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Case report: a seven years journey of advanced heart failure management including left ventricle assist device implantation and heart transplantation

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Abstract

Introduction. The treatment of the advanced heart failure often requires surgical treatment modalities such as left ventricular assist device implantation and heart transplantation.

Case presentation. This case report highlights the challenges in treating advanced heart failure when long-term mechanical circulatory support is employed, as well as after heart transplantation. A 59-year-old male with advanced heart failure due to dilated cardiomyopathy underwent left ventricular assist device implantation in 2016. During the follow-up period, the patient experienced multiple driveline infections and two pump thromboses. After five years of left ventricular assist device support, a suitable donor was finally found and the patient underwent a successful heart transplant. However, the postoperative course was complicated by massive pulmonary embolism, severe COVID-19 infection, recurrent pyelonephritis, and mild episodes of transplant rejection. One year after heart transplantation, the patient remains in stable condition without any signs of rejection and with good heart function.

Conclusion. Although heart transplantation remains the gold standard for the treatment of advanced heart failure, the scarcity of donors and prolonged waiting periods for heart transplantation have resulted in a rise in complicated cases arising from prolonged left ventricular assist device support. In order to effectively manage advanced heart failure in its most severe forms, the early diagnosis and accurate treatment strategy of different complications and comorbidities is crucial.

Keywords: Heart transplantation, left ventricular assistance device, advanced heart failure, COVID-19, driveline infections

1. Introduction

The treatment of the advanced heart failure (HF) often requires surgical treatment modalities such as left ventricular assist device (LVAD) implantation and heart transplantation (HT). In this case report, we describe the seven years advanced HF "journey" of a 59-year-old male who underwent HeartMate II (HM II) implantation in October 2016, followed by HT in August 2021, for the treatment of advanced HF.

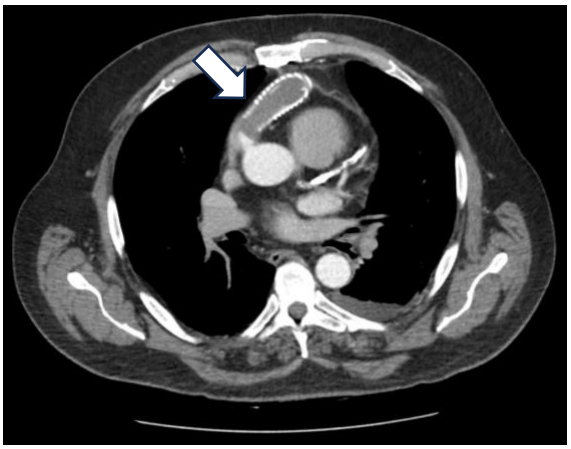
2. Case report

A 59-year-old male presented with rapid onset of fatigue and shortness of breath in 2015. Transthoracic echocardiography (TTE) revealed left ventricle (LV) dilatation, with LV end-diastolic diameter of 69 mm and severely reduced LV systolic function (LV ejection fraction [LV EF] 15%) with diffuse hypokinesis. Invasive angiography showed no evidence of coronary artery stenoses. The patient's clinical picture was consistent with dilated cardiomyopathy, which was confirmed by both TTE and cardiac magnetic resonance imaging (MRI) data. One year later, in 2016 the patient was diagnosed with advanced HF and LVAD - HM II - was implanted.

Three years later after LVAD implantation, the patient experienced pump thrombosis (PT) which was attributed to an inadequate hypocoagulation regimen and was successfully treated by administering alteplase. From 2016 to 2021, the patient was hospitalized multiple times due to evidence of HM II driveline infection. Despite ongoing efforts, a suitable donor was not identified, as the patient's weight had increased to 128 kg, resulting in a body mass index of 39.07 kg/m2.

In August of 2021, a patient who had undergone LVAD implantation five years prior was admitted due to recurrent HM II PT (Figure 1). Heart team decision was to replace the HM II with an HM3 device. However, after two days a suitable donor was identified, and the patient underwent a successful orthotropic HT.

Figure 1. *Computer tomography imaging of a patient with recurrent HeartMate II pump thrombosis.*



During the post-transplantation period, two myocardial biopsies were conducted which revealed grade I rejection (with changes being less pronounced in the second biopsy). It was decided to maintain higher concentrations of tacrolimus, staying with the usual doses of other immunosuppressants. TTE showed – preserved function of both the left and right ventricles (LV EF 50 %). Because the patient had not received vaccination against COVID-19 prior to the HT, the first dose of the vaccine was administered four weeks after HT and the vaccination course was completed after rehabilitation.

During the initial 8-month postoperative period following HT, the patient experienced recurrent urinary tract infections, including cystitis and pyelonephritis, with a total of six documented episodes. The patient was treated with etiotropic antibiotic therapy utilizing carbapenems with a treatment duration up to 21 days per episode. Additionally, i/v immunoglobulin G administration was employed to correct the secondary immunodeficiency.

Four months post-HT, the patient was admitted to the hospital due to dyspnoea at rest. A massive

pulmonary embolism (PE) and thrombosis of the right femoral vein were confirmed (Figure 2).

Figure 2. *Computer tomography imaging showing confirmed PE and thrombosis in pulmonary veins.*

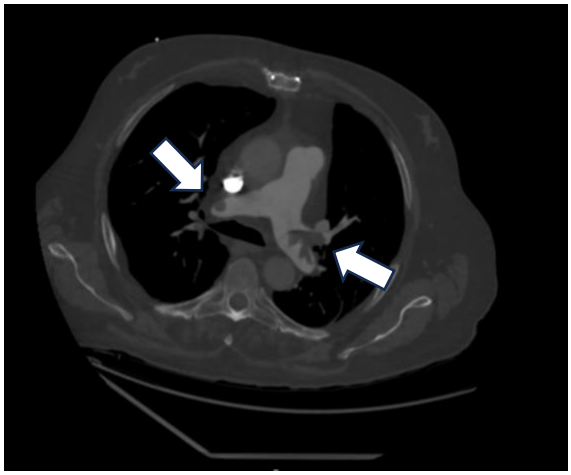
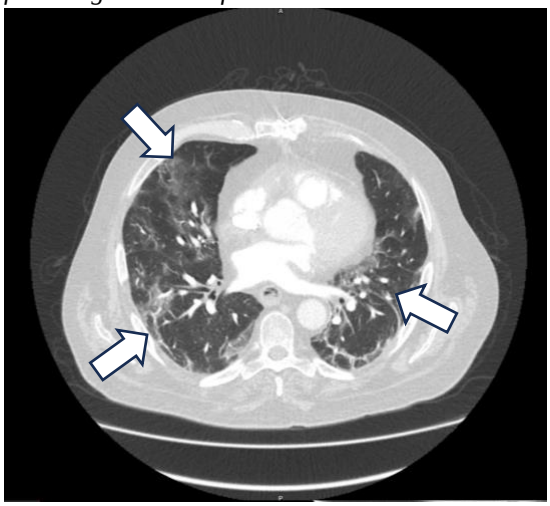


Figure 3. *Computer tomography imaging showing confirmed severe COVID-19 infection in a patient following treatment for PE.*



The patient received PE treatment, but following stabilization of the PE, a severe form of COVID-19 infection was diagnosed (Figure 3). Repeated CT scans showed bilateral reduced airiness, predominant areas of frosted glass, reticular and perilobular changes consistent with COVID-19, with a positive dynamic of PE. Remdesivir and immune-infected COVID-19 plasma were administered, resulting in an improvement in the patient's condition. A fourth biopsy was performed after minimizing immunosuppression during COVID-19 treatment, but no rejection was detected. The patient remains in stable condition without rejection and infections more than a year post HT.

3. Discussion

Presented case shows how difficult the "journey" of a patient with advanced HF can be after LVAD implantation and HT. After LVAD implantation, frequent driveline infections were observed in our patient and according to the literature the duration of mechanical circulatory support represents the major risk factor [1-3], as our patient lived with HMII for 5 years. Driveline infections usually lead to high urgency listings for HT [1] as it was in our case, however, there were no for suitable donor because of increasing patient weight. The other important fact is that driveline infections lead to worse post-transplantation outcomes and cannot be predicted before LVAD implantation [1]. *Staphylococci* have been identified as the most prevalent pathogens, as were also observed in our case [4].

LVAD thrombosis is a rare but feared complication in the course of LVAD treatment [5]. It can result cerebral and peripheral thromboembolic events, haemolysis, as well as life-threatening hemodynamic impairments and death [6]. Current options for the treatment of PT include intravenous heparin, thrombolytic therapy or pump exchange. Medical therapy helps us to avoid a reoperative procedure however, it carries a variably risk for stroke and major bleeding as well as incomplete thrombus resolution [7]. Owing to this, many authors suggest pump exchange as the first-line treatment for PT [8,9]. However, newer-generation LVADs such as the HM3 have been shown to have extremely low rates of PT as in the MOMENTUM 3 trial, the rate of PT using the HM3 was 1% at 2 years of follow-up [10]. In our case, PT were predominantly caused by continuous non-adequate hypocoagulation. For the first time PT was treated using alteplase, for the second time – HT was performed.

Infections are the most relevant complications after HT and are among the most frequent cause of death along the post-transplantation follow-up [11]. Pneumonia (bacterial, *Pneumocystis carinii*), urinary tract infections (often bacterial), cytomegalovirus infections, herpes virus and mycosis frequently occur [12]. The risk of infection over time may be modulated by adjusting immunosuppressive medications. The concept that immunemonitoring may help to guide immune-suppression is promising and future studies are needed in this field. The prognosis in case of SARS-CoV-19 infection is less favourable than in general population and a survey of HT centres in Germany showed 33.3 % mortality [13], in the Italian HT population, mortality was almost 30 % [14]. Vaccination itself does not prevent severe forms of COVID-19 as we confirmed with our case [15]. As it was showed, older age (our patient underwent HT at age of 65 years), immune-suppression and lower estimated glomerular filtration rate are predictors of weakened response to the vaccination [16].

Deep vein thrombosis and PE are an important and serious postoperative complications after HT [17]. The incidence of venous thromboembolic events (VTE) has been reported to vary widely across studies, ranging from 42 % within 60 days post-HT to 7 to 12 % [17]. Patients with VTE had longer hospital stay, higher in-hospital mortality and worse 5-year survival [18]. Early postoperative discharge from the hospital may be the key to preventing the development of VTE.

Our patient had a prolonged hospital stay, with an initial 14-day stay in the ICU due to intensive delirium, followed by a subsequent 30-day stay in the Cardiac surgery department as a result of several episodes of pyelonephritis.

4. Conclusion

The scarcity of donors and prolonged waiting periods for HT have resulted in a rise in complicated cases arising from prolonged LVAD support. In order to effectively manage advanced HF in its most severe forms, the early diagnosis and accurate treatment strategy of different complications and comorbidities is crucial.

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