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Left ventricular assist device insertion and open abdominal aortic aneurysm repair in same admission for an end-stage heart failure patient

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Abstract

Patients suffering from end-stage heart failure also suffer from multiple cardiovascular comorbidities such as abdominal aortic aneurysm (AAA). Mechanical support with left ventricular assist device with open repair of AAA repair has rarely been reported in literature. The authors describe a 60-year-old male with end-stage heart failure and a symptomatic AAA with sequential left ventricular assist device insertion and open AAA repair with aortic cross-clamping.

Keywords: Left ventricular assist device • Abdominal aortic aneurysm • Heart failure

CASE HISTORY

A 60-year-old gentleman, with a history of diabetes mellitus and hypertension, was referred for symptomatic end-stage heart failure, INTERMACS profile 4. Transthoracic echocardiogram showed globally impaired left ventricular ejection fraction 10%, left ventricular diastolic diameter 7.7 cm and moderate tricuspid regurgitation. Left and right heart catheterization showed significant left main and triple vessel disease, cardiac index 1.65 l/min/m² and pulmonary vascular resistance of 3.67 Woods units. Thallium myocardial perfusion scan showed non-viable myocardium.

He also suffered from a symptomatic enlarging infra-renal abdominal aortic aneurysm (AAA). Computerized tomography scan showed an AAA measuring 5.8 × 6 cm that progressed to 6.9 × 6.6 cm over 6 months (Fig. 1). In view of his poor cardiac function, the referral hospital refused him general anaesthesia.

Our multi-disciplinary team opted for an implantable left ventricular assist device (LVAD) with HeartMate 3 (Abbott, Abbott Park, IL, USA) as bridge to transplant with sequential open AAA repair.

After general anaesthesia, median sternotomy and cardiopulmonary bypass (aortic and bi-caval cannulation) was ensued. Tricuspid annuloplasty with Sovering Tricuspid Band (size 30) (Sorin Biomedica, Salluggia, Italy) via right atriotomy without cardioplegia was performed. LVAD inflow cannula was attached to the left ventricular apex and the outflow graft was sewn onto the

ascending aorta. Bypass was weaned and LVAD flow adjusted with trans-oesophageal echocardiogram guidance to 3LPM; speed 4900 RPM. Right ventricular function was satisfactory, and intensive care unit stay was uneventful. He was extubated on postoperative Day 2. Swan-Ganz catheter facilitated haemodynamic and fluid management. Heparin infusion was started on postoperative Day 2 with an activated partial thromboplastin time of 45–55 s.

On postoperative Day 7, the patient underwent open AAA repair. Heparin infusion was stopped 4 h prior to general anaesthesia. Low-dose adrenaline and dopamine infusions were given to support right heart function. Through a midline laparotomy incision, the AAA was dissected out. Prior to cross-clamping, the patient was started on nitroprusside and nitroglycerine infusions. The infra-renal aorta was anastomosed end-to-end to a 20-mm Hemashield woven Dacron tube graft (Maquet, Getinge Group, Germany) with continuous sutures. Noradrenaline infusion was started prior to cross-clamp release and fluid boluses were given to maintain adequate blood pressure. Cross-clamp time was 55 min, operating time was 139 min and blood loss was 50 ml. The patient was haemodynamically stable throughout the procedure with pump parameters unchanged. Heparin was administered 6 h postoperatively.

Postoperative course was uneventful. He was maintained on aspirin and warfarin with target INR of 2–3. He was discharged

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Figure 1: Computerized tomography three-dimensional reconstruction of abdominal aortic aneurysm.

home on postoperative Day 30 with follow up CT showing complete repair (Fig. 2).

DISCUSSION

Patients with end-stage heart failure and AAA are challenging to manage. Current evidence for mechanical circulatory support and AAA intervention is limited to individual case reports with no long-term data. Impella device insertion prior to cross-clamping for open AAA repair [1], LVAD insertion followed by staged open AAA repair [2] and concomitant open AAA repair followed by Biventricular assist device [3] have previously been reported to support the failing ventricles in the perioperative period and prevent decompensated heart failure.

We decided for sequential LVAD insertion followed by AAA repair as continuous flow LVAD would off-load the heart and provide mechanical circulatory support prior to AAA repair. We opted against concomitant repair considering the significant bleeding risk from full heparinization required for cardiopulmonary bypass. Sequential repair would allow end-organ recovery after cardiopulmonary bypass, prior to open AAA repair.

Heart transplant graft availability is limited and unpredictable, and long waiting times in our locality precludes direct heart transplantation. Increased aneurysm-related adverse events have been described after heart transplantation [4], thus repair was performed in the same admission.



Figure 2: Computerized tomography post-repair.

Endovascular aneurysm repair in LVAD patients has been described favourably [5]. Our patient was not suitable for endovascular repair due to shortened proximal neck, excessive distal tortuosity and inadequate landing zone. Open repair avoids endovascular aneurysm repair associated endoleak, graft infection and contrast nephropathy from computerized tomography scans, which are undesirable in immunosuppressed heart transplant candidates.

The authors demonstrate that LVAD implantation followed by open AAA repair is feasible with short operating times and minimal blood loss, providing meticulous management of preload, afterload and pump speeds by the surgical and anaesthetic team.

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