

Case Report

HeartWare Implantation with Outflow Graft Anastomosis to the Descending Aorta via Left Thoracotomy

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- Outflow graft
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- Thoracotomy

Abstract

Ventricular assist devices (VADs) have revolutionized treatment of advanced heart failure. VAD recipients benefit from improved functional status, better quality of life and good survival result. The advancement of post-VADs implant management, improved durability of devices and scarcity of heart donor have made VAD an attractive alternative to heart transplant, with an increasing trend of it being used as destination therapy rather than bridge therapy. The increasing demand for VAD therapy and complexity of patients called for alternative VAD implantation approaches to be addressed. We report a case of HeartWare VAD implantation via left thoracotomy with outflow graft anastomosis to the descending aorta in a patient with previous sternotomy from coronary artery bypass.

ABBREVIATIONS

VAD: Ventricular Assist Device; TTE: Transthoracic Echocardiogram; EF: Ejection Fraction; CT: Computed Tomography; TEE: Transesophageal Echocardiogram; LV: Left Ventricle

CASE PRESENTATION

A 64 years old Malay gentleman with medical background of diabetes mellitus, hypertension hyperlipidemia, atrial fibrillation and coronary artery bypass performed in year 2000. He had multiple hospital admissions for congestive cardiac failure, his transthoracic echocardiogram (TTE) done in September 2012 showed an ejection fraction (EF) of 10-15%. A cardiac resynchronization therapy defibrillator was implanted in September 2012, but there was no significant functional improvement.

He suffered from worsening shortness of breath on 18th May 2013, and became unresponsive in a taxi en route to hospital. He was found to be in a systole upon reaching Emergency Department, cardiopulmonary resuscitation commenced with return of spontaneous circulation after 10 minutes. He was transferred to coronary care unit with intravenous Dopamine support. A TTE done on 30th May 2013 showed EF of 11%, he continued to be inotropes dependent and pre-left VAD workup carried out. Coronary angiogram showed patent left internal

mammary artery and saphenous vein grafts. Computed tomography (CT) thorax showed that the grafts were very high up in ascending aorta, leaving insufficient area of ascending aorta for applying a side-biting clamp.

After medical optimization, he was scheduled to have HeartWare implantation on 5th July 2013. We decided to approach via left thoracotomy in view of previous sternotomy and above CT thorax result. Patient was put under general anesthesia, positioned in semi-right lateral position with both groins exposed. Transesophageal echocardiography (TEE) was routinely used. Chest entered via left anterolateral thoracotomy on 5th intercostal space, left inferior pulmonary ligament freed for better exposure. After systemic heparinization, femoral vessels were cannulated for cardiopulmonary bypass. Pericardium was opened over left ventricle (LV) apex, 8 pledgetted sutures placed on LV apex and sewing ring sutured in place. LV coring was then performed, pump connected and secured tightly. De-airing of LV was carried out and outflow graft was clamped after adequate de-airing. Soft spot of descending aorta was identified at LV apex level, side-biting clamp applied. Incision made on descending aorta and outflow graft anastomosis performed using 5/0 Prolene sutures. A size 18 Unigraft was placed over the outflow graft. De-airing needle was placed in outflow graft till TEE showed no air bubbles in system. Cardiopulmonary bypass was weaned off with simultaneous transition to full left VAD support. Thorough hemostasis was performed and pericardial membrane was used

to cover the outflow graft from lung to reduce adhesion. Chest was closed with 2 chest tubes in-situ, patient was transferred to intensive care unit in stable hemodynamic condition. His post-operative recovery was complicated by right frontal lobe intracerebral hemorrhage, necessitated a period of anti-coagulation interruption. Serial CT brain showed improvement of intracerebral hemorrhage, weighed in risk of thrombosis of VAD; warfarin was restarted with lower target of international normalized ratio (INR) at 1.8 - 2.2. Patient was discharged home at post-operative day 42. He was reviewed twice in outpatient setting with TTE performed, pump speed adjusted to ensure intermittent opening of aortic valve. A TTE done 5 months post VAD implantation showed evidence of clot in aortic root on right coronary cusp, for which the warfarin dose was increased to aim INR of 2.5. Unfortunately he was admitted to hospital on 25th December 2013 for massive brain stem stroke, VAD support was terminated after he was certified brain death. His total VAD support was 173 days.

DISCUSSION

Conventionally VAD is implanted through sternotomy to ascending aorta. However in patients with hostile chest/mediastinum, alternative approaches of VAD implantation to minimize complications have been explored and described [1-3]. Apart from the usual anastomotic site of ascending aorta, outflow graft had been anastomosed on alternative sites such as descending and abdominal aorta, innominate artery and axillary artery. Sajjah³ described the suitability of using left thoracotomy approach for HeartWare explant, exchange and initial implantation, while recognizing the limitations of this approach.

In our case, to avoid complications of resternotomy [4] and due to limited space for applying side-biting clamp on ascending aorta, we attempted left thoracotomy implantation of HeartWare to descending aorta. A size 18mm Unigraft was also used to cover the outflow graft for kinking prevention, as described by Cohn [5] with good result. We also acknowledge that this patient's reasonable right heart function has made the thoracotomy approach a feasible option in our case, otherwise the need for simultaneous right VAD will likely preclude this approach.

Kar [6] and colleagues have aptly demonstrated a flow characteristic of stagnant in aortic root using computer simulation when outflow graft is anastomosed to descending aorta. As we are aware that this implies a potential for thrombogenesis, our initial strategy of post VAD implant management was to keep a target INR of 2.5 - 3, and adjusting pump speed to ensure intermittent opening of aortic valve on follow up TTE to reduce stagnation of aortic root. However in this case the occurrence of hemorrhagic stroke post VAD implantation has led us to revise our target INR range to a lower one when the patient's condition allowed us

to restart warfarin therapy. Despite our best effort in striking an anti-coagulation balance of thrombosis vs further cerebral bleeding complication, aortic root thrombosis still occurred 5 months post-surgery and this probably was the cause of brain stem stroke in our case. As for the attempt to adjust pump speed to allow intermittent aortic valve opening, we found it in this case was very challenging to achieve owing to patient's very poor heart function (two follow up TTEs showed EF of 10%).

Umakanthan [2] has reported a total of 7 (in two different centers) successful VAD implantation with outflow graft anastomosis to descending aorta through left thoracotomy, but there was no long term result being reported. In our case we demonstrated not only the advantages of using such approach that allow avoidance of complications from re-sternotomy and injury to previous bypass graft, but also the disadvantages as exemplified in our case by fatal thrombotic event that happened just shy of 6 months post-surgery. Therefore to reach a conclusion that this alternative approach is indeed superior, we believe a larger study cohort with long term follow up are warranted.

With the trend of VADs design getting more and more miniature, less invasive approaches present as an attractive alternative in patients with hostile chest. Physicians must understand the complex flow dynamic, the risks and benefits associated with each approach. These understandings will allow management plans to be tailored to every single patient in order to maximize the potential benefits and minimize the risks.

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