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Long-Term Left Ventricular Assist Device (LVAD): A Rare Case of 10 Years' Support and Follow-Up

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Manuscript Preparation E
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Conflict of interest: None declared

Patient: Male, 66
Final Diagnosis: Ischemic cardiomyopathy
Symptoms: Angina pectoris • dyspnoea
Medication: —
Clinical Procedure: —
Specialty: Surgery

Objective: Unusual clinical course

Background: We report a 66-year-old patient who received implantation of HeartMate II LVAD (St. Jude Medical, Minneapolis, MN, USA) as destination therapy 10 years ago.

Case Report: Preoperatively, the patient developed acute heart failure due to transmural myocardial infarction requiring catecholamine therapy and intra-aortic balloon pump. Echocardiography revealed a left ventricular ejection fraction of 15%. We saw an indication for left ventricular assist device (LVAD) implantation. The intraoperative course was uncomplicated. The operation time was 153 minutes and the cardiopulmonary bypass time was 69 minutes. The procedure was performed in normothermia, and no further combined procedures were necessary. Only one re-hospitalization, due to driveline infection, was required. Once a month, the patient visited our heart failure outpatient clinic for laboratory control, echocardiographic examination, and device measurement. There was always a normal LVAD function. During the 10 years of follow-up, the patient did not have any other complications.

Conclusions: Patients with a strict indication for LVAD and fewer risk factors can show a relatively uncomplicated postoperative course. Our case report demonstrates the opportunity to care for a patient for years using LVAD. Modern LVADs are reliable cardiac support systems as destination therapy from the long-term perspective. Careful patient selection, timely decision on LVAD implantation, and structured patient care are critical.

MeSH Keywords: Artificial Organs • Cardiac Surgical Procedures • Heart Failure

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Background

Heart failure is one of the leading causes of death in the developed world [1]. In its advanced stages, either cardiac transplantation or mechanical circulatory support is recommended after exhaustion of all medical therapy [2]. Moreover, the importance of assist devices as destination treatment measure by left ventricular failure grows continuously due to a shortage of donor's hearts and it's accepted use as destination therapy. From all long-term MCS devices over 95% are left ventricular assist devices (LVAD) [3]. Despite its spread, the implantation of LVAD still represents a high-risk procedure, which is related to severe adverse events, such as right heart failure, cerebrovascular accident, infection, pump thrombosis and hemolysis [4].

International databases on LVAD therapy report a 1 year survival to be 69% to 80% [3,5]. A recent post-market analysis of 254 patients treated with a continuous-flow LVAD showed a 5-year survival of 59% [6]. Data on long-term outcomes are sparse and can only be meaningfully obtained from destination therapy cohorts as most bridge-to-transplant patients are censored due to transplantation with long-term follow-up [7]. We report a patient who received implantation of HeartMate II (St. Jude Medical, Minneapolis, MN, USA) as destination therapy in our center 10 years ago, in 2009.

Case Report

Ten days before LVAD implantation, the patient had suffered a transmural anterior wall myocardial infarction. The occluded left anterior descending artery was recanalized using a drug-eluting stent in the prima vista percutaneous coronary intervention. After the intervention, ventricular fibrillation occurred, with approximately 30-minute cardiopulmonary resuscitation, 10-time defibrillation, and intubation with mechanical ventilation. The next day, the patient was extubated, with no neurological abnormalities. However, because of recurrent supra- and ventricular cardiac arrhythmias, including circulatory instability and cardiac decompensation with recurrent chest pain coupled with dyspnea, the patient was transferred to our department for further diagnosis and therapy.

We performed a coronary angiography, showing an in-stent thrombosis, which was successfully recanalized using a DES. During the intervention, the patient developed a cardiac instability requiring high-dose catecholamine therapy and implantation of an intra-aortic balloon pump. Echocardiography revealed a left ventricular ejection fraction of about 15%, no relevant valve pathology, and a hemodynamically irrelevant pericardial effusion. The right ventricular function was normal. In the interdisciplinary case after discussion with other cardiologists, we saw the indication for urgent implantation of a LVAD. Further preoperative characteristics of the patient are shown in Table 1.

Table 1. The patient's demographics, preoperative baseline characteristics, and laboratory parameters.

Demographic data	Value
Age (years)	56
Body mass index, kg/m^2	27.8
Body surface area, m^2	2.2
Comorbidities	None
Antiaggregation preoperatively	Aspirin + Clopidogrel
Cardiorespiratory conditions preoperatively	
INTERMACS class	I
Intensive Care Unit length of stay (days)	8
Duration of mechanical ventilation (days)	6
Duration of IABP support (days)	6
Laboratory parameters	
White blood cell count, ×10^9/L	11.6
Creatinine, mg/dl	0.9
Blood urea nitrogen, mg/dl	23.35
Alanine aminotransferase, U/l	51
Lactate dehydrogenase, U/l	682
C-reactive protein, mg/l	10.1

INTERMACS – Interagency Registry for Mechanically Assisted Circulatory Support; IABP – intra-aortic balloon pump.

The intraoperative course was uncomplicated. The operation time was 153 minutes and the cardiopulmonary bypass time was 69 minutes. The procedure was performed in normothermia, and no further combined procedures were necessary. Postoperatively, the patient was hemodynamically stable under moderate catecholamine doses. On the first postoperative day, a pericardial tamponade developed, which required an immediate re-thoracotomy. As a result of preoperatively existing aspiration pneumonia, no stable respiratory weaning was achieved, so a dilation tracheostomy was performed on the seventh postoperative day. The sepsis could be controlled under antibiotic therapy, and the patient was successfully weaned from ventilation on the 25th postoperative day. He was mobilized and discharged in a good general condition to the rehabilitation center. The total length of stay in our department was 62 days.

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Since discharge in 2009, only one hospitalization was required. Ten months after the procedure, a driveline infection developed, which required surgical revision. The infected skin and the subcutaneous tissue around the driveline were excised. The wound was flushed, and the driveline was moved 3 cm laterally. The wound was primarily closed. Wound swabs revealed bacteremia with multi-resistant *Streptococcus epidermidis*, and treatment with bacteria-sensitive antibiotics Moxifloxacin and Rifampicin was administered for two weeks postoperatively. The blood cultures in follow-up were negative. There were no other surgical procedures for the extracardiac disease over the follow-up period.

Once a month, the patient visited our heart failure outpatient clinic for laboratory control, echocardiographic examination, and device measurement. Regarding anticoagulation, phenprocoumon was administered to maintain an INR between 2.0 and 2.5, and 100 mg aspirin was given daily. The residual left ventricular function after five and ten years was constant and did not exceed 20%, without any signs of myocardial recovery, which is why we did not see any way to wean off the LVAD. The aortic valve was unmarkable and opened at every cardiac beat. No signs of aortic root thrombosis were observed. The function of the right ventricle was not impaired. There was always a normal LVAD function. During the ten years of follow-up, the patient did not have any other complications: no stroke, no gastrointestinal bleeding, and no chronic kidney injury. The hemoglobin values and creatinine clearance were within the normal range over time. Under LVAD support, the patient did not experience any exercise limitation during his usual daily physical activity. We discussed with the patient a possibility for heart transplantation, but he refused it because he was satisfied with his quality of life and did not want to take the risk that this surgery entails. The patient showed high compliance throughout follow-up. Figure 1 shows a chest X-ray 10 years after placement of the LVAD.

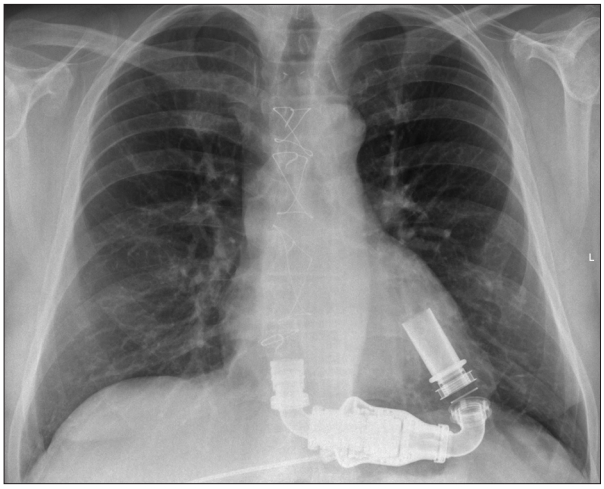

Figure 1. Chest X-ray ten years after LVAD.

Discussion

The HeartMate II is a second-generation, axial-pump, continuous-flow LVAD system that has been used successfully worldwide since the early 2000s [8]. Newer and fully magnetically levitated centrifugal-flow LVAD models showed superiority compared to axial-flow pumps during two-year follow-up with regard to survival free of disabling stroke or reoperation to replace or to remove a malfunctioning device [9]. Also, the minimally invasive techniques of LVAD implantation are growing in importance and show better outcomes compared to full sternotomy [10].

We report the excellent long-term outcomes of a patient under LVAD support. We assume that the success was based on the following components: the absence of right ventricular failure, the partially preserved function of the left ventricle, and the high compliance of the patient during his life with the LVAD. Only one adverse event was encountered in our patient: he developed a driveline infection, which was successfully treated without any further recurrence. Driveline infection is a common post-LVAD complication that reduces patient quality of life and can lead to fatal consequences. The IMACS registry suggests freedom from infection in only half of patients at two years [11]. Pya et al. recently reported the first human use of a wireless coplanar energy transfer coupled with a continuous-flow LVAD [12]. They described a revolutionary alternative to standard LVADs with driveline in two patients and showed a 30-day survival free of wireless energy transfer device malfunction.

Conclusions

Patients with a strict indication for LVAD and fewer risk factors can have a relatively uncomplicated postoperative course. Our case report demonstrates the opportunity to care for a patient for years using a LVAD. Modern LVADs are reliable cardiac support systems as destination therapy from the long-term perspective. Careful patient selection, timely decision on LVAD implantation, and structured patient care are critical.

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