Left Ventricular Assist Device Outflow Graft Pseudoaneurysm Treated with Covered Balloon Expandable Stent

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Left ventricular assist device (LVAD) outflow graft injury is a very rare complication after LVAD implantation and is usually treated surgically. This is a case report of successful stenting of the damaged outflow graft 2.5 years after LVAD implantation, followed by successful heart transplantation. *ASAIO Journal* 2020; 66:e74–e76.

Key Words: left ventricular assist device, heart failure, outflow graft stenting, Kazakhstan, heart transplantation

Insufficient supply of donor hearts necessitates mechanical circulatory support as the optimal option for patients with advanced heart failure in many countries. Left ventricular assist device (LVAD) complications include device thrombosis, aortic valve insufficiency, and graft complications. In addition, LVAD outflow graft injury is an uncommon life-threatening complication after device implantation. We report a case of successful stenting of the damaged outflow graft in a patient 2.5 years after LVAD implantation, followed by successful heart transplantation.

Case Report

A LVAD was implanted in a 50 year old male patient (70 kg, 171 cm, body surface area 1.82 m^2) with ischemic cardiomyopathy and INTERMACS class 4 using minimally invasive technique (HeartWare International, Inc., Framingham, MA). The postoperative course was uneventful and the patient was regularly monitored with no complications. One year after implant, the patient experienced a driveline infection and this was successfully managed medically. Two years after implant, the patient was admitted because of bleeding from the driveline exit site. A fistula with bloody purulent excretion was found under the xiphoid process and at the driveline exit site. Bacteriological examination revealed *Pseudomonas aeruginosa* 10^6 CFU. Laboratory assessment revealed increased levels of presepsin (641 pg/ml, normal range 0–365 pg/ml), C-reactive protein (10.748 mg/dl, normal range 0–0.5 mg/dl), leucocytes (12.22×10^9/L, normal range 4.5–11 $\times 10^9$/L), and normal procalcitonin (0.150 ng/ml, normal range 0.1–0.5 ng/ml). The deep driveline infection was treated with intravenous cefipime 4 g/day and intravenous ciprofloxacin 400 mg/day for 20 days and wound dressing. After 20 days, the condition of the driveline exit site had improved and the patient was discharged on oral amoxicillin/clavulanic acid 625 mg 3 times per day for 2 weeks. Four months later, the patient was readmitted to our Center complaining of fever and pain. Examination revealed reemergence of a fistula on the anterior abdominal wall under the xiphoid process, bleeding from the fistula and a painful hematoma (2.5 × 4 cm) on the left side of the thorax. Bacteriological analysis of discharge revealed *Pseudomonas aeruginosa* 10^8 CFU. Intravenous ceftazidime 4 g/day and amikacin 400 mg/day were initiated with standard wound care. Computed tomography with contrast revealed a pseudoaneurysm (8.1 × 9.2 × 4.3 cm) around the apex of the left ventricle and a defect on the outflow graft close to the LVAD pump (**Figure 1, A**).

Standard procedures were followed for informing patients about potential risks and benefits. Risks of this procedure included graft rupture and trapping of the guidewire by the rotor. We explained the risks of the procedure to the patient, because this procedure is not routine and that there was uncertainty regarding its chance of success and risk of failure, including serious morbidity and death.

Stenting procedure was carried out under local anesthesia in the catheterization laboratory using the biplane angiography system. A 5 Fr sheath was inserted in the artery using femoral access. Left ventriculography was taken in several runs (**Figure 1, B**).

During the polyprojection ventriculography, extravasation of the contrast was detected at the level of the connection between the pump and the outflow graft (**Figure 1, B**).

A 5 Fr right coronary Judkins catheter (Terumo Corporation, Leuven, Belgium) was used *via* crossing it in retrograde manner from the ascending aorta to the outflow graft with the aid of a hydrophilic guidewire (Terumo Corporation, Leuven, Belgium). The hydrophilic guidewire was exchanged for an Amplatz Super Stiff 0.035 inch 260 cm wire (Boston Scientific, Costa Rica). The wire was positioned inside the pump (15 mm proximally from the connection with the graft).

A cheatham-platinum stent covered with expanded polytetrafluoroethylene was used (NuMED Inc., Hopkinton, NY). The length of the chosen stent was based on the location of the damaged graft, so attempts were made to cover the metal part of the pump and extend 10–15 mm distally from the damaged graft.

The internal diameter of the graft was 10 mm and the internal diameter of the pump, near the connection with a graft, was also 10 mm. However, at 5–7 mm proximally from the connection

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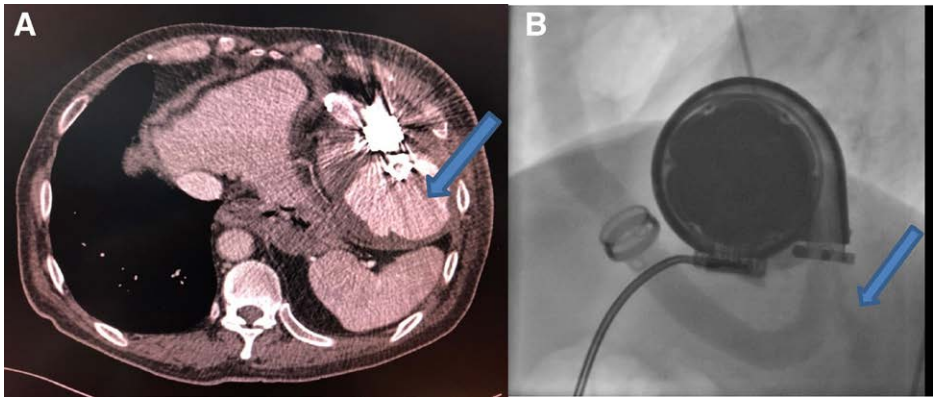

Figure 1. A: Computed tomography with contrast. B: Left ventriculography in angulation cranial 64, Right anterior oblique – 19; volume 28 ml, rate 14 ml/sec, Pounds per square inch – 750)

Figure 2. LVAD HeartWare demo model.

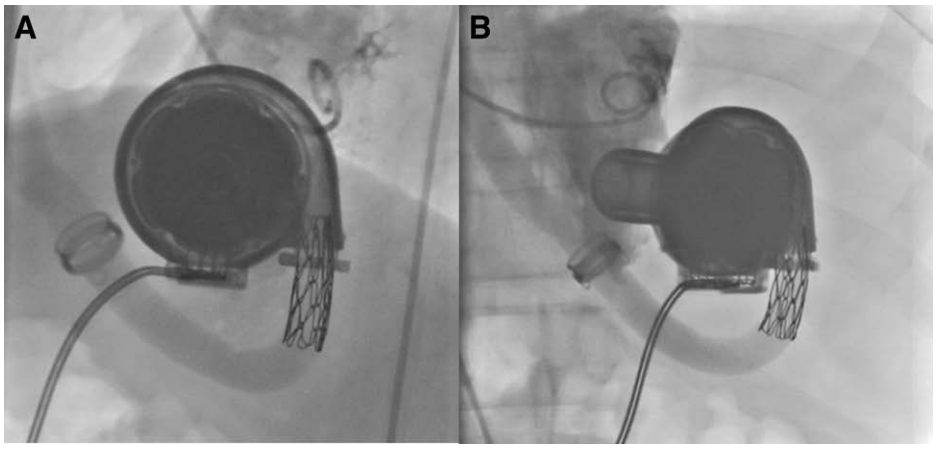

Figure 3. Control left ventriculography after stent implantation (A: left ventriculography in angulation cranial 0; Left anterior oblique 63; B: left ventriculography in angulation cranial 10, Left anterior oblique – 15; volume 28 ml, rate 14 ml/sec, Pounds per Square Inch – 750)

with the graft, the diameter of the pump narrowed to 7 mm (**Figure 2**). Therefore, a 34 mm covered cheatham-platinum stent with a 12/40 AndraBalloon (Andramed GmbH, Germany) was applied, which was 2 mm wider than the outflow graft.

A delivery system 14 Fr of left appendage occlude Amplatzer TorqVue 45° × 45° (AGA Medical Corporation, Plymouth, MN) was placed over a 0.035 inch stiff exchange length guidewire and used for stent delivery.

The stent was crimped onto an AndraBalloon manually. During the stent implantation, the LVAD was switched off for 7 sec. Left ventriculography revealed that the damaged part of outflow graft had closed completely (**Figure 3, A** and **B**).

Femoral arteriotomy was repaired surgically. Heparin 75 IU/kg was given to maintain the activating clotting time between 200 and 220 sec during the procedure. The patient was stable after this procedure. A matching donor was

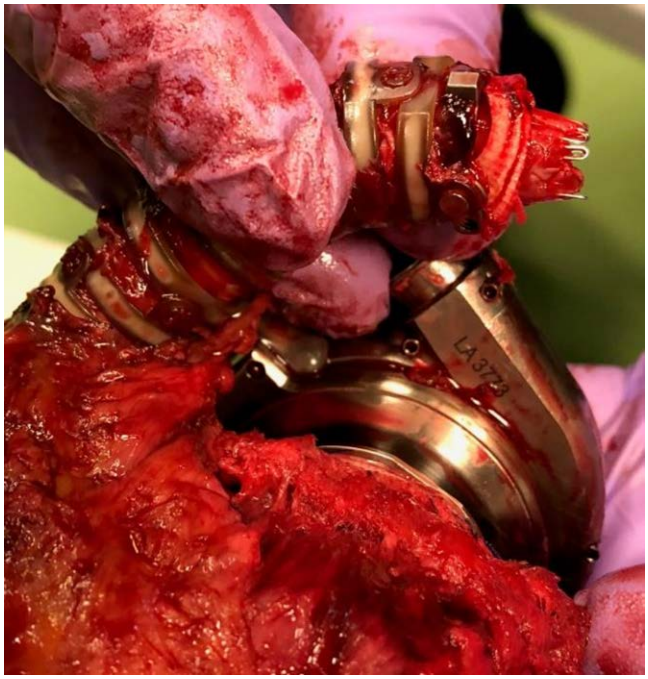

Figure 4. The stent covered the defect of the outflow graft.

identified shortly after this procedure and heart transplantation was successfully performed 6 days later. Upon LVAD explant, the stent was observed to cover the whole defect of the outflow graft (**Figure 4**). Microbiological examination of the area of the pump housing did not reveal infection, and the infection did not occur after transplantation. One month after heart transplant, the patient was discharged in good condition.

Discussion

Recent literature describes interventional percutaneous procedures that have been used to manage LVAD mechanical complications such as device thrombosis, *de novo* aortic insufficiency and outflow graft stenosis.[1,2] Pseudoaneurysms after LVAD implantation are rare, as are cases of interventional treatment for this complication.[3] Detachment of the bend relief device which overlies the LVAD outflow graft is a known risk for some LVAD devices[3] but to our knowledge has not been reported for the HeartWare device. Displacement and subsequent rubbing of outflow graft against the bend relief ring may have resulted in damage to the outflow graft which worsened over time. In this case, the prosthetic graft damage developed 2.5 years after the LVAD implant, confounding the ability to determine the precise cause. Infection may have been a contributing factor. This interventional approach is a potential effective method with acceptable risk.

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