Tunneling of ventricular assist device outflow graft rostral to superior vena cava

Prashant N. Mohite, MCh, Aron F. Popov, MD, Tarun K. Mittal, MD, and Andre R. Simon, MD, Harefield, United Kingdom

A majority of patients supported with ventricular assist devices (VADs) require further surgical interventions for heart transplantation, removal of the device upon recovery, or complications that involve re-sternotomy. Proper placement of the outflow graft in relation to intrathoracic structures is a key element to avoid its injury during sternotomy.

CLINICAL SUMMARY

A 33-year-old man diagnosed with familial dilated cardiomyopathy whose disease was being managed with medical therapy was deteriorating clinically. He underwent assessment for heart transplantation and was accepted on the waiting list. Echocardiography showed severely dilated left and right ventricles with poor systolic function, severe tricuspid regurgitation, and a patent foramen ovale. In view of deteriorating renal and hepatic function despite maximum medical therapy including inotropic support, it was decided to implant a ventricular assist device as a bridge to transplant.

At surgery, the patient was put on cardiopulmonary bypass (CPB) via aortic and bicaval cannulation. The operation was performed on a beating heart with the foramen ovale being closed first, followed by the tricuspid annuloplasty using a 36 mm ring. The HeartWare ventricular assist device (HeartWare International Inc, Framingham, Mass) was implanted in a routine fashion. The connective tissue rostral to the superior vena cava (SVC), caudal to the azygos vein was dissected and the outflow graft was passed under the SVC, in close proximity to the right pulmonary artery (Figure 1). The length of the graft was adjusted and it was anastomosed laterally to the ascending aorta. After additional de-airing, the HVAD was started with flows > 5 L/minute. A computed tomography (CT) scan performed after a week showed ideal positioning of the outflow graft situated beneath the SVC without kinking or compromising the SVC caliber (Figure 2). The patient made rapid recovery and was discharged after 3 weeks.

DISCUSSION

The disparity between donor hearts and potential recipients has formed a niche well filled by VADs.^{1,2} Continuous-flow centrifugal pumps are newer-generation VADs being used as a standard of care for end-stage heart failure.^{3,4} Conventionally, outflow graft of the left VAD spouts out from the device motor, and travels along the right side of the heart over the superior vena cava to terminate into the ascending aorta. This brings the graft in close proximity to the sternum. It is implied that all bridge-to-transplant patients who survive will undergo re-sternotomy at some point. The proximity of the outflow graft to the sternum poses a significant risk of lacerating the graft, possibly resulting in catastrophic hemorrhage, exsanguinations, or cerebral damage.

We innovated an approach that passes the outflow graft under the SVC before anastomosing it to the ascending aorta. This modification avoids the graft coming in contact with the sternum. The entry angle into the convex aspect of the lateral ascending aorta is ideal and the chances of kinking the graft after closure of the chest are minimized because graft position remains stable under the SVC. The theoretical possibility of external compression of SVC by the outflow graft cannot be ruled out. However, the graft nests in the space between the higher pressure pulmonary artery, lower end of the

FIGURE 1. Outflow graft passing under the superior vena cava and anastomosing to ascending aorta. SVC, Superior vena cava; RA, right atrium; Ao, aorta.

From the Department of Cardiothoracic Transplantation & Mechanical Support, Royal Brompton and Harefield NHS Trust, Harefield Hospital, Harefield, Middlesex, United Kingdom.

Disclosures: Authors have nothing to disclose with regard to commercial support. Received for publication May 18, 2012; revisions received June 25, 2012; accepted for publication July 25, 2012; available ahead of print Sept 10, 2012.

Address for reprints: Prashant N. Mohite, MCh, Room 006, Parkwood House, Harefield Hospital, Harefield, Middlesex UB9 6JH, United Kingdom (E-mail: drprashantis@rediffmail.com).

J Thorac Cardiovasc Surg 2012;144:1519-20
0022-5223/\$36.00

Copyright © 2012 by The American Association for Thoracic Surgery
<http://dx.doi.org/10.1016/j.jtcvs.2012.07.027>

FIGURE 2. Computed tomography scan showing passage of outflow graft under the superior vena cava. SVC, Superior vena cava; OG, outflow graft; Ao, aorta; RA, right atrium; RPA, right pulmonary artery.

SVC, and roof of the left atrium, rendering compression of the SVC unlikely. As expected, we did not encounter SVC syndrome and the CT scan did not show any compression. At the time of VAD explant due to recovery or heart transplant, we propose to either remove the whole graft or leave a few millimeters of length behind the SVC if the adhesions prohibit its removal, thereby avoiding dissection and injury to adjoining structures like the right pulmonary artery, azygous vein, and SVC. Because the graft runs inside the pericardium, the phrenic nerve remains protected. The technique is simple, easy, and reproducible.

References

1. Goldstein DJ, Oz MC, Rose EA. Implantable left ventricular assist devices. *N Engl J Med.* 1998;339:1522-33.
2. Smedira NG, Hoercher KJ, Yoon DY, Rajeswaran J, Klingman L, Starling RC, et al. Bridge to transplant experience: factors influencing survival to and after cardiac transplant. *J Thorac Cardiovasc Surg.* 2010;139:1295-305, 1305.e1-4.
3. Slaughter MS, Rogers JG, Milano CA, Russell SD, Cone JV, Feldman D, et al. Advanced heart failure treated with continuous-flow left ventricular assist device. *N Engl J Med.* 2009;361:2241-51.
4. Russo MJ, Hong KN, Davies RR, Chen JM, Sorabella RA, Ascheim DD, et al. Posttransplant survival is not diminished in heart transplant recipients bridged with implantable left ventricular assist devices. *J Thorac Cardiovasc Surg.* 2009;138:1425-32.e1-3.

Use of cryopreserved saphenous vein grafts in congenital heart surgery

Arman Kilic, MD, Duke E. Cameron, MD, and Luca A. Vricella, MD, Baltimore, Md

From the Division of Cardiac Surgery, Department of Surgery, Johns Hopkins Hospital, Baltimore, Md.

Disclosures: Authors have nothing to disclose with regard to commercial support. Presented at the Congenital Heart Surgeons' Society Annual Meeting, Chicago, Illinois, October 23-24, 2011.

Received for publication March 29, 2012; revisions received May 24, 2012; accepted for publication July 26, 2012; available ahead of print Sept 28, 2012.

Address for reprints: Luca A. Vricella, MD, Division of Cardiac Surgery, Department of Surgery, Johns Hopkins Hospital, 600 North Wolfe St, Blalock 618, Baltimore, MD 21287 (E-mail: lvricella@jhmi.edu).

J Thorac Cardiovasc Surg 2012;144:1520-2

0022-5223/\$36.00

Copyright © 2012 by The American Association for Thoracic Surgery

<http://dx.doi.org/10.1016/j.jtcvs.2012.07.071>

The use of saphenous vein grafts (SVGs) in congenital heart surgery was reported as early as 1984.¹ SVGs have several advantages, including a low incidence of thrombosis and infection and superior handling characteristics and hemostasis, with acceptable patency rates. A potential hemodynamic benefit of a competent valve also exists in cases in which SVGs are used as right ventricle to pulmonary artery (RV-PA) conduits.² We report our experience with cryopreserved SVGs as RV-PA conduits or modified Blalock-Taussig shunts (MBTSs) in neonates and infants.