

Asia's First Minimal-Access Left Ventricular Assist Device Implantation

Dear Editor,

Left ventricular assist device (LVAD) has become an established therapy for end-stage heart failure, bridging patients to cardiac transplantation or to destiny in transplant-ineligible patients. New generation pumps continue to improve outcomes with 84% 1-year survival reported for the HeartWare Ventricular Assist Device (HVAD, HeartWare Inc, Framingham, MA).¹ Minimal access implantation hopes to further improve outcomes by minimising surgical insult and blood transfusion in these fragile patients.

Case Report

We report a 47-year old male with hypertension for 20 years, viral myocarditis 8 years earlier and dilated cardiomyopathy. He was New York Heart Association functional class II in 2008 but had deteriorated for 1 year with recurrent admissions for congestive heart failure. He was referred for LVAD implantation as a bridge-to-transplant.

Minimal access HVAD implantation was performed via 2 small incisions. A left anterolateral mini-thoracotomy exposes the apex of the left ventricle for the sewing of a "docking mechanism" onto its surface. The heart muscle in the middle of this docking ring is then cored to facilitate the insertion of the LVAD inflow-cannula directly into the left ventricular apex (Fig. 1). An externalised power supply

cable then drives the hybrid rotating impeller within the LVAD in order to flush the patient's blood via centrifugal force through the outflow vascular graft. Blood is hence pumped forward through this graft that is sewn directly onto the ascending aorta beyond the aortic valve. The aortic outflow graft anastomosis was performed through a partial upper midline mini J-sternotomy (Fig. 1).

The procedure was completed with the heart beating without the need for a heart-lung machine. The patient did not require blood transfusion and was discharged home 2 weeks later having made an uneventful recovery. The patient remains well 18-months post-implant with normal functional status. Specifically, he was free from any driveline infection, bleeding or thromboembolic complications.

Discussion

Minimal access cardiac surgery performed through the apex of the left ventricle via a left anterolateral mini-thoracotomy is routinely performed nowadays.^{2,3} Less invasive approach has also been successfully used to explant LVAD.⁴ Familiarity with these surgical techniques and modern LVAD-pumps facilitate the development of minimal access LVAD implantation.⁵

The LVAD off-loads the left ventricle, hence resting the heart and assists the left heart to maintain normal

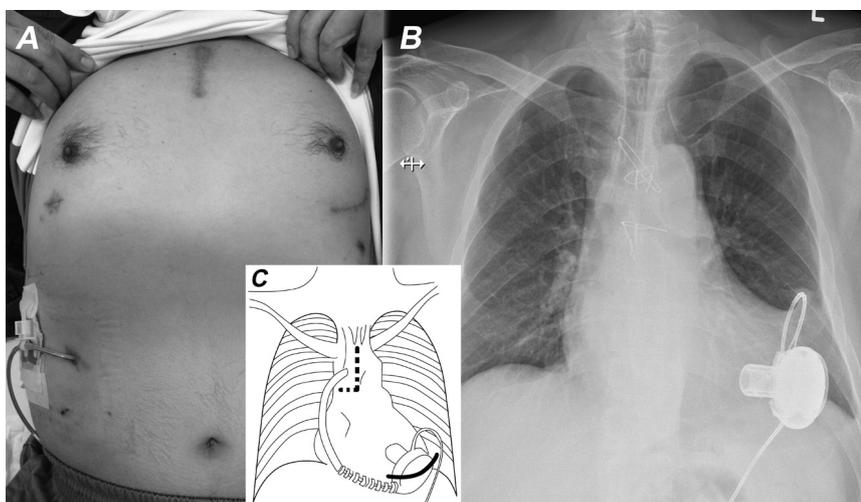


Fig. 1. A) Photograph of healed surgical scars with the LVAD driveline (connecting to batteries and control module) exiting patient's right hypochondrium. B) Radiograph showing the intrapericardial pump and manubrial sternal wires. C) Line diagram indicates surgical incisions (partial sternotomy = broken line; mini-thoracotomy = solid line) overlying both surgical sites.

organ perfusion. The potential benefits of this approach includes minimal surgical dissection, complete avoidance or shortened duration of use of the artificial heart-and-lung machine circulation during implantation and reduced blood loss.⁵⁻⁷ Subsequent transplantation may be easier with less adhesion.

Conclusion

Heart failure is a significant burden across Asia due to changing lifestyles and increasing prevalence of obesity, hypertension, diabetes and coronary artery disease in this populous part of the world.⁸ We are encouraged by the outcome seen in this new procedural variation that uses a modern generation life-saving LVAD technology.

REFERENCES

1. Slaughter MS, Pagani FD, McGee EC, Birks EJ, Cotts WG, Gregoric I, et al; HeartWare Bridge to Transplant ADVANCE Trial Investigators. HeartWare ventricular assist system for bridge to transplant: combined results of the bridge to transplant and continued access protocol. *J Heart Lung Transplant* 2013;32:675-83.
2. Ye J, Cheung A, Lichtenstein SV, Carere RG, Thompson CR, Pasupati S, et al. Transapical aortic valve implantation in man. *J Thorac Cardiovasc Surg* 2006;131:1194-6.
3. Soon JL, Chua YL, Chao VT, Chiam PT, Ewe SH, Seetho VY, et al. Asia's first successful minimally invasive transapical transcatheter mitral valve-in-valve implantation. *Ann Acad Med Singapore* 2013;42:85-7.
4. Cheung A, Soon JL. Minimal-access left ventricular assist device explantation. *Innovations (Phila)* 2012;7:300-2.
5. Cheung A, Soon JL, Bashir J, Kaan A, Ignaszewski A. Minimal-access left ventricular assist device implantation. *Innovations (Phila)* 2014;9:281-5.
6. Strueber M, Meyer AL, Feussner M, Ender J, Correia JC, Mohr FW. A minimally invasive off-pump implantation technique for continuous-flow left ventricular assist devices: early experience. *J Heart Lung Transplant* 2014;33:851-6.
7. Wagner CE, Bick JS, Kennedy J, Haglund N, Danter M, Davis ME, et al. Minimally invasive thoracic left ventricular assist device implantation; case series demonstrating an integrated multidisciplinary strategy. *J Cardiothorac Vasc Anesth* 2015;29:271-4.
8. Reyes EB, Ha JW, Firdaus I, Ghazi AM, Phrommintikul A, Sim D, et al. Heart failure across Asia: same healthcare burden but differences in organization of care. *Int J Cardiol* 2016;223:163-7.

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