months) after

his off-pump HeartMate VE implantation. He is currently recovering at home undergoing rehabilitation.

References

1. Hosenpud JD, Bennett LE, Keck BM, Boucek MM, Novick RJ. The Registry of the International Society for Heart and Lung Transplantation: eighteenth Official Report—2001. *J Heart Lung Transplant*. 2001; 20:805-15.
2. Kasirajan V, McCarthy PM, Hoercher KJ, Starling RC, Young JB, Banbury MK, et al. Clinical experience with long-term use of implantable left ventricular assist devices: indications, implantation, and outcomes. *Semin Thorac Cardiovasc Surg*. 2000;12:229-37.
3. Rose EA, Gelijns AC, Moskowitz AJ, Heitjan DF, Stevenson LW, Dembitsky W, et al. long-term use of a left ventricular assist device for end-stage heart failure. *N Engl J Med*. 2001;345:1435-43.
4. Bedi HS, Suri A, Kalkat MS, Sengar BS, Mahajan V, Chawla R, et al. Global myocardial revascularization without cardiopulmonary bypass using innovative techniques for myocardial stabilization and perfusion. *Ann Thorac Surg*. 2000;69:156-64.
5. Hall RI, Smith MS, Rocker G. The systemic inflammatory response to cardiopulmonary bypass: pathophysiological, therapeutic, and pharmacological considerations. *Anesth Analg*. 1997;805:766-82.
6. Cleveland JC Jr, Shroyer AL, Chen AY, Peterson E, Grover FL. Off-pump coronary artery bypass grafting decreases risk-adjusted mortality and morbidity. *Ann Thorac Surg*. 2001;72:1282-8.

Management of aortic insufficiency in patients with left ventricular assist devices: A simple coaptation stitch method (Park's stitch)

Soon J. Park, MD,^a Kenneth K. Liao, MD,^a Romualdo Seguro, MD,^a K. P. Madhu, MD,^b and Leslie W. Miller, MD,^b Minneapolis, Minn

Left ventricular assist device (LVAD) implantation increases survival and quality of life for patients with advanced heart failure.¹ Because of device design, competence of the native aortic valve is critically important. Even trivial aortic insufficiency could worsen with time,² and the

regurgitant flow could make the device ineffective for hemodynamic support.

Managing native aortic valve insufficiency at the time of LVAD implantation has been challenging. Various procedures to prevent aortic insufficiency have been anecdotally reported (eg, aortic valve replacement with a bioprosthetic valve or with a polytetrafluoroethylene patch, or primary closure of the aortic valve opening).³⁻⁵ Such procedures have been performed successfully, but they could make surgery more complicated. We describe a simple coaptation stitch method of dealing with central aortic insufficiency at the time of LVAD implantation in 2 patients.

Case Summaries

PATIENT 1. A 61-year-old man with a long-standing history of ischemic cardiomyopathy had a myocardial infarction and was in cardiogenic shock. The LVAD (HeartMate-XVE, Thoratec Corporation, Pleasanton, Calif) was implanted uneventfully. Because of patent venous grafts, anastomosis of the outflow graft to the aorta was completed under aortic crossclamping. Through the aortotomy incision between two proximal vein grafts we were able

From the Departments of Surgery^a and Medicine,^b University of Minnesota, Minneapolis, Minn.

Received for publication Jan 28, 2003; accepted for publication June 18, 2003.

Address for reprints: Soon J. Park, MD, Associate Professor, Director Cardiac Assistance Program, St Jude Medical Chair in Biomedical Engineering, University of Minnesota, Department of Surgery, 420 Delaware Street SE, MMC 207, Minneapolis, MN 55455 (E-mail: parkx021@umn.edu).

J Thorac Cardiovasc Surg 2004;127:264-6

0022-5223/\$30.00

Copyright © 2004 by The American Association for Thoracic Surgery

doi:10.1016/S0022-5223(03)01301-1

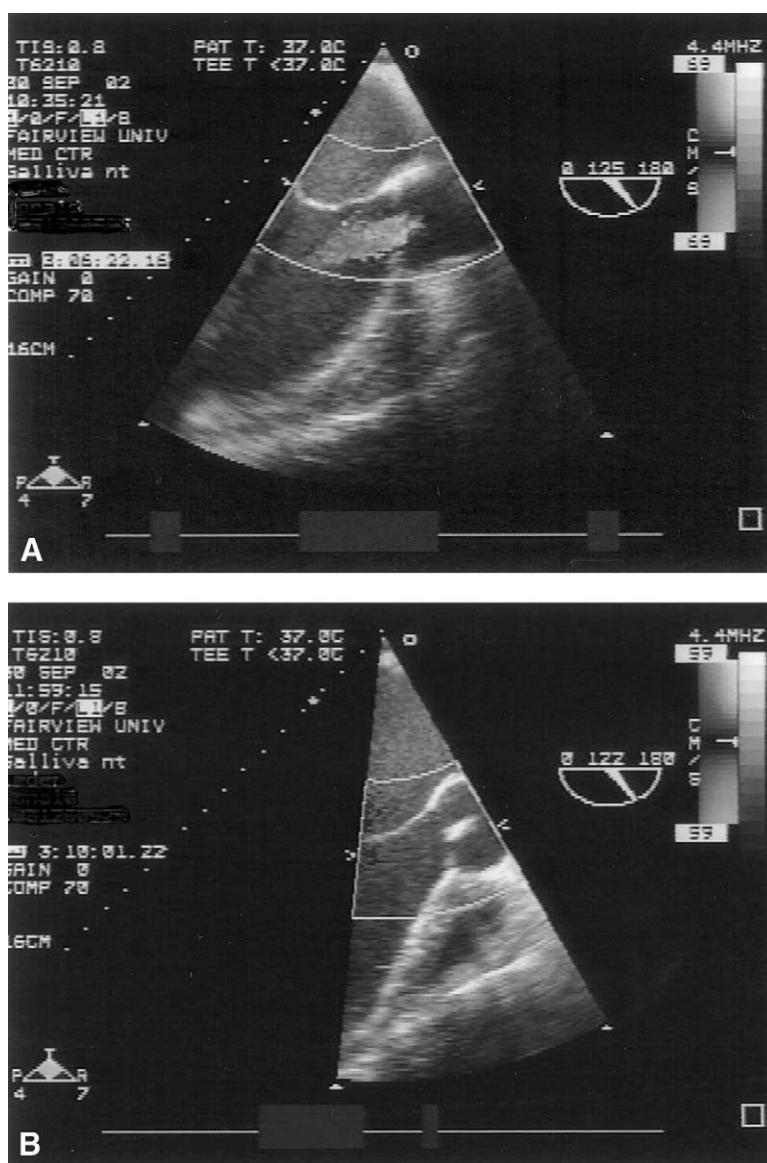


Figure 1. A, A transesophageal echocardiogram demonstrates a moderate aortic insufficiency jet. B, No aortic insufficiency is noted following placement of Park's coaptation stitch.

to inspect the native aortic valve for myxomatous changes. We then placed a coaptation stitch at the central portion of the cusps to ensure aortic valvular competence. The patient was supported with the LVAD as an outpatient for about 6 months, after which he underwent heart transplantation. His excised heart showed that the coaptation stitch was in good condition, without any commissural or leaflet problems.

PATIENT 2. A 61-year-old man with ischemic cardiomyopathy underwent HeartMate-XVE implantation uneventfully. The patient had a known mild to moderate aortic insufficiency. An aortic crossclamp was applied to arrest the heart. The aortotomy incision was made, and we were able to place a coaptation stitch at the central portion of the aortic leaflets to establish aortic competence (Figure 1). The patient was discharged from the hospital unevent-

fully and has been waiting for a heart transplant as an outpatient for the past 3.5 months.

Recommended Procedure

Candidates for LVAD implantation are evaluated by echocardiography to assess native aortic valve insufficiency. Those with pronounced aortic valve incompetence as a result of structural problems of the valve may need to undergo aortic valve replacement or surgical closure of the aortic valve leaflets. Mild to moderate aortic insufficiency, however, can be corrected with a simple coaptation stitch placed at the central portion of the three aortic cusps.

First, a routine median incision is made for LVAD implantation. The ascending aorta is cannulated centrally with an aortic

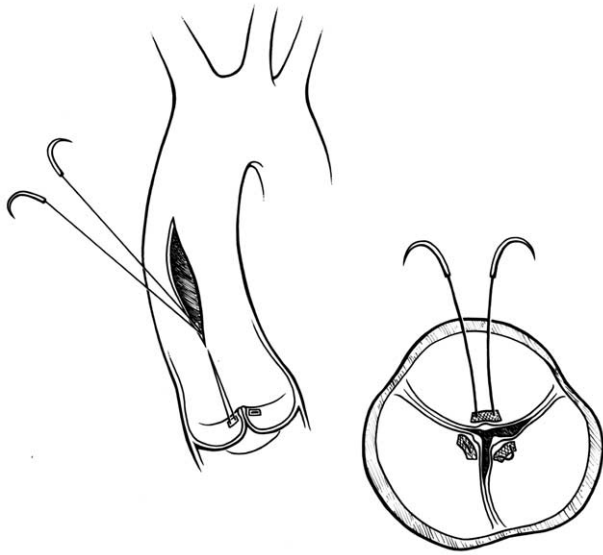


Figure 2. Pledgeted 4-0 Prolene sutures are applied to approximate the fibrous nodules of Arantius to create a coaptation stitch.

cannula. The superior and inferior venae cavae are cannulated through the right atrial wall. Cardiopulmonary bypass is initiated. The native aortic valve is examined with transesophageal echocardiography, which should estimate the degree of aortic insufficiency to be expected on LVAD support. Any degree of insufficiency (more than trace) should be corrected with a coaptation stitch.

The aortic crossclamp is applied to arrest the heart with antegrade cardioplegia infusion. If the aortic insufficiency impairs antegrade cardioplegia infusion, a retrograde catheter may be used instead. Then a lateral aortotomy incision is made, long enough to complete the anastomosis between the outflow graft and the aorta. An aortic root retractor is placed, and the native aortic valve is inspected through the incision. The cusps of the native aortic valve are carefully examined to make sure that no other structural

problems could be causing the aortic insufficiency. If the central aortic insufficiency is due to poor coaptation of the myxomatous aortic valve, then a simple coaptation stitch at the center will easily mend this problem. Pledget-supported 4-0 Prolene sutures (Ethicon, Inc, Somerville, NJ) are applied to approximate the fibrous nodules of Arantius (Figure 2).

The aortic valve is still able to open for ejection, even though the effective orifice area of the aortic valve is diminished. After placement of the coaptation stitch, the anastomosis between the outflow graft and the aorta is completed in the usual fashion. Transesophageal echocardiography with Doppler ultrasonography can be used to confirm aortic competence.

Discussion

A simple coaptation stitch is useful for managing mild to moderate aortic insufficiency in patients undergoing LVAD implantation. It effectively eliminates native aortic valve insufficiency. Use of this stitch in otherwise competent aortic valves at the time of LVAD implantation for long-term support may reduce the incidence of LVAD-related aortic insufficiency with time as well.

References

1. Rose EA, Gelijns AC, Moskowitz AJ, Heitjan DF, Stevenson LW, Dembitsky W, et al. Long-term mechanical left ventricular assistance for end-stage heart failure. *N Engl J Med.* 2001;345:1435-43.
2. Samuels LE, Thomas MP, Holmes EC, Narula J, Fitzpatrick J, Wood D, et al. Insufficiency of the native aortic valve and left ventricular assist system inflow valve after support with an implantable left ventricular assist system: signs, symptoms and concerns. *J Thorac Cardiovasc Surg.* 2001;122:380-1.
3. McCarthy PM, Smedira NO, Vargo RL, Goormastic M, Hobbs RE, Starling RC, et al. One hundred patients with the HeartMate left ventricular assist device: evolving concepts and technology. *J Thorac Cardiovasc Surg.* 1998;115:904-12.
4. Savage EB, d'Amato TA, Magovern JA. Aortic valve patch closure: an alternative to replacement with HeartMate LVAS insertion. *Eur J Cardiothorac Surg.* 1999;16:359-61.
5. Naka Y, Edwards NM, Oz MC. Novel technique to repair type A acute aortic dissection in patients with a left ventricular assist device. *Ann Thorac Surg.* 2001;72:1403-4.